



Improve constantly and forever

The influence of W. Edwards Deming into the twenty-first century

The influence
of W. Edwards
Deming

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Abstract

Purpose – The purpose of this paper is to examine the impact of Deming's ideas on the twenty-first century.

Design/methodology/approach – A ProQuest search of articles is done mentioning “Deming” and “quality” or “legacy” in the title published between 1994 (Deming died in December 1993) and 2006.

Findings – It is found that 136 articles described Deming's legacy. Legacy in five areas are examined: professional accreditation, customer satisfaction, business ethics, human error, and supply-side management.

Practical implications – Deming's ideas have furthered not only quality management but have also touched areas in the social sciences, such as ethics and organizational relationships.

Originality/value – This paper shows that Deming's ideas continue to flourish in areas that he emphasizes, such as the importance of customer satisfaction and understanding human error, and areas that he did not foresee, such as business ethics and supply-side management.

Keywords Quality, Quality management, Continuous improvement

Paper type General review

W. Edwards Deming, variously described as the “patron saint of quality” (Creech, 1995) a revolutionary, “the man who discovered quality” (Gabor, 1992), and a quality pioneer (Aguayo, 1991), was born on October 14, 1900 and died on December 20, 1993 at the age of 93. His life thus encompassed most of the twentieth century, and for half of that time he espoused and developed his conceptualization of quality. Deming started his professional life in the 1930s as a statistician, first with the US Department of Agriculture, then Bell Labs, and then the US Census Bureau (Walton, 1986). For the last 40 years of his life, Deming was an independent consultant. After World War II, in the early 1950s, the Japanese invited him to help them improve the quality of their products. This struggling nation realized early on that they could not compete head-to-head with the USA on productivity, so they decided to establish a niche for themselves in quality – thereby focusing not on producing more but on producing better. By the 1970s, coincident with the oil embargo, the Japanese had successfully positioned their cars as high-quality and fuel-efficient (Walton, 1990). As a consequence, the American automotive industry, and in the larger sense, the American business sector “discovered” Deming and feverishly began efforts to implement his 14 principles of quality as included in his quality manifesto, *Out of the Crisis* (Deming, 1986):

- (1) Create constancy of purpose toward improvement of product and service.
- (2) Adopt the new philosophy.



- (3) Cease dependence on inspection to achieve quality.
- (4) End the practice of awarding business on the basis of price tag.
- (5) Improve constantly and forever the system.
- (6) Institute training on the job.
- (7) Institute leadership.
- (8) Drive out fear.
- (9) Break down barriers between departments.
- (10) Eliminate slogans and exhortations.
- (11) Eliminate quotas.
- (12) Remove barriers that rob people of pride of workmanship.
- (13) Institute education and self-improvement.
- (14) Put everybody to work to accomplish the transformation.

Collectively, Deming’s 14 points distill his systemic, integrated approach to quality improvement, and they represent the salient contribution which most firmly established his legacy.

To objectively gauge his continuing impact, we conducted an online ProQuest literature search from January 1, 1994 through December 31, 2006 (Table I and Figure 1). The search criteria were that “Deming,” and either “quality” or “legacy,” be in the title of the publication. This procedure generated 136 articles, but 15 were eliminated from subsequent consideration (four articles were repeated, one did not deal with the subject, and ten described Deming Prize winners). The remaining 121 articles were placed in three categories:

- (1) Legacy.
- (2) Application.
- (3) Research.

Those articles labeled as legacy dealt with Deming’s life and impact, the application articles used Deming’s ideas in specific industries and occupations, and the research articles dealt with rigorous theoretical development or empirical boundary testing of Deming’s ideas. Table I displays the number of articles found in each year as well as the three categories into which they were placed.

Table I.
Results of the ProQuest
Deming search

Year	Total number of articles	Legacy	Category	
			Application	Basic research
1994	36	31	2	3
1995-1996	30	15	13	2
1997-1998	16	3	12	1
1999-2000	15	12	2	1
2001-2002	5	3	1	1
2003-2004	12	4	6	2
2005-2006	7	0	4	3
Total	121	68	40	13

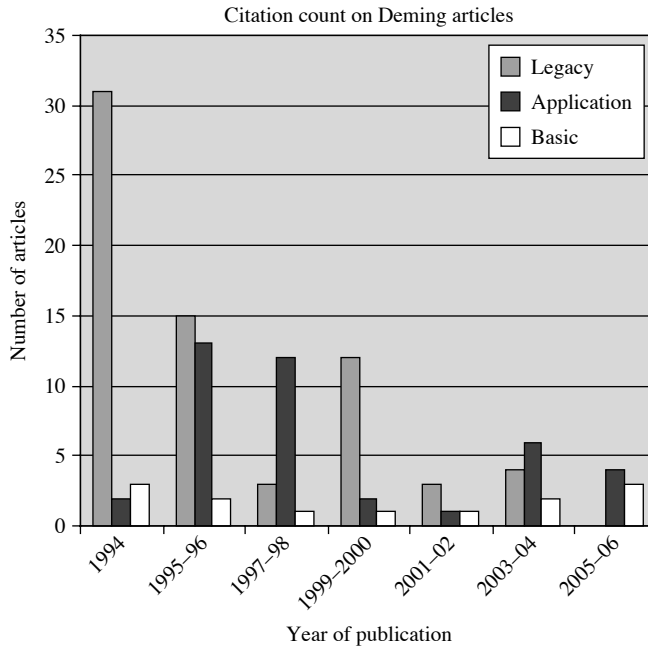


Figure 1.
Citation count on articles
on Deming over time

As expected, there were numerous legacy articles (31) written about Deming in the 12 months immediately following his death (1994 as a separate line in both the table and figure). These rapidly tapered off, spiked again after 5 years, and have now dwindled. Subsequent to publication of the dearth of the initial legacy articles, there were several applications articles (25) published from 1995 to 1998. These applications articles decreased to three from 1999 to 2002 but have rebounded to ten from 2003 to 2006. In the research area, there were five articles from 1994 to 1996. These then lessened, but jumped again to five publications from 2003 to 2006. In summarizing these trends, there has been a clear reduction in legacy articles, but there is some renewed interest in applying his ideas as well as an apparent intent to scientifically test the limits of his precepts.

It has been 15 years now since Deming's death – an adequate passage of time to begin assessing the theorist's enduring contributions. Indeed, even as he lived, he was declared to be ahead of his time (Mooney, 1996), and our data supply evidence for this assertion. Despite an apparent contemporary resurgence in interest in Deming's work, Dalglish (2003) questioned why Deming's influence had waned around the turn of the millennium. He concludes the cause was not disconfirmation of his philosophy, eroded value of his teachings, or waning faddism, but instead it was economic prosperity. Indeed, American businesses tend to lapse too quickly into complacency – into the "if it ain't broke, don't fix it" mode – during health economic eras. An alternate explanation is that Deming's influence has been sustained, but it has evolved and morphed into domains not commonly associated with Deming. This article explores five such areas of influence – areas which may not typically be associated with Deming but that have most certainly benefited from his progressive thinking.

These five areas include: professional accreditation, customer satisfaction, business ethics, human error, and supply chain management.

Professional accreditation

Although Deming (1986) is associated with total quality management (TQM), he did not specifically use that term to describe his quality management philosophy. The term TQM supposedly arose from navy quality innovations in the early 1980s (Walton, 1990). Instead, Deming preferred “continuous quality improvement” as the bedrock concept of his quality approach (Deming, 1986). Deming argued that customer demands, technology, and competitors were constantly and rapidly changing. To keep ahead of these, companies had to continuously improve their products and services (Deming, 1986).

Early attempts at continuous improvement in the USA included National Cash Register rewarding employee suggestions in 1894 and the federal government training industrial managers on continuous improvement during World War II (Bhuiyan and Baghel, 2005). Unfortunately, the heritage of classical management theories, such as scientific management (Taylor, 1911), which emphasized managers doing the thinking while workers did the physical labor, tended to lessen the importance of worker ideas for continuous improvement. Deming was actually one of the first advocates of continuous improvement to include the input of workers (Walton, 1986).

Deming both built upon scientific management and diverged from it (Knouse *et al.*, 1993). Deming was educated as a scientist, receiving a PhD in physics from Yale (Walton, 1986), which underscores his emphasis upon measurement and the use of the scientific method. Thus, he directly followed Frederick Taylor’s emphasis upon data-based decisions enumerated in his philosophy of scientific management (Taylor, 1911). Deming differed from Taylor, however, on the concept of the One Best Way. Taylor (1911) believed that through the use of objectivity and science managers could find the best way to perform any business task from shoveling iron to hiring employees. Once that Best Way was discovered, there was nothing further to be gained from subsequent inquiry. Deming (1986), on the other hand, emphasized that because customers, technology, and economic environments were constantly changing, organizations could not rest on their laurels, but had to continually improve.

Organizations that have discovered the One Best Way but do not continue to improve find that eventually they will be left behind. For example, computer giants, like IBM and HP (Yost, 2005), at one time dominated their markets but then lost their lead and had to reorganize, improve, and redirect their efforts to try to win back market share.

Presently, continuous improvement is showing several innovative directions. One is professional accreditation. The traditional method of accreditation was to count the number of successes in each accreditation area to show excellence. The current approach for many accrediting bodies is to show a continuous improvement process. For example, the hospital accrediting organization, JCAHO, now has continuous improvement as a primary aim (Carson *et al.*, 1995). Medical errors in hospitals were a particular area in which Deming (1986) had grave concerns. Another example is The Association to Advance Collegiate Schools of Business International (AACSB International, 2007), the accrediting agency for business schools that also requires continuous improvement efforts.

A similar arena is the profession of accounting. Traditionally accountants measured financial ratios and reported results. The accounting profession has now evolved into a profession focused upon the financial continuous improvement process through consulting and other suggestion modes (Albright and Lam, 2006). Still another area is environmental concern. Companies that directly affect the environment, such as heavy manufacturing, are using continuous improvement techniques to lessen harm to the environment, which is being termed "green continuous improvement" (Nachimutha *et al.*, 2006).

Into the twenty-first century, we must improve the technology of continuous improvement itself. Innovation must occur in the enabling mechanisms of worker training and teamwork. Moreover, continuous improvement occurs differently at different levels of the organization, including the managerial, team, and individual levels (Bhuiyan and Baghel, 2005).

Customer satisfaction

Historically quality has been defined several ways: excellence (uncompromising standards), value (multiple attributes), and conformance to specifications (Reeves and Bednar, 1994). Deming (1986), however, defined quality as meeting or exceeding customer satisfaction with the product or service. One major advantage of such a definition is that it encompasses all of the others in one way or another (Reeves and Bednar, 1994). Indeed, some believe that the customer satisfaction approach to quality is returning to nineteenth century craftsmanship, where the craftsman directly interacted with the customer and was responsible for all phases of satisfying the customer (Reis *et al.*, 2003).

Deming's approach to quality diverged from other quality perspectives, like Juran (Juran and Godfrey, 1998) and ISO 9000 (Hoyle, 2005), which both subscribe to the approach that inherent characteristics define quality. Indeed, earlier versions of ISO 9000 were criticized as a type of closed system that could not account for customer satisfaction. An example of the importance of this omission is the Firestone/Bridgestone tire debacle. Even though Firestone was ISO 9000 certified, defects in their tires caused a number of accidents and even deaths. Critics maintained that if the ISO 9000 process had had a venue for customer satisfaction indicators, including customer complaints, the company might have been able to resolve the defect problems early on with minimal injury (Daniels, 2000). To its credit, the newer version of ISO 9000:2000 contains customer satisfaction mechanisms (Self *et al.*, 2002).

A primary means of understanding customer satisfaction is through customer feedback modes, like survey feedback, counts of customer complaints, and unsolicited customer responses. New means of measuring customer feedback are arising. For example, 360-degree feedback stresses not only traditional managerial and coworker feedback, but also feedback from customers (Rao and Rao, 2005). Each stakeholder has a unique perspective on evaluating performance. Into the twenty-first century, we predict that customer feedback will become increasingly important for measuring overall firm performance, but the going can be slow. For example, Mitra and Golder (2007) found customer perceptions lag by five to seven years actual changes in product quality.

An offshoot of customer satisfaction is delighting the customer (Deming, 1986). For example, Rust and Oliver (2000) reported that a delighting experience for the customer does enhance the firm by raising customer expectations of the firm's quality.

In 1992, strategists Kaplan and Norton (1996) introduced their balanced scorecard approach to institutional evaluation, which provides a mechanism and a philosophy for

organizations wishing to assess performance in a deeper manner than traditional financial measures. What these scholars offered was a methodology for refocusing on process elements of operations as opposed to simple bottom-line metrics. The four criteria included in the balanced scorecard approach encompass:

- (1) Financial measures, to include traditional ratios and results, as well as cost-benefit assessments and risk analyses.
- (2) Customer assessments, including satisfaction, which is conceptualized as a leading indicator of future success or failure.
- (3) Business process metrics, to include strategic, core, and support processes.
- (4) Learning and growing evidence, including the strength of a functional corporate culture, training and development initiatives at the individual and the collective level.

Quality management tenets embedded in the balanced scorecard approach include continuous improvement, quantitative measurement of processes, customer perceptions of quality, and organizational learning and adaptation (Gold-Bernstein, 2007; Janowski, 2006).

Interestingly, the emphasis upon measurement proposed by Taylor (1911) and supported by Deming (1986) has led to a basic problem. Marketers have become so effective at measuring customer satisfaction and then relating it to sales, market share, and ultimately profitability that a company can very accurately gauge how much business a customer generates. Whereas on the surface this would seem to be desirable, many businesses have focused only upon the customers generating high levels of profitability and are losing touch with other important customer criteria (Reis *et al.*, 2003). Thus, into the twenty-first century, we must ensure that we do not only focus upon gauging profitable customers but also upon customer indicators, such as embrace of technology and innovative usage, that may have significant impact in the future.

Business ethics

A domain which has quite recently reflected Deming's impact is organizational ethics. Deming's quality management principles reflect the necessity of businesses assuming the high-moral ground (Rayborn and Payne, 1996). Employee empowerment encourages active employee participation in the organization and implies a basic level of trust between management and employees in order to share ideas for continuous improvement. Further, the reduction and early identification of errors in products and services increase their quality and reliability. In short, a commitment to quality improves the integrity of products and services – a primary ethical value.

An emphasis on quality enhances ethics in other ways. Tracking customer complaints and defects requires a degree of honesty with customers. Further, benchmarking, sharing information with other organizations and adapting those that fit the company culture, presupposes the moral values of good will, honesty, and truthfulness with competitors (Nayebpour and Koehn, 2003). Employee participation in the continuous improvement process implies the ethical value of employee responsibility (Fisscher and Nijhof, 2005; Freiesleben and Pohl, 2004). Ethics and quality are connected in the Baldrige National Quality Award criteria which follow a number of Deming's principles. As an arbiter of quality, the Baldrige in turn serves as

a basis for the influential Caux Round Table Principles for Business, a set of business ethical practices (Goodpaster *et al.*, 2004).

Another area where Deming's ideas and ethics converge is the organizational code of ethics. An effective code delineates honesty with customers, which is imperative to identifying customer expectations. The code also delineates responsibility for quality, reliability, and safety. Further, the code describes the freedom of employees to verify quality and identify non-conformance. Moreover, the code has to emphasize honesty in such areas as producing true reports on product defects and non-conformance (Stimson, 2005). Into the twenty-first century, quality is becoming a cultural value of the organization (Sciarelli, 2002). Thus, the defining aspect of quality that will increasingly reflect the organization culture of dealing with customers, employees, and the community.

One important twenty-first century issue is customer concern over privacy of personal information in company databases. Deming emphasized a customer orientation, which implies that honesty and integrity must underlie the operation of company databases. The code of ethics should reinforce these principles (Iles and Healy, 2004).

Human error

Deming's beliefs concerning human error are among his most important legacies. It is no exaggeration to say that some of management's basic assumptions about workers and their ability to produce defect free products and services has changed. This legacy, in a sense, occurred by default.

Before Deming started his consulting practice there already was a strong stream of research known as "human factors." Human factors research became important during World War II and has flourished since the mid-1950s. It predominately involves industrial psychologists and industrial engineers, but it is a broad field and many academic disciplines are involved. Participants in human factors research formed their first formal organization, Human Factors Society of America (now the Human Factors and Ergonomics Society), in 1957. They defined the human factors discipline as involving the study of how people interact with tasks, machines, and the environment with the consideration that humans have limited capabilities. A key point is that this research stream, which involved many researchers at many institutions of higher learning, did not develop a significant branch that took a statistical view of human behavior and did not give the inevitability of human error a central position. Human factors research does have a human reliability branch, but it focuses on causal errors, as described in the taxonomies described in Reason (1990, 2000). Because of this, when Deming began consulting, the quality control field was ripe for his new message about human error.

Deming's background in statistics and his passion for quality made it almost inevitable that he would merge these areas. In doing so, he developed a fundamentally new approach to quality control. Despite the fact that his tenth principle was to eliminate exhortations to the workers, he unceasingly exhorted management to accept responsibility for poor quality products. He argued that management was responsible for quality, because they controlled the worker's tools and the worker's environment. This, in turn, largely controlled the variability of the worker's product. What variability was left was mostly inevitable random behavior, which, of course, Deming showed how to manage through using various statistical procedures. One way Deming

taught managers this principle was by using his famous red bead experiment (Deming, 1986). It shows in vivid terms how futile it is to exhort workers to eliminate defects when the defects are due to system problems beyond their control.

Eventually, Deming's emphasis on the statistical approach to controlling human error changed management's assumptions about how to achieve quality. They learned that demanding perfection in human activity was fundamentally futile. This realization began a stream of research dedicated to understanding human error and the prerequisite system characteristics which induce them (Reason, 2000). Moreover, it led to a decrease in management taking an adversarial position of assigning blame to workers. Management finally accepted that they must manage human error rather than try to eliminate it. Clearly, the new concept is that errors will happen. The goal is to design and manage such that the consequences of the errors are minimized.

Deming's synthesis of quality, human variation, and statistics is considered "obvious" to most managers and management theorists today. But this perspective was not at all obvious when Deming started his consulting practice in 1946. This point can be substantiated, for instance, by reviewing books on risk published in the 1970s. Human risk, be it in flying an airliner or driving car, is intimately involved with human reliability. Books of this time period or earlier gave almost no attention to the random human element, and when they did address it they either focused on "improving human behavior" or reducing on causal errors (Baker, 1971; Rowe, 1977).

Once it was accepted that humans are fallible and that human error is inevitable, the nature of the quality control manager's job began to change. As Reason (2000) posits, "we cannot change the human condition, but we can change the conditions under which humans work." Over the past 15 years, research on human error has evolved into two streams:

- (1) preventing errors through system modifications; and
- (2) maximizing the value of unpreventable mistakes by avoiding individual blame and maximizing organizational learning (Schoemaker and Gunther, 2006).

Initial efforts were oriented toward the development of high-reliability organizations (Weick, 1987), but product designers have come to understand the impact of error-proofing products on consumer satisfaction. The concept of error proofing was originally known as Poka Yoke, a term originated by Shigeo Shingo as part of the Toyota Production System in the 1960s (Shingo, 1986).

Deming's innovative ideas about downplaying blame and scrubbing processes to eliminate blame-inducing incidents have elevated error-proofing to a new level. Recently, Universal Serial Bus drives can be inserted only the correct way, gas caps are tethered to the vehicle and threaded to prevent over-tightening, coffee makers and automobile headlights automatically turn off, file cabinets prevent users from opening more than one drawer at a time, light and faucet sensors prevent waste, drop-down menus drive software applications, double action devices start power hand tools, and "dead man" switches prevent bodily harm when using lawnmowers (Manivannan, 2006).

Another example of how Deming fundamentally changed business practices involves how the factory floor is managed. Before Deming, most mass production was engineered using long production lines where the motor driven belt controlled the worker. After Deming, many factories were designed around a series of cells, each cell having several workers, each of whom was responsible for a several different

operations. The workers were encouraged to help one another when resolving a mistake, they were authorized to stop production when a significant error occurred, and they were allowed to exchange their operations to combat boredom, a major contributor to worker error.

Still another example of Deming's human error legacy involves a topic that Deming often spoke of in his seminars. Stimulated by the early 1990s reports of the pervasive and lethal impact of medical errors, both natural and social scientists began to critically heed Deming's notion that reformed processes, not enhanced individual action, will produce the greatest gains in quality (Bornstein, 2000). Recently, more and more hospitals and pharmacies are revamping their procedures and equipment to cope with the always present human error (Villa, 2006; Escovitz *et al.*, 1998).

Supply chain management

Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistic activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, or customers. In essence, supply chain management integrates supply and demand management within and across companies (Council of Supply Chain Management Professionals, 2007). As organizations matured in their understanding of the meaning, costs and benefits of this approach, the sub-discipline of supply chain management began to emerge in the 1990s (Quinn, 2007).

The usual justification for supply chain management is that by unifying the chain wasteful activities can be wrung from the system. Sometimes this involves completely removing middle men, almost always it depends on the integration of communication and database systems to reduce inventories and remove knowledge lags in the chain. These factors are very important, but Deming taught a lesson that is no less important. He taught that a quality product is impossible without quality raw materials, and that the customer cannot be delighted if the producer does not know what the customer wants and needs, or cannot provide it quickly. Once this understanding of mandatory prerequisites is understood, it follows that the supply chain must be managed as a whole. Deming (1986) continually stressed the importance of both the "upstream" relationships with suppliers as well as the "downstream" ones with consumers.

To successfully implement supply chain management, Deming taught that companies must have intense, long-term, collaborative relationships with suppliers, they must have a profound mastery on internal business processes, they must listen to customers and in all these arenas, and they must be attuned and responsive to stakeholder and environmental alterations (Anderson *et al.*, 2007).

Deming's fourth principle condemned the practice of doing business with other organizations based on price alone, and insisted that companies must come to view suppliers as long-term key partners in the continuous improvement journey. In effectively demonstrating the necessity for this precept, Deming (1986) convinced many businesses to more actively manage the links in their supply chain.

Deming's third principle emphasized that quality cannot be achieved by inspection. Deming's saying "you cannot inspect quality into the product" sums up his position (Deming, 1986). Before supply chain management can be successful, the product must be able to flow smoothly from company to company and, in effect, this means that we cannot stop the flow for testing every time the product moves from one company to another.

Deming's ninth principle points out the necessity of breaking down barriers between departments. Of course, if supply chain management is to succeed, then we must remove barriers to communication, flow of authority, and trust that commonly exists among companies. Before Deming's time mistrust between companies was strong and almost universal. It is no exaggeration to say that that companies nurtured strong adversarial relationships with both their suppliers and customers. Supply chain management is impossible under these conditions. Each part of the chain must trust that the other parts will deliver quality goods, on time, all the time. They must trust each other to the point that they can share confidential sales and engineering data. To not do so would mean that inventories within the chain would have to be reinstated to cover for the increased uncertainty each company had. This would cause reduced efficiencies and increased instabilities in the overall system.

Concluding observations

The contributions discussed above by no means represent all of the enduring legacies of Deming. Indeed, his influence is still felt in substantive as well as in whimsical ways. For example, a couple years after Deming's death, Professor E. L. Kersten, PhD founded Despair.com, which markets a line of "de-motivational" posters and products. While Kersten still publishes in academic outlets, he expends most of his energy on his business dedicated to satirizing the once-popular product lines of motivation rhetoric that Deming (1986) so often criticized and admonished against as meaningless "slogans and exhortations." An example of Kersten's cynical rebuttals is: "Potential: Not Everyone Gets to be an Astronaut When They Grow Up." Kersten writes, and Deming would no doubt concur:

Psychology tells us that motivation – true, lasting motivation – can only come from within. Common sense tells us it can't be manufactured or productized. So how is it that a multi-billion dollar industry thrives through the sale of motivational commodities and services? Because, in our world of instant gratification, people desperately want to believe that there are simple solutions to complex problems. And when desperation has disposable income, market opportunities abound.

In a more profound impact, Vinzant and Vinzant (1999) indicated that the Deming method of quality management has influenced and strengthened strategic management approaches, specifically citing the importance of including customer perceptions in strengths, weaknesses, opportunities, and threats analyses, the importance of control processes in strategy implementation, and the importance of decentralization in strategic planning. In other domains, Deming's ideas have stimulated critical inquiry into crucial business disciplines, and although not all research supports his arguments, his foundation has nonetheless contributed to the advancement of the social sciences. Finally, while these contributions we have covered may not have been exactly what Deming would have foreseen, it is indeed his vision that allows us to "improve constantly and forever" the boundaries of our discipline so many years after his death.

References

AACSB International (2007), The Association to Advance Collegiate Schools of Business International, available at: www.aacsb.org

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- Aguayo, R. (1991), *Dr. Deming: The American Who Taught The Japanese About Quality*, Fireside/Simon & Schuster, New York, NY.
- Albright, T. and Lam, M. (2006), "Managerial accounting and continuous improvement initiative: a retrospective and framework", *Journal of Managerial Issues*, Vol. 18 No. 2, pp. 157-75.
- Anderson, D.L., Britt, F.F. and Favre, D.J. (2007), "The 7 principles of supply chain management", *Supply Chain Management Review*, available at: www.scmr.com/article/CA6432096.html (accessed April 1 2007).
- Baker, R.F. (1971), *The Highway Risk Problem: Policy Issues in Highway Safety*, Wiley-Interscience, New York, NY.
- Bhuiyan, N. and Baghel, A. (2005), "An overview of continuous improvement: from the past to the present", *Management Decision*, Vol. 43 No. 5, pp. 761-71.
- Bornstein, B. (2000), "Medical mistakes: human error or system failure?", *Momentum*, pp. 1-8.
- Carson, P.P., Carson, K.D. and Roe, C.W. (1995), "Human resource management and TQM in the medical sector", in Knouse, S.B. (Ed.), *Human Resources Management Perspectives on TQM*, American Society for Quality Control Press, Milwaukee, WI, pp. 151-84.
- Council of Supply Chain Management Professionals (2007), Council of Supply Chain Management Professionals, available at: <http://cscmp.org/Website/AboutCSCMP/Definitions/Definitions.asp> (accessed May 15, 2008).
- Creech, B. (1995), *Five Pillars of TQM*, Penguin Books/Plume, New York, NY.
- Dalglish, S. (2003), "Could Deming have been wrong?", *Quality*, Vol. 46 No. 6, p. 18.
- Daniels, S.E. (2000), "Tire failures, SUV rollovers put quality on trial", *Quality Progress*, Vol. 33 No. 12, pp. 30-46.
- Deming, W.E. (1986), *Out of the Crisis*, Center for Advanced Engineering Education, Cambridge, MA.
- Escovitz, A., Pathak, D.S. and Schneider, P.J. (1998), *Improving the Quality of the Medication Use Process: Error Prevention and Reducing Adverse Drug Events*, Haworth Press, New York, NY.
- Fisscher, O. and Nijhof, A. (2005), "Implications of business ethics for quality management", *The TQM Magazine*, Vol. 17 No. 2, pp. 150-60.
- Freiesleben, J. and Pohl, T. (2004), "Quality: an ethical inquiry", *Total Quality Management and Business Excellence*, Vol. 15 No. 9, pp. 1209-17.
- Gabor, A. (1992), *The Man Who Discovered Quality*, Penguin Press, New York, NY.
- Gold-Bernstein, B. (2007), *The Growing Imperative for Business Process Monitoring and Management*, available at: www.ebizq.net/topics/scm/features/5068.htm (accessed May 29, 2008).
- Goodpaster, K.E., Maines, T.D. and Wiemerskirch, A.M. (2004), "A Baldrige process for ethics?", *Science and Engineering Ethics*, Vol. 10 No. 2, pp. 243-58.
- Hoyle, D. (2005), *ISO 9000 Quality Systems Handbook*, Reed Elsevier, Boston, MA.
- Iles, J. and Healy, M. (2004), "Quality management and e-commerce: the role of codes of conduct governing the use of technology", *The TQM Magazine*, Vol. 16 No. 5, pp. 354-8.
- Janowski, D. (2006), "What can we learn from Deming?", *Mortgage Banking*, Vol. 66 No. 11, pp. 94-9.
- Juran, J.M. and Godfrey, A.B. (1998), *Quality Handbook*, McGraw-Hill, New York, NY.
- Kaplan, R.S. and Norton, D.P. (1996), *The Balanced Scorecard: Translating Strategy into Action*, Harvard Press, Cambridge, MA.

- Knouse, S.B., Carson, P.P. and Carson, K.D. (1993), "W. Edwards Deming and Frederick Winslow Taylor: a comparison of two leaders who shaped the world's view of management", *International Journal of Public Administration*, Vol. 16, pp. 1621-58.
- Manivannan, S. (2006), "Error proofing enhances quality", *Manufacturing Engineering*, Vol. 137 No. 5, pp. 99-104.
- Mitra, D. and Golder, P.N. (2007), "Quality is in the eye of the beholder", *Harvard Business Review*, Vol. 85 No. 4, p. 26.
- Mooney, M. (1996), "Deming's real legacy: an easier way to manage knowledge", *National Productivity Review*, Vol. 15 No. 3, pp. 1-8.
- Nachimutha, M.D.G., Selladurai, V. and Santhi, P. (2006), "Green productivity indexing: a practical step towards integrating environmental protection into corporate performance", *International Journal of Productivity and Performance Management*, Vol. 55 No. 7, pp. 594-605.
- Nayebpour, M.R. and Koehn, D. (2003), "The ethics of quality: problems and preconditions", *Journal of Business Ethics*, Vol. 44 No. 1, pp. 37-48.
- Quinn, F. (2007), "10 years and counting", *Supply Chain Management Review*, available at: www.scmr.com/article/CA6432096.html (accessed April 1).
- Rao, T.V. and Rao, R. (2005), *The Power of 360 Degree Feedback: Maximizing Managerial and Leadership Effectiveness*, Sage, Thousand Oaks, CA.
- Rayborn, C. and Payne, D. (1996), "TQM: just what the ethicist ordered", *Journal of Business Ethics*, Vol. 15 No. 9, pp. 963-72.
- Reason, J.T. (1990), *Human Error*, Cambridge University Press, Cambridge.
- Reason, J.T. (2000), "Human error: models and management", *British Medical Journal*, Vol. 320, pp. 768-70.
- Reeves, C.A. and Bednar, D.A. (1994), "Defining quality: alternatives and implications", *Academy of Management Review*, Vol. 18 No. 3, pp. 419-45.
- Reis, D., Pena, L. and Lopes, P.A. (2003), "Customer satisfaction: the historical perspective", *Journal of Management History*, Vol. 41 No. 1, pp. 195-8.
- Rowe, W.D. (1977), *An Anatomy of Risk*, Wiley-Interscience, New York, NY.
- Rust, R.T. and Oliver, R.L. (2000), "Should we delight the customer?", *Journal of Marketing Science*, Vol. 28 No. 1, pp. 86-94.
- Schoemaker, P.J.H. and Gunther, R.E. (2006), "The wisdom of deliberate mistakes", *Harvard Business Review*, Vol. 84 No. 6, p. 106.
- Sciarelli, S. (2002), "Business quality and business ethics", *Total Quality Management*, Vol. 13 No. 8, pp. 1141-9.
- Self, B., Roche, G. and Hill, N. (2002), *Customer Satisfaction Measurement for ISO 9000*, Reed Elsevier, Boston, MA.
- Shingo, S. (1986), *Zero Quality Control: Source Inspection and the Poka Yoke System*, Productivity Press, Portland, OR.
- Stimson, W.A. (2005), "A Deming inspired management code of ethics", *Quality Progress*, Vol. 38 No. 2, pp. 67-74.
- Taylor, F. (1911), *Principles of Scientific Management*, Harper, New York, NY.
- Villa, A.L. (2006), "Rampant drug errors in hospitals are preventable", *Trial*, Vol. 42 No. 10, pp. 78-9.

-
- Vinzant, J.C. and Vinzant, D.H. (1999), "Strategic spin-offs of the Deming approach", *Journal of Management History*, Vol. 5 No. 8, pp. 516-27.
- Walton, M. (1986), *The Deming Management Method*, Putnam, New York, NY.
- Walton, M. (1990), *Deming Management at Work*, Putnam, New York, NY.
- Weick, K.E. (1987), "Organizational culture as a source of high reliability", *California Management Review*, Vol. 29, pp. 112-27.
- Yost, J.R. (2005), *The Computer Industry*, Greenwood Press, Westport, CT.

Further reading

- Argyris, C. and Schon, D.A. (1978), *Organizational Learning*, Addison-Wesley, Reading, MA.
- Lu, X.A. (2004), *Surveying the Concept of the Learning Organization*, available at: www.weleadinlearning.org/xaoct04.htm (accessed March 10, 2008).
- Senge, P. (2006), *The Fifth Discipline: The Art and Practice of the Learning Organization*, Doubleday, New York, NY.

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