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ISO 9000 : a step backward for the philosophies of W. Edwards Deming?

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Deming?**

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San Jose State University, 1992

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ISO 9000: A STEP BACKWARD FOR THE
PHILOSOPHIES OF W. EDWARDS DEMING?

A Thesis

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The Faculty of the Division of Technology
San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

David A. Abell

December, 1992

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Abstract

ISO 9000: A STEP BACKWARD FOR THE PHILOSOPHIES OF W. EDWARDS DEMING?

by David A. Abell

Total Quality Management (TQM) is replacing the more traditional business methods of Taylor's scientific management. Many companies which have implemented TQM are requiring their suppliers to meet quality system standards to assure a consistent product. One popular method of the assessment of suppliers is by the ISO 9000 quality system registration standards.

This thesis studies the ISO 9000 standards and uses the philosophies of Dr. W. Edwards Deming as a guide to quality methods. Competitive pressure and rapid acceptance of these standards in international markets may result in companies designing their quality systems simply to meet the standards and thus miss other benefits. Research and interviews conducted during the development of this thesis identify the weak points and benefits of ISO 9000. Analysis provides suggestions to companies that must meet the standard but wish to enhance their current quality philosophies and culture as well.

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Chapter 1

Problem Definition

Introduction

Rarely has an international standard garnered such interest as has the ISO 9000 series for quality systems registration. Many factors are causing this but three seem the most prominent. First is the accelerating globalization of the world marketplace. Second is the development of the European Community (EC) in 1992 which requires simplified standards to allow free trade across borders. Third is the economic success of the Japanese widely perceived to be based upon quality leadership. Yet one of the foremost leaders in the quality revolution, W. Edwards Deming, teaches a philosophy that appears at odds with several aspects of ISO 9000. This study seeks to assess the ISO 9000 quality system standards using the philosophy of Deming as a framework.

The ISO 9000 series of quality systems standards is rapidly growing both in interest and in international acceptance. "That fully 90 countries thus far have adopted ISO 9000 standards says a lot about the global business community's commitment to the concept of quality" (Benson, 1991, p. 54). These standards have become popular because they are the first to be widely accepted as a minimal listing required for a functional quality system (Lofgren, 1991). Benson (1991) believes that successful implementation and

acceptance of these standards has not been simple partially because of differing views regarding the definition of a quality system.

One definition is described by the philosophies of W. Edwards Deming whose views are reviewed and summarized in this thesis. Deming's teachings span more than fifty years. Combined, these teachings offer a philosophical basis to build a quality management system instead of a prescriptive sequential approach which is the hallmark of other quality proponents, most notably Philip Crosby (Crosby, 1979). Deming is noted for his evolving 14 points, but they are far from being a checklist to follow and instead represent a codification of his principles. This does not mean that Deming opposes any kind of prescriptive standard. He has been involved in the development of international agreements for cross-border railway gauges and the sharing of census methodology since 1939 (Neave, 1990).

This thesis endeavors to answer the question "is ISO 9000 a step backward for the philosophies of W. Edwards Deming?" Many feel that "there has been a breakthrough in the way 'standards' are being used changing from the prescriptive, specific and detailed form to a much broader and conceptual application" (Johnston, 1988, p. 365). There continues to be concern about these standards doing more harm than good when used by the unsophisticated. Furthermore, there is no clear evidence that countries that have used these standards the longest have benefitted from increased

efficiencies, productivity, or enhanced customer satisfaction. Indeed, ISO 9000 "may divert many companies from making the cultural and management changes necessary to ensure organizationwide quality" (Levine, 1991, p. 28).

Statement of the Problem

Momentum to accept ISO 9000 may cause companies to implement a form of Total Quality Management (TQM) which could be a regressive step from the transformation taught by Deming. There are several reasons to seek compliance. The first motivation comes from customer contractual obligations or market pressure from a major competitor. Specific military quality requirements may be replaced in some countries by ISO 9000 standards. Registration to ISO 9000 can be used as preparation for the Malcolm Baldrige National Quality Award or the Deming Prize. Finally, registration can be sought because management believes the rigor required to pass a third party audit will result in internal process improvements (Kerr, 1992). Lawrence D. Eicher is the Secretary General of the International Organization for Standardization which developed and continues to evolve the ISO 9000 standards. He stated that "the main purpose of ISO is to foster cooperation between people and nations and to develop standards for the world markets with all the obvious benefits" ("Interview with ISO Secretary General," 1991, p. 37).

The problem addressed by this thesis centers on the efficacy of the ISO 9000 standards as they are applied by two different kinds of organizations. The first case is that of a sophisticated company with a history of Total Quality Management: Will the ISO 9000 standards be compatible with the existing quality culture or will adherence to the requirements of ISO 9001, ISO 9002, or ISO 9003 be disruptive? The second case is that of an unsophisticated company using the requirements of ISO 9000 as the first major attempt to install a quality system. For that company, the problem to be investigated is whether or not the template laid out in ISO 9000 is sufficient to develop an effective quality culture. In either case, the key question is whether the rapid gain in popularity of ISO 9000 registration will be a regressive move for TQM using the philosophies of Deming as a guide.

Significance of the Study

ISO 9000 is growing in importance to United States and world trade. A publication of the British Standards Institute (BSI) in 1991 indicated that "9,000 firms [were] assessed and registered by second and third parties against BS 5750 [ISO 9000] or directly equivalent standards [in the United Kingdom]" (British Standards Institute, 1991, p. 1). The United States has been slower to accept quality systems registration, yet a partial listing of accredited assessors and registrars by Burrows (1992) shows that 124

companies are registered and 497 are under contract to be assessed. By mid 1991, Underwriters Laboratories had registered only 25 U.S. firms but had received more than 2,500 inquiries (Benson, 1991).

A rush to become registered to the ISO 9000 standards may result in a simple prescriptive form of Total Quality Management. Prescriptive means forcing a checklist or step by step approach to TQM by literal adherence to the paragraphs of the ISO 9000 standards. This approach is not sufficient to achieve a lasting management shift to a quality focus which may be required to remain competitive. This study compares the requirements of ISO 9000 to the philosophies of W. Edwards Deming to determine if compliance can be achieved within the comprehensive framework of his methods. This broader understanding is necessary for quality unsophisticated companies because, as Kanter wrote, older tradition bound companies are "used to setting policy at the top, they cannot easily free the levels below to contribute new ideas" (Kanter, 1983, p. 75). This freeing of entrepreneurial spirit will be required for success in the increasingly competitive global marketplace.

Limitations of the Research

The method of study was an extensive literature search and interviews with practitioners of TQM, registrants to ISO 9000, and developers of the standards. The ISO 9000 standards are being revised with minor corrections in 1992 and a major release in 1996. The current release of the standards

dated 1987 may have critical omissions which are investigated. There are many conflicting views and interpretations of both the usefulness and application of quality systems registration as embodied in these standards. Thorough review of available literature is required to avoid overlooking significant trends and information.

Interviews were used to corroborate and expand the results of the literature search. These interviews could have been limited by the availability of people who are knowledgeable about either Deming's philosophies or ISO 9000. The researcher was optimistic that people with in-depth understanding of both topics would be available. Precise conclusions are made even more difficult because the Deming philosophy is constantly changing as he continues to apply his own principles of continuous improvement. For example, the 14 points came about only in the early 1980s and he is still working on the concepts of profound knowledge (Neave, 1990).

Delimitation of the Study

This study cannot completely review the concepts of Total Quality Management nor the structure of quality systems registration due to the complexity of both topics. Only a representative summary of either subject can be adequately addressed, but this thesis attempts to do so in as complete a manner as necessary to provide a foundation for analysis of the research questions. Many people hold widely divergent opinions on these

topics, and the structure of this study does not allow statistical sampling of large numbers. Critical opinions were derived from interviews with the authors of the quality standards, selected proponents of quality management principles, and users of the standards. Thus careful selection of sources and interviews with experienced people helped assure a balanced and thorough perspective.

Definition of Terms

Corporate Culture

"Corporate culture is the basic pattern of shared beliefs, behaviors, and assumptions acquired over time by members of an organization"

(Organizational Development Resources, 1989, p. 3). Culture refers to the corporate culture of an organization that reflects the attitudes and practices related to quality systems application. A culture is considered robust if it is insensitive to uncontrollable, outside sources. Any modification of core procedures in a company intended to only meet the requirements of an auditor would be affected whenever the auditing requirements changed. "By *robust*, we mean that the product or process performs consistently on target and is relatively insensitive to factors that are difficult to control"

(Montgomery, 1991, p. 414).

Deadly Diseases

These are seven characteristics of an organization which Deming considers a continuation of ruinous management procedures. They are listed in Table 3 of chapter 2 on page 45.

Fourteen Points

These are statements which Deming uses to summarize the key points of his philosophy. They are discussed in chapter 2.

Hoshin Planning

Hoshin in Japanese means "shining metal" or "pointing direction" (King, 1989, chap. 1, p. 2). Hoshin planning is:

[a] system that has integrated PDCA [Plan Do Check Act] language and activity based on clear, long-term thinking, a realistic measurement system with a focus on process and results, identification of what's important, alignment of groups, decisions by people who have the necessary information, planning integrated with daily activity, good vertical communication, cross-functional communication, and everyone planning for himself or herself, and the buy-in that results." (King, 1989, chap. 2, p. 3)

ISO 9000 Standards

For the purpose of this thesis, ISO 9000 standards, or simply standards, refers to the collection of ISO 9000 quality systems registration standards maintained by the International Organization for Standardization based in Geneva, Switzerland. These standards are also issued by the American National Standards Institute under the numbering system of the

Q90 series. The Q90 series are technically equivalent to the ISO 9000 series and differ only in minor spelling changes to fit American practice. These standards are:

ANSI/ASQC Q90-1987: "Quality Management and Quality Assurance Standards - Guidelines for Selection and Use." [Equivalent to ISO 9000].

ANSI/ASQC Q91-1987: "Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing." [Equivalent to ISO 9001].

ANSI/ASQC Q92-1987: "Quality Systems - Model for Quality Assurance in Production and Installation." [Equivalent to ISO 9002].

ANSI/ASQC Q93-1987: "Quality Systems - Model for Quality Assurance in Final Inspection and Test." [Equivalent to ISO 9003].

ANSI/ASQC Q94-1987: "Quality Management and Quality System Elements - Guidelines." [Equivalent to ISO 9004].

PDCA

PDCA is an acronym for "Plan - Do - Check - Act." This is the circle of continuous process improvement taught by Deming based upon original ideas of Walter Shewhart (Neave, 1990, p. 139). Deming revised it in 1990 to PDSA with the S signifying "study" to place more emphasis on the analytical nature of the checking stage (Dobyns & Crawford-Masch, 1991).

Profound Knowledge

Deming's philosophy is based upon his system of profound knowledge. It comprises the four elements of appreciation of systems, the knowledge of variation, the theory of knowledge, and psychology (Deming, 1990).

Quality Audit

Mills (1989) defines the quality audit as:

. . . a management tool for determining the effectiveness of the quality system. . . . The results of the audit provide an assessment of the adequacy of the existing program. They also provide a bench mark against which system improvements can be developed and evaluated. (p. 7)

The quality audit is the primary tool used by registrars to confirm compliance to the requirements of quality system standards.

Quality Function Deployment

Quality Function Deployment (QFD) is an analytical tool used to translate "customer requirements into appropriate technical requirements for each state of product development and production" (Eureka & Ryan, 1988, p. 13). A QFD relationship matrix is used in this thesis to graphically analyze the intersection of the ISO 9001 paragraphs and Deming's 14 points.

Quality System

Deming (1990) defines a system as "a series of functions or activities (subprocesses, stages - hereafter 'components') within an organization that work together for the aim of the organization" (p. 30). A quality system

comprises the processes in an organization intended to yield consistency or improvement to the enterprise of the corporation.

Sophisticated

In the context of quality systems, a sophisticated company is one that has adopted a conscious quality focus as a strategic element of management. An unsophisticated company has not recognized the strategic importance of quality. Feigenbaum (1983) defines two management steps required to establish quality as a strong business strategy:

[1] The total-customer-satisfaction-oriented concept of quality, together with reasonable costs of quality, must be established as one of the primary business and product planning and implementation goals and performance measures of the marketing, engineering, production, industrial relations, and service functions of the company.

[2] Assuring this customer-satisfaction quality and cost result must be established as a primary business goal of the quality program of the company and of the quality-control function itself - not some narrower technical goal restricted to a limited technical or production-oriented quality result. (p. 18)

Third Party Registration

Third party refers to the independent agent hired by an organization to evaluate a supplier. Registration by a third party is a formal process in which the third party is accredited by an independent body which is sometimes a government agency. This agent then provides independent registrations of suppliers through a formal quality audit and these registrations are then

recognized by other potential customers. The supplier initiates and funds the independent third party registration process.

Transformation

Deming speaks of a transformation of management. He uses this word to emphasize that change is not enough, but an entirely new paradigm or foundation is required in management thinking (Deming, 1986, p. ix).

Total Quality Management (TQM)

TQM is a comprehensive system of management that emphasizes a commitment to quality, focus on customer needs, and continual process improvement enlisting all members of the organization (Axline, 1991).

Chapter 2

Review of the Literature

A company cannot achieve Total Quality Management in simple, straightforward steps. Evolution to TQM is not a project like redesigning the pension plan. Achieving TQM requires a fundamental review of the principles that guide strategic planning and day to day activities. The works of W. Edwards Deming represent one model for TQM and this thesis uses his principles as a framework to study ISO 9000. These standards are evaluated for effectiveness in moving a company toward TQM if it currently lacks quality as a management emphasis.

Deming History

Deming was born in 1900 in Sioux City, Iowa and earned a PhD in mathematical physics at Yale in 1928. He is active as a statistical consultant, lecturer and Distinguished Professor in Management at Columbia University, New York. The Japanese Deming Prize for quality was named after him in 1951 and he received the elite Japanese Order of Sacred Treasure, Second Class in 1960 (Port, 1991).

Most of his life has been spent as a private consultant, but he began his career with summer work at Bell Laboratories where much of the foundation for his work was established. Pivotal in his development was exposure to Dr. Walter A. Shewhart beginning in 1927. Deming has always

recognized the importance of Shewhart's work and its influence on him: "In fact, I [Deming] could claim that I had the privilege to work closer with Dr. Shewhart than any one had in the Bell Laboratories. He kindly spent much time with me as I tried to understand his thoughts" (Kilian, 1988, p. 56). He continued to study with Shewhart for several years (Walton, 1986). Shewhart developed statistical process control and control charts which greatly influenced Deming's approach to quality management.

Much of what today is attributed to Deming comes from the ideas of Shewhart, a fact which Deming acknowledges. His emphasis on processes and systems is rooted in Shewhart's concepts. Deming believes Shewhart's special contribution was to know when to act on a process and when to leave it alone, sometimes referred to as distinguishing between special and assignable causes (Walton, 1986). Other contributions are the role of top management in designing systems, control charts to assess the stability of a process, and cost savings through quality control (Rosander, 1991). The Deming method's special contribution is a broad view that encompasses the responsibility of management and the intrinsic motivation of the worker. It promotes a way of life as opposed to simple management fix-it schemes.

In the summers of 1925 and 1926, Deming learned much at the Bell Laboratories Hawthorne plant that would influence his work in future years. The growing complexity of telephone equipment was dictating consistency

and interchangeability and significant improvements in reliability (Kilian, 1988). Shewhart's work with control charts helped in achieving these aims. These years also were important in the development of management philosophy due to experiments conducted by Elton Mayo at that plant. Perhaps best known for the "Hawthorne effect," these studies pointed to the human element in work situations and that management must acknowledge worker motivation. Laborers were no longer thought of as brainless hands of the scientific management theories espoused by Taylor (George, 1972). The human element forms a major part of Deming's theories of profound knowledge, but he does not seem to have had any direct contact with Mayo's studies at the time.

After graduate school, Deming spent several years with the U.S. Department of Agriculture. His expanding reputation as a statistician led to work with the 1940 census and an invitation to work in Japan after World War II. In 1950 he gave the first in a series of lectures on statistics to Japanese engineers. Many advances gained by Shewhart in statistical application and improvement had been transitory due to management's focus on short-term profits and inability to grasp the significance of these teachings. Much of the work done in the 1930s with statistical process control fell into disuse in the 1950s and Deming decided it was critical to avoid a repeat of this U.S. failure.

Quality in these postwar years took a back seat to production -- getting the numbers out. Quality control came to mean end-of-the-line inspection. If there were defects and rework, there would be profit enough to cover them. Although a few control charts lingered here and there for a time, particularly in defense industries, for the most part the techniques taught by Dr. Deming and his colleagues were now regarded as time-consuming and unnecessary, and they faded from use. (Walton, 1986, p. 9)

Deming concluded he would have to work at the management level in Japan. After his lectures to engineers in Japan in July of 1950, he met with Ichiro Ishikawa, the President of the JUSE, Union of Japanese Scientists and Engineers (Walton, 1986). He was highly successful with this approach and was honored in 1951 by JUSE with the establishment of the coveted Deming Prize. It is awarded to an individual or company for accomplishment in the application of statistical theory (Walton, 1986).

Deming's work in Japan would continue for another forty years, but broad recognition of his work in the United States would not come until the 1980s. He first came to the attention of the American public in the summer of 1980 through a television documentary "If Japan Can, Why Can't We?" (Dobyns & Crawford-Mason, 1991). This sparked an interest in his work that has obtained almost cult like proportions. "In the 1980's pursuit of greed, glamour, and instant gratification, it has been intriguing to watch a grass-roots movement thrive on the ideals of quality, learning, and self-improvement" (Gabor, 1990, p. 286).

Deming and Total Quality Management

Total Quality Management is a phrase used to describe a comprehensive management method with an accent on quality. Chapter 1 includes a definition by Axline. Another good example is by Armand V. Feigenbaum who defines total quality control but whose definition encompasses TQM:

Total quality control's organizationwide impact involves the managerial and technical implementation of customer-oriented quality activities as a prime responsibility of general management and of the main-line operations of marketing, engineering, production, industrial relations, finance, and service as well as of the quality-control function itself. (Feigenbaum, 1983, p. 13)

Dr. Robert S. McQueen (1991) of the Center for Productivity and Manufacturing Engineering, San Jose State University describes TQM as:

a philosophy for continuous improvement for products, process [sic] and services to enhance quality and overall performance. It involves the application of quantitative methods and human resource management techniques to manage and organize all functional processes of an enterprise system of systems in order to realize optimum customer value and satisfaction. (p. 1)

McQueen compares traditional scientific management approaches prevalent in the West with those ascribed to TQM (Table 1). This comparison emphasizes a holistic approach that includes a humanistic element of TQM such as "people are assets." This means that the efforts of a corporation or organization are more than the sum of the individual parts. This is a major

Table 1.

TQM Cultural Change Model

FROM:	TO:
management people are cost burdens short term objectives quarterly profits quality means high cost get product out management directed decisions reactive detection oriented focus on results quality by inspection meets specifications compartmentalized experts close held positional power sequential engineering management by control individual heroism competition/confrontation functional group success top down communications	leadership people are assets long term mission customer satisfaction quality means low cost exceed customer expectations data driven decisions proactive prevention oriented focus on process quality by intent measurable improvement learning organization employee empowerment concurrent engineering employee commitment teamwork cooperation/partnership enterprise success multi-directional communications

Source: McQueen (1991), "Total Quality Management," p. 1.

theme in the works of Deming emphasized by his decision to concentrate on management commitment early in his Japanese work.

The importance Deming attaches to controlling and reducing variation has led him to a holistic view of leadership that casts management in a very different role from the one prevailing in American companies since the end of World War II. Deming rejects the model of the modern American manager who can 'manage anything' based on a company's balance sheet. Instead, he advocates a process-obsessed management culture that is capable of harnessing the know-how and natural initiative of its employees and fine-tuning the entire organization to higher and higher standards of excellence and innovation. (Gabor, 1990, p. 7)

This holistic approach meshes well with the orientation of traditional Japanese culture (Yoshida, 1989). Western society's approach is not as inclusive and follows the scientific tradition of breaking down a problem into its individual parts. This approach is known as "atomism" and is in contrast to the Japanese holistic approach called "vitalism" (Boznak, 1991). These differing world views may account for the delay Deming's approach has experienced in being accepted by Western management.

A discussion of TQM requires a definition of quality. Quality is sometimes mistakenly confused with expensive products. Modern TQM programs have shown just the opposite: Quality products are less costly to manufacture because of reduced waste and effort. Deming uses the analogy of an orchestra to explain the meaning of quality. A world class orchestra or a local school orchestra may play from the same score. Both performances

may be technically flawless and without error. Yet, the result from one is much different from the other, demonstrating that the whole is greater than the parts (Deming, 1986).

This sophisticated view of quality exceeds Philip Crosby's definitions of "conformance to specifications" or "quality means conformance to requirements" (Crosby, 1988a, p. 35). If quality was meeting requirements, it would be reasonable to assume that once the specifications or requirements were met, no further effort would be required other than maintenance. "The idea of stopping any effort toward improvement once everything is within specifications seems logical. Shouldn't everything pay for itself, including quality? . . . It seems logical but it's wrong" (Aguayo, 1990, p. 41).

Manufacturing of tangible products is easier to understand than the intangible of services. Quality for services is elusive for as Rosander (1991) says, "customers buy a sample of one" (p. 48). The customer's judgment of the quality is based upon the single transaction of the service.

To understand the Deming method, it is best to understand his insistence not just upon change in management style, but on transformation.

Transformation of American style of management is not a job of reconstruction nor is it revision. It requires a whole new structure, from foundation upward. Mutation might be the word, except that mutation implies unordered spontaneity. Transformation must take place with directed effort. (Deming, 1986, p. ix)

His insistence upon the "total transformation of Western style management" (Neave, 1990, p. 30) is central to understanding his method. He questions fundamental assumptions of Western society. He is fond of saying that "best efforts will not be enough" (Neave, 1990, p. 30) and talks of restoring pride in workmanship, dignity, and the self-esteem of the worker. This is why his approach stands out from other quality proponents. An organization must make a complete paradigm shift in its thinking. A company cannot adopt only parts of his philosophy and be successful.

The change required is transformation, change of state, metamorphosis. The transformation will restore the individual; will abolish grades in school on up through the university; will abolish the annual appraisal of people on the job, MBO [Management by Objectives], quotas for production, specified requirements that people work 57 minutes out of every hour, incentive pay, monthly or quarterly reports on business targets, competition between people, competition between divisions, and other forms of suboptimisation. Leadership will replace these bad practices, and will restore the individual [Deming]. (Neave, 1990, p. ix)

Another element distinguishes Deming's methods from that of others to achieve TQM and that is his opinion of traditional American management's focus on profits. He believes this approach is ruinous and causes fixation on short-term solutions. He quotes Dr. Yoshi Tsurumi:

Most American executives think they are in the business to make money, rather than products or services. . . . The Japanese corporate credo, on the other hand, is that a company should become the world's most efficient provider of whatever product and service it offers. Once it becomes the world leader and continues to offer good products, profits follow. (Deming, 1986, p. 99)

To drive this point home, he quotes Dr. Lloyd Nelson who says, "The most important figures needed for management of any organization are unknown and unknowable" (Deming, 1986, p. 20). Some unknowable figures are the unknown sales lost because of a dissatisfied customer or decreased productivity from unmotivated employees. Awareness of the importance of unknown figures places a responsibility on management in a TQM mature company that is much more broad than can be reflected in the balance sheet.

Comparing the Deming Method with Other Quality Experts

There are several people who are considered experts in quality systems and planning. This researcher has chosen to use the methods of W. Edwards Deming as the basis for an analysis of the ISO 9000 standards. Two others will be reviewed briefly to provide a reference. These proponents are Joseph M. Juran and Philip B. Crosby. No single person is widely acknowledged to provide the best methods to achieve TQM, but Deming, Juran, and Crosby have established distinguished reputations as quality management leaders.

J. M. Juran was born in 1904 in Romania, four years after Deming. He earned a BS in electrical engineering (1924) from the University of Minnesota and a JD from Loyola in 1935 (Port, 1991). His career also has taken him to Japan where his work is considered second only to Deming in its importance (March, 1990). Some consider the work of Juran even more critical because of his emphasis on the management dimension, something which Deming

evolved later. "Juran was more important to Japan than Deming. . . . [He] applied quality to everybody, from managers to clerical staff" said Junji Noguchi, Executive Director of JUSE (Port, 1991, p. 17). Juran received the Order of Sacred Treasure, Second Class from Japan in 1981, 21 years after Deming. Juran founded the Juran Institute in 1979 to carry on his works and ideas.

His definition of quality is based upon the concept of fitness for use:

An essential requirement of these products is that they meet the needs of those members of society who will actually use them. This concept of *fitness for use* is universal. It applies to all goods and services, without exception. The popular term for fitness for use is *quality*, and our basic definition becomes: *quality means fitness for use*. (Juran & Gryna, 1980, p. 1)

This definition is used by the British Standard BS 5750, one source document of the ISO 9000 standards. "For the corporate quality policy, management should define objectives pertaining to key elements of quality, such as fitness for use, performance, safety, and reliability" (ANSI/ASQC Q94, 1987, paragraph 4.3.1).

The second significant quality consultant is Philip Crosby who started in industry as a junior technician at the Crosley Corporation in 1952 and progressed to become Corporate Director of Quality at ITT Corporation (Crosby, 1988b, p.2). He left ITT in 1979 and formed Philip Crosby Associates and the Crosby Quality College. By 1986, approximately 35,000

executives and managers had attended his Quality College (March, 1990, p. 23). Crosby is a more popular leader in the quality movement if only because his approach is simple and prescriptive and thus easier to understand and teach. His early work concentrated on developing cost of quality metrics to gain the attention of management who usually lead an organization by financial measures. He also focused on the corporate culture and in his 1988 book, "The Eternally Successful Organization," developed the management maturity grid to be used for assessing the relative quality sophistication of a company. Crosby, like Deming, also has 14 "steps" but they are more tactical than philosophical.

Mr. H. Grimmik (1990) of Philip Crosby Associates discussed in a lecture the key elements of these three quality leaders. To Crosby, Grimmik ascribed an emphasis on organization and culture. Deming, he said, promoted tools and skills as evidenced by the role that statistical analysis plays in the Deming methods. Juran, he felt, stressed people, teamwork, and Total Quality Circles (TQC). This assessment is useful but is limited in that it does not recognize the broad evolution of the Deming method to include a comprehensive philosophical system. The summary of Deming's methods is more accurate of his early work in the 1940s.

In comparison to Crosby and Juran, Deming's teaching concentrates more heavily on the human element in the quality equation. Much of his

philosophy is based on his deep religious nature and he sometimes quotes scripture in his lectures. More than the other two experts, "Deming's is a highly humanistic philosophy born of an intrinsically optimistic view of mankind and what working men and women can accomplish, if only they are given a chance" (Gabor, 1990, p. 285).

His insistence on radical change such as the elimination of merit systems puts him at odds with many of the teachings of American business universities and consultants such as Peter Drucker (Aguayo, 1990). The unique holistic approach to quality and society makes his teachings a distinctive compass to use in assessing the ISO 9000 standards.

Profound Knowledge

Although Deming is best known for his 14 points, his system of quality management is rooted in what he calls the system of profound knowledge. This is a recent development appearing in his lectures in the late 1980s and encompasses more than just statistical tools, the understanding of processes or variation (Neave, 1990). The system of profound knowledge defines a philosophical system more comprehensive than a simple quick fix manual for installing quality.

The system of profound knowledge is evolving and he continues to clarify the definitions and ideas. In the videotape series "The Deming Library" (Deming, 1990) he described four elements of the system:

- A. Appreciation for a system
- B. Some knowledge of the theory of variation
- C. Some theory of knowledge
- D. Some psychology

Besides listing these four elements, he emphasized that no one segment is sufficient by itself. All four must be considered as a whole and the interrelation between each forms the system of profound knowledge (Neave, 1990).

Whereas the 14 steps of Philip Crosby can be easily summarized in a poster displayed on the shop floor, the system of profound knowledge is less accessible to the average worker. Emphasis is on management, which in Deming's mind is responsible for most of the performance of any system. Management makes the decisions about how a process will be designed, what materials will be purchased, how employees will be treated, and so forth. They are the ones who must understand and enable this comprehensive philosophical system (Aguayo, 1990).

Appreciation for a System

Understanding systems is important to understanding everything else in the teachings of Deming. His earliest contribution was a simple flow diagram that he used with management in his first Japanese lectures of 1950 (Figure 1). Deming said:

What is a system? It is a series of functions or activities (subprocesses, stages - hereafter 'components') within an

that work together for the aim of the organization. The mechanical and electrical parts that work together to make an automobile or a vacuum cleaner form a system. (Deming, 1990, p. 30)

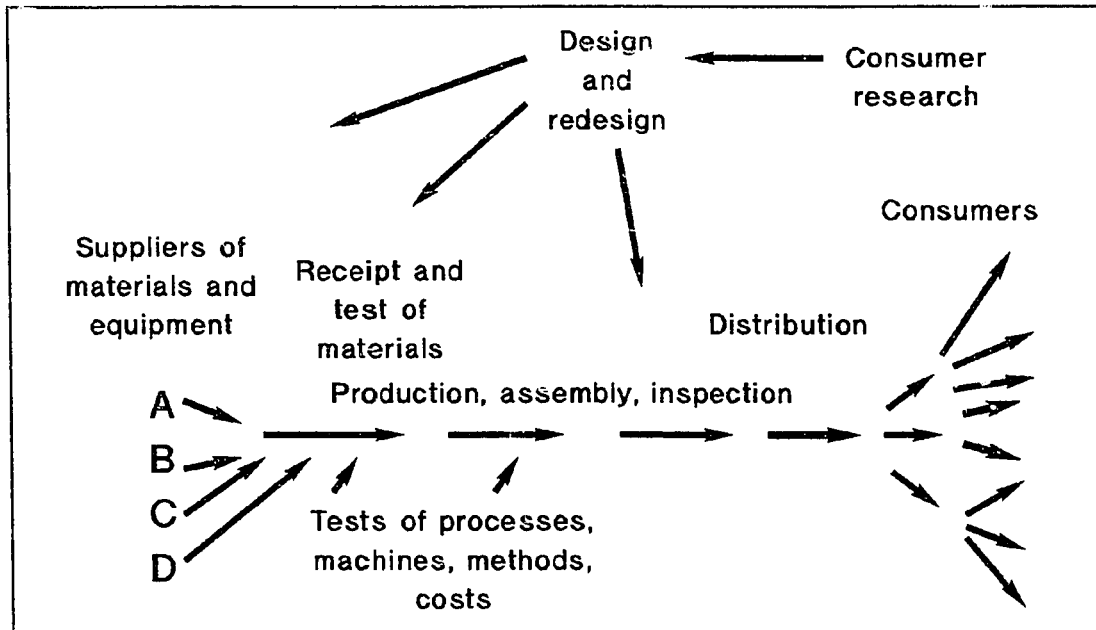


Figure 1. Deming View of a Manufacturing System
Source: Deming (1986), "Out of the Crisis," p. 4.

The importance of this contribution was to educate the Japanese managers that the bits of expertise they possessed needed to be formed into a synergetic system. This simple flow diagram is the basis for systems thinking. Systems thinking means that each element of a process, such as production and receipt of test materials, is not important by itself. The elements are important in their relationship to the output of the system.

Efforts to concentrate on only one part of the process and optimize the performance of that area can lead to suboptimization and to the detriment of the system. "Management of the system therefore requires knowledge of the inter-relationship between all the sub-processes within the system and of everybody that works in it [Deming]" (Neave, 1990, p. 129). The other key idea taught by this flow chart is the feedback loop between the consumer, to the consumer research department, design and research, and finally, back into the production process. This is the basis of continual process improvement. "A business is not merely an organization chart, all departments striving for individual goals (sales, profit, productivity). It is a network of people, materials, methods, equipment, all working in support of each other for the common aim" (Deming, 1991, p. 15).

Some Knowledge About Variation

Deming's primary career throughout his life has been statistical consulting. "Statistical theory is the leitmotif of Deming's Fourteen Points of Management. And to understand Deming's philosophy, one must first understand its statistical underpinnings" (Gabor, 1990, p. 31). His stress on the importance of statistical theory is grounded in his belief that variation is ubiquitous and affects every process from manufacturing to human systems. Traditional scientific management is based upon a deterministic view of the world that expects exact outcomes in similar situations. A view of the world

based upon knowledge of variation recognizes that there is always random irregularity involved in any process and the method for optimization must concentrate on reducing variation.

Theory is just theory until some action is taken. The purpose of a statistical study is to better understand a process to predict its future behavior. Statistical studies can be divided into two primary categories. Enumerative studies are those that seek to understand outcomes and to base action on a mathematical description of the outputs. Analytic studies probe more deeply to understand how to modify the inputs to a process to affect the output (Scherkenbach, 1991). Action is the emphasis in Deming's teaching. Knowledge of variation is not enough unless this information is used to continually improve the process. Rosander (1991) indicated Deming utilized about 45 statistical examples to reinforce his message in "Quality Productivity and Competitive Position." Rosander emphasized that although "the analysis shows that statistics has a lot to do with the 14 points, statistics is necessary but not sufficient" (p. 80).

It is a mistake to think that Deming's teachings are simply about statistics.

A master statistician, in Deming's view, is someone who grasps the entire picture of statistics, someone who sees the forest of statistics rather than merely the trees of formulae. Specifically, a master statistician has formed a holistic view from a set of individual observations. (Yoshida, 1989, p. 13)

Theoretical statisticians not grounded in practicality will fall short of this description of a master statistician. Deming emphasizes that a statistical view of anything is far from being precise: "There is no such thing as a fact concerning an empirical observation. Any two people may have different ideas about what is important to know about any event" (Deming, 1990, p. 35).

An understanding of variation does not necessarily require complicated mathematics. In a lecture in 1990, Deming showed the example of a ten year old boy who charted the arrival time of his school bus. The child used a simple control chart to better predict the school bus schedule and identified special causes of delay, such as "new driver," on the graph (Deming, 1990). Scherkenbach used the phrase, "voice of the process," to characterize the central tendency, shape, dispersion, and other parameters that enumerate the stable performance of a system (Scherkenbach, 1991, p. 22).

Some Theory of Knowledge

The significance of the simple flow chart of Figure 1 cannot be understated. What Deming found in his initial trips to Japan was that the Japanese were very knowledgeable in specific areas but had failed to grasp the significance of the interactions. They did not understand systems. This is the third element of the system of profound knowledge, the theory of knowledge. It is the ability to understand how individual pieces of

information are formed into a more sophisticated realization of some fundamental truth. Working only with isolated pieces of knowledge or with the latest fad in quality management has been a major failing of American companies attempting to develop TQM. Masaaki Imai (1986) in "Kaizen: The Key to Japan's Competitive Success" emphasized this point: "Where management has failed to establish such a system and has instead directed its efforts randomly and in bits and pieces to such areas as suggestions and QC circles, success has often been short-lived" (p. 94).

Neave discusses the theory of knowledge and lists several attributes (Neave, 1990). The job of management is essentially prediction and strategic efforts as opposed to tactical actions. Profound knowledge teaches that "there is no knowledge without prediction" (Neave, 1990, p. 269). This is followed by an understanding that there is no knowledge without a theoretical basis, and finally that "no number of examples establishes a theory" (Neave, 1990, p. 269). Managers seeking to apply Deming's principles will find a discussion of the theory of knowledge of little value to them by itself. One way of applying this principle is by operational definitions. The purpose of an operational definition is to put into words the definition of the system and the management interpretation of all the elements of information that form the predictive knowledge about the process. These words are not effective unless they are acted upon consistently by everyone in the organization who

impacts the process (Neave, 1990). The concept of operational definitions provides a theoretical basis for the ISO 9000 standards' emphasis on documentation. Writing something down removes ambiguity about processes and specifically what is to be done to achieve the desired fitness of purpose required by the customer. Operational definitions are widely used by the Japanese to translate Deming's process flow chart into action.

The Japanese paid great attention to the development of operational definitions in the early 1950s, and . . . the benefits they gained from this bore comparison with those obtained by their use of concepts and tools of the statistical control of processes. (Neave, 1990, p. 109)

Some Psychology

Deming's early years growing up in poverty in Wyoming instilled in him values that form the humanistic element of his teachings. He is disdainful of waste and extravagance and, although he demands great fees in his consulting work, lives in the same modest Washington home he and his wife bought during the depression in the 1930s (Gabor, 1990). Understanding the role that psychology and values play in his system of profound knowledge explains the radical change he requires in society's traditional emphasis on grading, rewards, and competition.

Deming speaks of intrinsic as contrasted with extrinsic motivation. Intrinsic motivation emphasizes a person's innate self-esteem and dignity as the basis of the idea of joy in work. Extrinsic motivation is at the heart of the

scientific management theory and modern American management by objectives. Like his emphasis on understanding variation which derived from Shewhart's influence, this concept is not new. Herzberg (1959) studied worker motivation and identified factors he described as "self-actualization" and "self-realization" (p. 114). Deming believes emphasis of extrinsic motivation is counterproductive and is destructive of intrinsic motivation.

Extrinsic motivation is submission to external forces that neutralize intrinsic motivation. Pay is not a motivator. Under extrinsic motivation, learning and joy in learning in school are submerged in order to capture top grades. On the job, innovation and joy in work become secondary to a good rating. Under extrinsic motivation, one is ruled by external forces. He tries to protect what he has. He strives for a high rating, or for a high grade in school. He tries to avoid punishment. He knows no joy in work. He knows no joy in learning. He tries to avoid punishment. Extrinsic motivation is a zero-defect mentality. (Deming, 1990, p. 36)

This reference emphasizes both understanding the motivation of people and his rejection of simpler prescriptive approaches such as Crosby's (1979) zero defect campaigns.

The management transformation or metamorphosis of which Deming writes is intimately connected with this study of psychology. He advocates fundamental changes in society and the way motivation and values are viewed and advocates elimination of employee ranking and pay for performance. He advocates an understanding of intrinsic motivation and the

evolution of society and corporations to an era in which "everyone will win; no loser" (Deming, 1991, p. 23).

The emphasis on psychology is also related to the understanding of variation. Psychology helps understand the variation that is present in people and their reactions to circumstances. The role of a leader is to optimize people's performance by understanding how their particular abilities can best be augmented through the design of their jobs (Neave, 1990).

People are different from one another. A leader must be aware of these differences, and use them for optimization of everybody's abilities and inclinations. Management of industry, education and government operate today under the supposition that all people are alike. (Deming, 1991, p. 21)

Fourteen Points

The system of profound knowledge was discussed first to provide a theoretical framework to understand the 14 points. Profound knowledge is the foundation of these statements which form much more than a prescriptive implementation list. Profound knowledge also is described in the 14 points but they do not provide a simple bridge from theory to application.

Many of these items discuss the nature of processes and warn against the futility of management exhortations to "do better" when the process itself limits results.

This is the most seductive fallacy. All we need, supposedly, is for everyone to give a little more, and all our problems will be solved. The corollary is that our problems arise because people aren't doing their

best. They're careless, or they're purposely making mistakes. Deming claims that in his more than sixty years of experience he has yet to find the person who isn't trying his or her hardest. Some people, though, are constrained by the system from doing what they know is best and right. (Aguayo, 1990, p. 31)

Another foundation theory for Deming's 14 points is the

Deming/Shewhart circle called PDCA for Plan-Do-Check-Act (Figure 2).

Based upon ideas he learned from Shewhart in the 1930s, PDCA is at the heart of his ideas of continual process improvement. He revised the acronym to PDSA, Plan-Do-Study-Act, in 1990 to emphasize the analysis that takes place at the review stage (Dobyns & Crawford-Mason, 1991). Scherkenbach (1991) describes PDSA in the steps listed in Table 2.

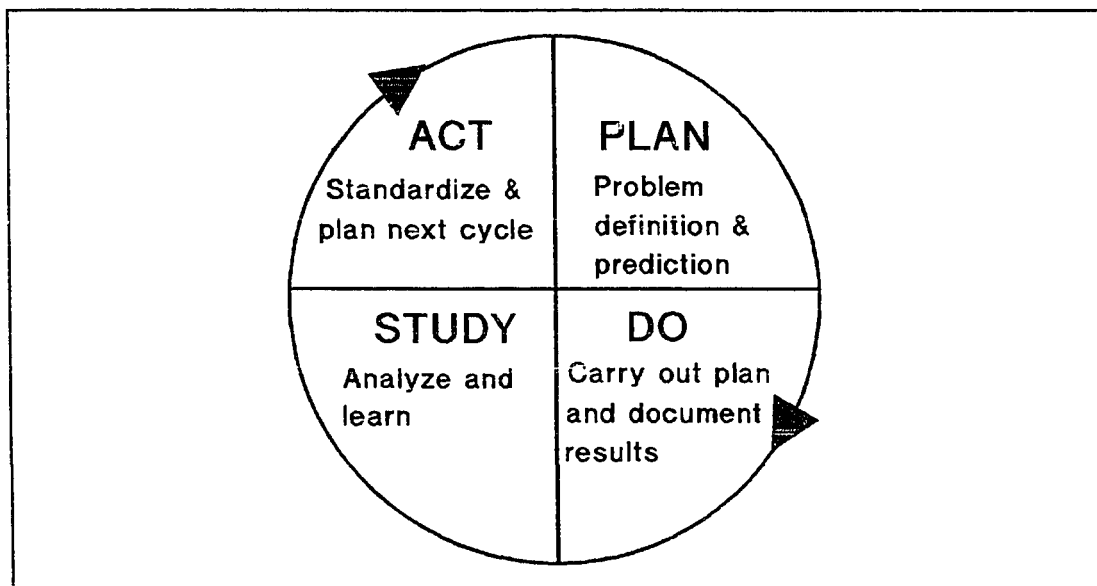


Figure 2. Deming/Shewhart Circle

Table 2

Plan-Do-Study-Act

I. PLAN: Develop a Plan to Improve

1. Identify the opportunity for improvement
2. Document the present process
3. Create a vision of the improved process
4. Define the scope of the improvement effort

II. DO: Carry Out the Plan

5. Pilot the proposed changes on a small scale, with customers and over time

III. STUDY: Study the Results

6. Observe what you learned about the improvement of the process

IV. ACT: Adjust the Process, based on your new knowledge

7. Operationalize the new mix of resources
8. Repeat the steps (Cycle) on the next opportunity

Source: Scherkenbach (1991), "Deming's Road to Continual Improvement," p. 63.

The following titles for the 14 points are taken from a listing in the study guide to the film "The Deming Library" (Deming, 1990, p. 6).

1. Create Constancy of Purpose

"Constancy of purpose" is a concise phrase that accentuates the long-term over short-term business practice. Like much of Deming's work, the ideas are not new but his integration of them into a coherent system is his contribution. Samuel P. Newman in "Elements of Political Economy" in 1835 used the phrase constancy of purpose to describe the perseverance a manager must have in carrying out plans (George, 1972). Hoshin planning, also known as policy deployment, is a good technique to formalize an emphasis on long-range, breakthrough planning. It establishes a corporate culture that places value on constancy of purpose (King, 1989).

2. Adopt the New Philosophy

This point details the transformation that is required in society and management. Deming's teachings describe this new philosophy. The shared societal view of what is the acceptable norm for a reward system or business enterprise constitute a paradigm. Thomas Kuhn (1970) describes paradigms used by the scientific community as a common sharing of "rules and standards for scientific practice" (p. 11) that act as a filter to color what people see and how they interpret new information. Deming's point 2 is a challenge to adopt a new paradigm for management success.

3. Cease Dependence on Mass Inspection to Achieve Quality

Point 3 is a criticism of traditional American manufacturing techniques that developed to maturity in the 1950s. After World War II, consumer demand was so great that industry could scarcely keep up with sales. Inspection was used at the end of the assembly line to sort out the products that were bad. The system of profound knowledge emphasizes the interrelatedness of all elements of the manufacturing process. Needless waste that is generated through rejection of inspected items is eliminated early in the manufacturing stream by careful design and process control. A stable process, well understood by management, needs little or no inspection.

4. End the Practice of Awarding Business on Price Tag Alone. Instead, Minimize Total Cost, Which is Often Accomplished by Working With a Single Supplier

When purchasing an item, cost must not be the only concern. Indeed, a low price supplier may cost more in the long run because the product either does not meet the customer requirements, or is shoddily manufactured and not reliable. Deming recommends developing a relationship of trust with single suppliers. A single supplier is preferable since it is difficult to characterize and control variation from a single source let alone two. Multiple suppliers complicate the statistical distribution of parts considerably.

5. Improve Constantly the System of Production and Service

Constant improvement is the result of the application of the PDSA Deming circle. Continual improvement implies that traditional management fire fighting is not enough. Solving problems as individual isolated events, constant tampering with a system, and short-term focused corrective action reports, ignores the essence of systems knowledge. Lasting results are obtained through improving the process as far up stream as possible, not reacting after the fact as management by objectives promotes.

6. Institute Training on the Job

The use of training is different than education in this phrase. Education is a broad term that means integration of individual items of knowledge into something new. Training refers to specific skills required to accomplish a job. Deming emphasizes two aspects of training, "1. People learn in different ways. . . . 2. Once a worker has brought his work into statistical control, further lessons will not help him" (Neave, 1990, p. 326). Training requires well thought out, objective, and formal means. On the Job Training (OJT) is one employee teaching the next and this practice leads to the propagation of errors and divergence from the skills that were taught to the first person in the OJT chain.

7. Institute Leadership

As Scherkenbach (1991) stated, "The quality of decisions made by the top leaders of a company has a far greater impact on the prosperity of the enterprise than the efforts exerted by the willing workers" (p. 29). Leadership is more than supervision. Leadership means to create an environment in which people can do a better job and enjoy the pride of workmanship. A leader understands all elements of the system of profound knowledge including knowledge of variation as applied to people and their performance. Ranking and evaluation of people is counterproductive. It is more important to understand who is outside the normal system and requires special help, such as finding a job that matches ability and inclination.

8. Drive out Fear

"Drive out fear" is another example of Deming's humanistic approach to quality improvement rooted in the system of profound knowledge and the need to understand psychology. Unlike Taylor's scientific management theory that had little consideration for the human element, Deming emphasizes that people must work without fear. This fear can be tangible threats or more subtle ones such as pressure caused by unrealistic quotas and capricious ranking. Fear of not meeting quotas may lead to falsification of data and the inability of management to lead by the numbers since the figures that are submitted are incorrect.

9. Break Down Barriers Between Departments

Point 9 is related to the understanding of systems in profound knowledge. Breaking down barriers reduces the possibility of suboptimizing a process to achieve the goals of a single department at the expense of the total success of the enterprise. Each department must understand the parts of the process that precede and follow their own to optimize the result that the customer receives.

10. Eliminate Slogans, Exhortations, and Numerical Targets

An earlier version of this point added the phrase "without providing methods" (Neave, 1990, p. 358). Informative posters and morale building slogans in themselves are not wrong. What Deming considers wrong are slogans that exhort the worker to produce zero defects, or to take pride in quality without management addressing the effect of their decisions on the worker's ability to produce a quality product. Slogans and exhortations are a simple way for management to shirk the responsibility of the hard work of leadership in improving work environments and processes.

11. Eliminate Work Standards (Quotas) and Management by Objective

Deming does not imply that businesses should manage without numbers or objective measures, but he advocates the elimination of arbitrary quotas or objectives. For example, a sales organization that improved sales last year by 8 percent is exhorted by management to improve to twelve this

year. Management gives no thought to how this will be achieved or what new products will be available to reach this goal. Quotas and numbers may also lead to wrong behavior and ultimately customer dissatisfaction. Deming (1986) gives an excellent example of conflicting objectives in "Out of the Crisis":

A woman in my class at the Graduate School of Business Administration of New York University described her job with an airline, which was to answer the telephone, to make reservations, and to give information. She must make 25 calls per hour. She must be courteous, don't rush callers. She is continually plagued by obstacles: (a) the computer is slow in delivery of information that she asks for; (b) it sometimes reports no information, whereupon she is forced to use directories and guides. Christine, what is your job: Is it:

To make 25 calls per hour?

or

To give callers courteous satisfaction; no brushoff?

It cannot be both. (p. 73)

12. Remove Barriers that Rob Workers, Engineers, and Managers of Their Right to Pride of Workmanship

There are many barriers to pride in workmanship that face hourly workers and management. Some examples of these are inadequate training, poorly designed processes, poor environment, and bad materials. Although workers are paid for doing rework, most will say they take no pride nor are they happy in this work. Given the opportunity, most people want to do well. This is another element of psychology which management needs to consider.

13. Institute a Vigorous Program of Education and Self-Improvement

This point is closely related to Deming's efforts at promoting continual improvement. He sees education as a basic ingredient to life and especially to everyone's ability to continue to grow and contribute to an enterprise. Companies must encourage and support life long-learning. Education is more broad in scope than training since what is learned through education may have no immediate use. Training is the bits and pieces and education is integration into knowledge.

14. Put Everyone in the Company to Work to Accomplish the Transformation

Earlier versions of this point highlighted the role of top management and its responsibility to provide leadership to the transformation (Neave, 1990). This point is a recapitulation of the previous thirteen, building upon the understanding of systems and establishing that everyone in an organization must be involved in the transformation. Chief executives who believe they can appoint a quality director and then feel they've done their part have missed the essence of Deming's teachings. Deming refuses to consult with any company unless the top management has agreed to accept his philosophies and there is commitment throughout the organization to work toward transformation (Gabor, 1990).

Seven Deadly Diseases and Obstacles

This review of Deming's philosophies started with the system of profound knowledge and then proceeded to the 14 points. The final view of his teachings are the seven deadly diseases and other obstacles that inhibit the development of a quality system using his methods. Table 3 summarizes the seven deadly diseases that Deming considers symptoms of a ruinous Western management practice. Many of these are simple corollaries to one of the 14 points. For example, disease 4, management mobility, conflicts with point 1, constancy of purpose.

Elsewhere in Deming's work, he describes obstacles to the management transformation he preaches. For example, the cavalier attitude that once quality control is installed the job is done. Another is reliance on automation and computers to solve process problems when the processes are neither stable nor understood. A third is the belief that it is only necessary to meet specifications, nothing more. Many of these are summed up in his phrase "hope for instant pudding" to emphasize Western management's passion for short, quick, easy solutions (Deming, 1986, p. 126). Deming's humanistic approach is evident when he says, "Barriers against the realization of pride in workmanship may in fact be one of the most important obstacles to reduction of cost and improvement of quality in the United States" (Deming, 1986, p. 83). One of the main reasons this dehumanization

Table 3

The Seven Deadly Diseases

1. Lack of constancy of purpose to plan product and service that will have a market and keep the company in business and provide jobs.
 2. Emphasis on short-term profits: short-term thinking. Fed by fear of unfriendly takeover and push from bankers and owners for dividends.
 3. Evaluation of performance, merit rating or annual review.
 4. Mobility of management; job hopping.
 5. Management by use only of visible figures with little or no consideration of figures that are unknown or unknowable.
 6. Excessive medical costs.
 7. Excessive costs of liability, swelled by lawyers that work on contingency fees.
-

Source: Deming (1986), "Out of the Crisis," p. 98.

happens is American management's fixation with short-term profits.

In Deming's view, the traditional financial mentality is the greatest impediment to quality management in the United States, because it deflects attention from the long-term interests of a company's operations and because traditional financial and accounting measures offer managers few of the insights they need to plan for the future. (Gabor, 1990, p. 7)

Deming points out that attention to short-term profits is self destructive because of the slight contribution it makes toward continuous improvement. Any manager can meet short-term financial objectives by destructive steps such as lack of maintenance, use of cheap parts, and reduction of training. A Wall Street Journal headline sums this message up succinctly: "GM Tries a New Tack; Build the Cars Right, Admit Your Mistakes. Restyled Models Get Raves; Quality Expert Deming Revs Up Engine Makers. *Profits Still Not in Sight*" [Italics added] (White, 1991, p. A1).

Summary

This thesis seeks to evaluate the ISO 9000 quality systems registration standards as an element or step toward TQM. There is no single accepted definition of Total Quality Management and there are several experts who offer complete systems intended to achieve the results of TQM. This review of literature has investigated the teachings of W. Edwards Deming in detail and briefly reviewed those of Juran and Crosby. Deming has neither the most complete nor only method to approach TQM. Deming's teachings

provide a substantial and thorough system of management thought within which to review the requirements and effect of the ISO 9000 standards. Thus it is appropriate to ask if prescriptive application of these standards would be counterproductive to Deming's teaching and, by inference, inadequate in application to achieve TQM.

Chapter 3

Methodology

Research Questions

This study compares the ISO 9000 standards with the teachings of W. Edwards Deming to determine if the two are compatible. His approach is chosen as a model for developing Total Quality Management within an organization, but his methods are not the only way to achieve TQM. Deming's theories are unique in that they represent a comprehensive consideration of all aspects of managing a company from tools and methods to psychology and learning, and this approach emphasizes the Total in TQM. His ideology is controversial because it promotes a much different method than traditionally taken by Western style management which emphasizes profit and management by numbers. This is the belief that a company can be primarily managed by review of numerical reports and information gathered through financial measurements. Interest in quality systems registration using the ISO 9000 standards is growing but rapid acceptance and expanding customer demand for registration may not be effective in promoting mature quality systems. For this study, the following hypothesis propositions have been constructed which assert that rapid acceptance of the ISO 9000 standards will be counterproductive to establishing TQM:

1. The ISO 9000 quality system standards are not a complete guide to use for achieving Total Quality Management.
2. The standards conflict with or neglect several important elements of TQM as described by Dr. W. Edwards Deming.
3. Rapid acceptance of these standards without additional management changes may be detrimental to the broad success of TQM principles.

This thesis attempted to confirm these statements in two ways. First, support for this hypothesis was sought through an extensive review of literature concerning the philosophies of Deming and the ISO 9000 standards. Second, interviews with key and influential people were conducted to test this hypothesis.

Research Design

This thesis is nonexperimental in design. The approach consists of a main study based upon a thorough review of literature and study of the ISO 9000 standards. Results of this main study were confirmed or modified by interviews with proponents of the Deming philosophy, with managers in companies that are in the planning stages or have achieved ISO 9000 registration, and with members of committees who have written the ISO 9000 standards. Sixteen interviews were conducted to confirm conclusions drawn from the literature search.

The main study consisted of a review of the ISO 9000 standards. Primary emphasis was placed on two standards: ANSI/ASQC Q94-1987:

"Quality Management and Quality System Elements - Guidelines" (ISO 9004); and ANSI/ASQC Q91-1987: "Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing" (ISO 9001).

These two represent the general principles and the most stringent of the three registration guidelines. Additional related standards were reviewed.

They are: ISO 9004-2: "Quality Management and Quality System Elements - Part 2: Guidelines for Services"; and DIS 9004-4.2: "Quality Management and Quality System Elements - Part 4: Guidelines for Quality Improvement (draft)."

ANSI/ASQC Q91-1987 (ISO 9001) was reviewed by sections for consistency with the principles of Deming. The literature search of chapter 2 provides the research regarding the Deming approach to quality systems. Additional references to the ISO 9000 standards were used to learn their applicability and relationship to TQM principles. Study of published commentaries regarding the standards were used for comparisons to the principles of Deming.

Three methods were used to compile the results of this study. The first is a written commentary comparing each section of ISO 9001 with the Deming ideology. The second uses a matrix diagram to position the major elements of a quality system defined by ISO 9001 within the framework of the four elements of profound knowledge described by Deming. The third uses a Quality Function Deployment (QFD) "house of quality" to show

interrelationships and conflicts between the twenty sections of ISO 9001 and Deming's 14 points (Eureka & Ryan, 1988).

Confirmation or modification of the results of the literature search was done through interviews. These interviews were held in person or through correspondence. They were with managers in companies registered or applying for ISO 9000 certification or with consultants in the quality field. Additional interviews were conducted with experts in the field familiar with the principles of W. Edwards Deming. Candidates selected for interviews were those closely involved with ISO 9000 such as functional level quality managers and quality directors. Involvement means that the company is already registered or is in the process of seeking registration to ISO 9001 or ISO 9002. Interviews were done with members of the technical committees responsible for writing ISO 9000 and with Deming and some of his close associates. Each person interviewed was informed that correspondence and comments were to be used in this published thesis thereby securing their permission to use the material obtained.

Target Resources

A comprehensive search of available literature was key to the success of the main study. Primary sources are texts published internationally on pertinent subjects such as Deming and quality system principles. Timely information was sought through quality and manufacturing periodicals

available in the United States. Additional material was researched in technical and quality related symposia proceedings. Periodical literature published in Europe was obtained whenever possible.

Interviews were sought with knowledgeable people regarding both the ISO 9000 standards and the theories of Deming. These people were identified through the local Santa Clara Valley, California, Deming User Group, Deming Study Group, and references identified through the literature search. A personal interview with Deming was conducted.

The nature and quality of the interview subjects dictate the appraisal of the interview information. Open ended questions were used to affirm or modify the research hypothesis propositions. The objective of the interviews was to gain insight from highly experienced people and, since the population sample was small, the measurement uncertainty was too great for statistical analysis. Other techniques were used to summarize the interview results. These methods include tabular presentation, affinity diagrams, and matrix diagrams.

Analysis of Threats to Validity

One threat to the validity of this study is researcher bias. The study of the ideas of W. Edwards Deming does not yield a simple prescriptive method to achieve Total Quality Management, and experts in the field of quality systems say that TQM cannot be easily achieved in a few simple steps. Since

Deming is constantly modifying and evolving his ideas, researcher interpretation of broad areas of importance to quality systems could yield bias.

Another difficulty is the availability of current information. Quality system registration and the ISO 9000 standards are in a state of change, and the standards are being reviewed for a major update in 1996. Many companies in the United States are planning for their first quality system audit to the standards. Current literature on the subject is limited primarily to frequently published periodicals and papers presented at technical symposia.

The final threat to validity is limited accessibility to experts knowledgeable about Deming or ISO 9000 standards. Few companies are registered in the United States further limiting the availability of first person information.

Summary

The hypothesis propositions chosen for this thesis do not lend themselves to precise, easily measurable answers. The importance of the questions, however, justifies the initial ambiguity of the research. The ISO 9000 standards are achieving a popularity unlike any quality system standards that have preceded them. The value of this study is to aid organizations seeking registration to sort through an overwhelming maze of frequently conflicting information regarding these standards and the implied

requirements. This thesis can help companies understand how to evolve toward Total Quality Management and remain competitive in world markets requiring ISO 9000 standards registration.

Chapter 4

Research

ISO 9000 History, Structure, and Future Directions

Numbering System for the Standards

Chapter 1 describes the numbering compatibility between the parent ISO 9000 standards and the American version, the ANSI/ASQC Q90 series. Most countries have adopted the ISO 9000 standards verbatim while making only minor changes to accommodate language translation. For example, in the European Community, the same standards are identified with a sequence beginning with EN 29000 (Meckstroth, 1992). Several interviews were conducted with Europeans, and material published in Europe is incorporated into the thesis research conclusions. All further references to the ISO 9000 standards will be made to the ISO 9000 numbering system because of the proliferation of country specific identification schemes.

Derivation of the Standards

Quality standards in the form of sampling plans and checklists of contractual obligations have been used for more than forty years. The Department of Defense standard MIL Q-9858A, "Quality Program Requirements," was developed in the 1950s. Later, industry specific standards emerged such as NQA-1, Quality Assurance Program Requirements for Nuclear Power Plants, and the Good Manufacturing Practice (GMP) used

in the medical equipment field. Other standards such as the British standard BS 5750-1979 and the Canadian standard Z-299 are utilized as quality requirements (Peach, 1991). Most of these documents are applied in a limited, legalistic manner and define product specifications or rigid management requirements. The Technical Committee TC/176 for Quality Assurance under the International Standards Organization studied many worldwide quality requirements. "This committee reviewed the existing standards and merged the content of several existing standards into the Quality Systems Standards series ISO 9000, published in 1987" (Peach, 1991, p. 72). Acceptance of these standards can be delayed because of the mistaken belief that the ISO 9000 standards suffer much the same limitations as the older standards from which they are descended.

It is true that the forerunners of the ISO 9000 standards were applied in a manner that was philosophically incompatible with today's approach to quality. Consequently, some people have assumed that use of the ISO 9000 standards is necessarily tied to the old philosophy. Nothing could be further from the truth. (Marquardt, 1992, p. 1)

Rapid Acceptance of the ISO 9000 Standards

Unlike the early quality standards mentioned, the ISO 9000 standards have achieved a broad acceptance and generated much interest in their use. One reason for this popularity is the heightened awareness in business of the impact of quality management methods on cost and productivity. This market sensitivity is manifested by buyers seeking assurance that their

suppliers provide a product or service that conforms to requirements and do so efficiently. This is observed in "snowballing market forces, as both buyers and sellers realize the benefits of ISO 9000 and third-party attestation to it" (Rosen, 1992, p. 1156).

Another influence of interest in ISO 9000 quality systems registration is the strengthening position of the European Community which represents a potential market of some 320 million individuals (Sheldon, 1990). The EC is a political and economic cooperative comprised of Belgium, Denmark, France, West Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and the United Kingdom (Boehling, 1990, p. 32). Quality systems registration is very popular in the EC business community, and companies outside of the EC are concerned that lack of registration will become a trade barrier.

So far about 20,000 European companies have been registered [to ISO 9000]. By the end of 1992, when economic unification is to be completed, many more European companies will have met ISO 9000 requirements. (Jackson, 1992, p. 48)

European business is not the only force promoting the use of the ISO 9000 standards. Other country markets are beginning to require registration, and among these are Canada, Taiwan, and Australia (Phipps, 1992). The U.S. Department of Defense has announced its intention to use the ISO 9000 standards to replace existing military standards such as

MIL Q-9858A. "In three years, the ISO 9000 standards have become *the* universally recognized international quality system standards" (Peach, 1991, p. 72). Deming comments on the advantages of the changes brought by the collaboration of the EC:

An example of cooperation that may bear fruit is the European Community. There are problems at the start, because some industries must take short-term losses in order to build the European Community. There should be some way to protect stockholders in these industries, and to protect employees thrown out of work. (Deming, 1992a, p. 50)

Intentions of the Writers of the Standards

The first hypothesis proposition of this thesis states that the ISO 9000 standards are an incomplete guide to use for TQM implementation. This proposition is strengthened by interviews conducted with committee members who wrote the standards, and consultants experienced with application of the standards. John T. Burr of the Rochester Institute of Technology writes the following in correspondence to the researcher about the design of the standards.

The writers' intent was [*sic*] to create a model of a quality system which could be used to improve the existing quality system of any company (ISO 9004) and evaluate whether the resultant quality system is adequately documented, implemented and effective (ISO 9001, ISO 9002, or ISO 9003) depending on which model is appropriate for that company. (Burr, 1992, p. 1)

Professor Burr writes that the standards are not meant to describe a Total Quality Management system, but represent the basic minimum quality system

requirements for companies. This minimum approach is intended to make the documents applicable to varying sizes of companies in many different industries (Burr, 1992).

The ISO 9000 guides are less prescriptive than their predecessors. Jeff Hooper, Quality Director at the American Telephone and Telegraph Company and Vice Chairman of one of the groups responsible for writing the standards, underscores this point in his correspondence to the researcher.

The ISO 9000 Standards are not prescriptive. They say your quality system should or must satisfy certain requirements but it [*sic*] does not say how you satisfy these requirements. (Hooper, 1992, p. 1)

Ian Durand (1992a), a member of the U.S. ISO Technical Advisory Group (TAG) strategic planning committee, says that the standards are descriptive and characterize what must be done rather than specifically list steps. The intentions of the writers of the ISO 9000 standards are to continually provide a broad framework that embraces a wide variation in management methods while avoiding a prescriptive checklist approach to quality systems registration.

Application and Levels of the ISO 9000 Standards

Systems level registration streamlines international trade acceptance. For example, "rather than specify every aspect of each product, EC officials now specify only the essential requirements necessary to protect consumer health and safety and the environment" (Meckstroth, 1992, p. i). Registration

procedures require a review of the management system and not the final product or service. This practice is described in the statement of scope in ISO 9004: "This International Standard describes a basic set of elements by which quality management systems can be developed and implemented" (International Organization for Standardization, 1992, p. 148). A footnote of that document elaborates: "Note 1: This International Standard is not intended to be used as a checklist for compliance with a set of requirements" (ISO, 1992, p. 148). The ISO 9004-2 document, "Quality Management and Quality System Elements - Part 2: Guidelines for Services" describes proper application:

Scope. This part of ISO 9004 can be applied in the context of developing a quality system for newly offered or modified service. It can also be applied directly when implementing a quality system for an existing service. The quality system embraces all the processes needed to provide an effective service, from marketing to delivery, and includes the analysis of service provided to customers. (ISO, 1992, p. 165)

Three levels of contractual obligations are applied. Of the five major documents (ISO 9000, ISO 9001, ISO 9002, ISO 9003, ISO 9004), the contractual requirements are ISO 9001, ISO 9002, and ISO 9003. The ISO 9000 document is a selection guide and ISO 9004 is a guideline and summary of quality system principles. The relation of these elements is depicted in Figure 3. This figure is an adaptation of one drawn by Dr. John Magistad (1991).

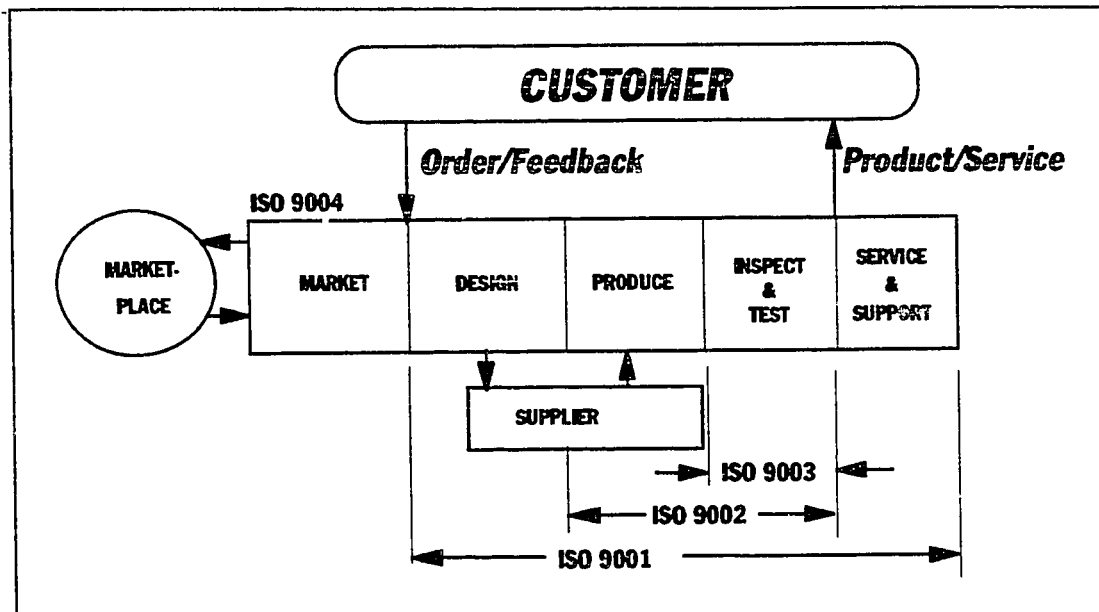


Figure 3. ISO 9000 Standards: Levels of Application
Source: Magistad (1991), [Lecture].

ISO 9001 is titled "Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation and Servicing." This is the most comprehensive requirement and describes the negotiation of design features and ongoing support of the finished product or service. The second most stringent document is ISO 9002, "Quality Systems - Model for Quality Assurance in Production and Installation." ISO 9002 is used for a business in which a product is fully described by exhibits or data sheets. The third and least comprehensive level is ISO 9003, "Quality Systems - Model for Quality Assurance in Final Inspection and Test." This standard is rarely used and, in Marquardt's (1992) estimation, accounts for less than 8% of the total use

worldwide. This level is applied in distribution applications and in situations in which final inspection is considered sufficient to assure conformance to the requirements.

Future Directions

These standards are continually reviewed, and the conclusions of this research are based on those standards in effect in 1992. A study of draft versions of future documents indicates evolving application and use. The majority of ISO 9000 standards that are applied today were approved in 1987. Similar to their predecessors, they may instill habits difficult to ameliorate later. Current practice can become entrenched so that it is difficult to evolve to the more sophisticated intentions of the writers as reflected in future revisions.

The ISO 9000 writing committee has published an article titled "Vision 2000: The Strategy for the ISO 9000 Series Standards in the '90s" in which they describe the planned evolution of the series. The committee is concerned that many countries may adopt the standards and then modify them for local reasons producing a "proliferation of supplemental or derivative standards" (Marquardt, Chové, Jensen, Petrick, Pyle, & Strahle, 1991, p. 26). This committee has four main goals for the standards:

Universal acceptance: The standards are widely adopted and used worldwide. . . .

Current compatibility: Part-number supplements to existing standards do not change or conflict with requirements in the existing parent document. . . .

Forward compatibility: Revisions . . . are few in number and minor or narrow in scope. . . .

Forward flexibility: Supplements are few in number but can be combined as needed to meet the needs of virtually any industry/economic sector or generic category of products. . . . [Italics added]. (Marquardt et al., 1991, p. 26)

Revisions are required by the International Organization for Standardization at five year intervals, but the committee has set an aggressive goal to release major revisions with substantive changes in 1996 instead of 1997 (Durand, 1992a). Minor changes will be made to ISO 9004 in 1993, but the committee continues to debate internally how strongly the standards should reflect a broad implementation of TQM. Durand (1992a) says that there are two opposing opinions among members of the committee. One opinion argues for gradual change, and the other supports radical modifications.

A preview of future trends of the standards can be seen in the manuscript DIS 9004-4.2, "Guidelines for Quality Improvement: Addendum to ISO 9004," dated October 3, 1991. This document is in draft stage and indicates the direction of the committee in writing future guidelines. It stresses: "the *plan-do-check-act* cycle is used for continuous quality improvement. The quality improvement methodology in this document

emphasizes the *check-act* phases of this cycle" (ISO, 1991, p. 16). The draft document intention moves toward TQM with statements such as, "measures of societal losses may be based on failure to realize human potential (e.g. as indicated by employee satisfaction surveys), damage caused by pollution and disposal of waste, and depletion of scarce resources" (ISO, 1991, p. 12). This progression to a more comprehensive TQM description causes concern among users. Will Cowan is worldwide Corporate ISO 9000 Program Manager for the Hewlett-Packard Company. He expresses concern about requirements continually "ratcheting up and no longer meshing with the style of the individual company" (Cowan, 1992, p.1).

Interview Methodology

Selection and Communication with Interview Subjects

People were chosen for discussion of the thesis hypothesis by following the guidelines of chapter 3. A complete listing of people contacted is given in Appendix A. Subjects interviewed represent members of the committees that develop the ISO 9000 standards, Dr. Deming, some of his proponents, and managers in companies that are registered to one of the standards.

Because many of these people are very busy and live in various parts of the world, three methods were used to interview them. When possible, a personal interview was sought with the individual. Next in order of

preference was an interview conducted by telephone. Third was an exchange of correspondence either by mail or facsimile machine. Several of the personal and telephone interviews were followed up later by the subject sending additional material.

A copy of the interview script is reproduced in Appendix B. This script was followed to assure complete coverage of ideas related to the hypothesis propositions. In some cases, the interview subjects held such strong convictions that it was difficult to lead the questioning. In those cases, during the interview, notes taken were organized into the interview script as a checklist to assure complete coverage.

The Relationship Between Deming, ISO 9000, and TQM

TQM Lacks a Universal Definition

The interviews revealed wide variation in interpretation of the concept of Total Quality Management. It is very clear that Dr. Deming does not subscribe to any definition of TQM. During a seminar given by him July 21 and 22, 1992, a participant referred to a definition of TQM by Dr. Deming. He immediately stopped the student and questioned him. When the student repeated that he thought Deming taught a definition of TQM, Deming emphatically said, "I do not! What is Total Quality Management? There isn't any definition" (Deming, 1992b). Disagreement about a definition of TQM is not limited solely to followers of Deming. John Locke (1992) in

correspondence writes: "What is TQM? You identify 12 people; you get 12 definitions for TQM. The problem with it is that it means whatever the speaker wants it to mean" (p. 1).

The relationship between ISO 9000 and TQM concepts is tenuous. As Ian Durand (1992a) pointed out in a telephone interview, "ISO 9004 was intended to be used for internal guidance. It was written before TQM became widely recognized." He continues on to explain that some Europeans perceive the concept and promotion of TQM as a United States phenomenon, and they do not consider the ISO 9000 standards related. Some who hold a definition of TQM feel that the objectives of the ISO 9000 standards should not be as comprehensive. Jeff Hooper (1992) who helped write the ISO 9000 standards declares:

The ISO 9000 Standards are intended to be a foundation for international commerce to improve quality and productivity throughout the world. If we were to produce a TQM standard today very few countries in the world could meet it. Many US companies and third world countries and European companies and even Japanese companies would be shut out of major markets. Certainly no one but a handful of top companies would be helped by this. (p. 1)

The ISO 9000 standards are precisely defined and simpler to understand than TQM. This characteristic supports the idea that the approach of the ISO 9000 standards is more like a checklist. As John Locke (1992) writes:

ISO 9000 is much more definitive than TQM and one knows what one has to do to comply. True, it would be desirable not to have to be as prescriptive; but then you end up with little or no implementation if the TQM is poorly done. . . . Where are the implementation guidelines for TQM which has (*sic*) been accepted worldwide? (p. 1)

Quality System Requirements Influence a Company Culture

Registration to ISO 9000 is more complex than meeting a product or regulatory compliance requirement. The systems level review of an organization requires cross-functional participation of most departments in the company. The corporate culture is influenced because all departments are involved in the registration effort.

It [a sound quality system] assists the cultural change, converting the attitudes of the entire work force from top management down, to concentrate on continual customer satisfaction and quality improvement. (Peach, 1991, p. 70).

A potential danger of this influence is that the external requirements supersede or conflict with the existing culture. Michael Payne (1992) in the following paraphrase of a telephone interview emphasizes this point:

There is always a danger that the standard creates a culture itself. The [mistaken belief is that the] quality department owns quality so it should sort out the procedures. The focus then becomes what is necessary to satisfy the auditor rather than what is right for the system. (p. 2)

John Locke (1992), President of the American Association for Laboratory Accreditation (A2LA) reiterates this point: "A third party assessment performed semiannually can do much to force a cultural shift - - we [A2LA]

have seen it happen" (p. 1). A2LA performs accreditation and registration audits.

ISO 9000 and the Deming Process Flow Diagram

Many people interviewed during the research phase of this thesis accentuated the importance of a systems view of an organization in TQM and ISO 9000 registration. Peach (1991) discusses this and says that the quality system of an organization is the sum of its current practice:

The quality system is the philosophy and procedures by which an organization conducts itself to satisfy customers and to comply with all other necessary requirements of the operations. A quality system represents the level of standards an organization *actually* employs to guide and regulate all its activities. (p. 71)

The international standard ISO 8402 defines a quality system as, "the organizational structure, responsibilities, procedures, processes and resources for implementing quality management" (ISO, 1992, p. 19).

Deming teaches the importance of the understanding of systems in the concept of profound knowledge. Figure 4 shows the researcher's interpretation of the way in which the ISO 9000 standards intersect Deming's drawing of a manufacturing system. The three increasing levels of complexity, from ISO 9003 to ISO 9001, are indicated by larger portions of the system that are assessed. This figure demonstrates that inputs from consumer research and innovation are missing and also shows that the standards reinforce the idea of quality as conformance to customer requirements.

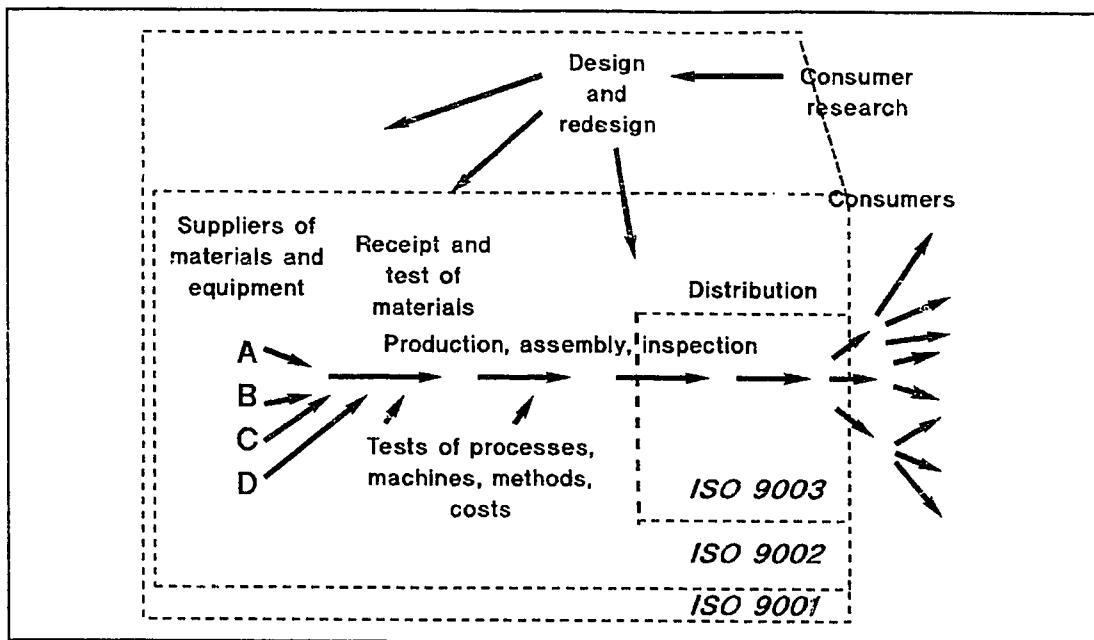


Figure 4. ISO 9000 and the Deming System View

Source: Deming (1986), "Out of the Crisis," p. 4 [adaptation].

Marquardt (1992) shows another relationship between ISO 9000 and the Deming view of a system which is shown in Table 4. This table lists Marquardt's view of ISO 9000 as a Deming PDSA cycle. Both of these devices highlight the systems nature of the ISO 9000 standards and the potential for continual improvement that is inherent in that structure.

ISO 9001 Compared by Sections to Deming's 14 Points

In the following paragraphs, ISO 9001 which is the most demanding of the contractual requirements, will be compared to each of Deming's 14 points. ISO 9001 is chosen since it is the document against which an auditor reviews a company applying for registration. The ISO 9004 guideline is not a

Table 4

ISO 9001/9002 in Relation to the Deming Cycle

PLAN	Say what you will do 'plan, define, establish, document'
DO	Do what you say 'implement, maintain'
CHECK	Check results versus expectations <ul style="list-style-type: none">- management review- internal audits- external audits
ACT	Act on any deficiencies <ul style="list-style-type: none">- quality system revision- preventive action- corrective action

Source: Marquardt, D. W. (1992) [Correspondence].

contractual requirement but it is a descriptive model that has less influence on companies preparing for registration.

Each of the following twenty sections is composed of five parts. The first is a quotation of the initial text of the section that describes the segment. The numbers listed are the section numbers used within ISO 9001 for identification. Section 4 of the standard defines the quality system requirements, thus all of the following segments are from that section. Next follows a brief interpretation or comments for further clarification. Third is a grouping of positive factors that were identified during research. Fourth are negative factors similarly determined. Fifth is the researcher's evaluation of the correlation between this ISO 9000 section and the relevant Deming point. This assessment is supported by specific observations and given a relative comparison rating of *+9 strong positive*, *+3 weak positive*, *-3 weak negative*, or *-9 strong negative*. Those relationships that are judged to be highly complementary are assigned *+9* and those that firmly contradict are given a *-9*. Sections and points that support or oppose each other to a lesser degree are given *+3* or *-3* ratings. These results are recorded in the matrix comparison diagram of Figure 5, and the sum of each row or column is displayed. The conclusions represented by this matrix are summarized in the section of analysis.

4.1. Management Responsibility

4.1.1. Quality policy - The supplier's management shall define and document its policy and objectives for, and commitment to, quality. The supplier shall ensure that this policy is understood, implemented and maintained at all levels in the organization. (ISO, 1992, p. 126)

"Where is quality made? The answer is, by the top management. The quality of the output of a company can not be better than the quality determined at the top" (Deming, 1992a, p. 13). Deming underscores the responsibility of management for the overall success of the system, and this obligation is the first quality system requirement stressed in ISO 9001.

Deming also discusses the responsibility of management to provide a clear aim for the organization:

A system must have an aim. Without an aim there is no system. The aim of the system must be clear to everyone in the system. The aim is a plan for the future. The aim is a value judgment. (Deming, 1992a, p. 35)

He also addresses the necessity to transform management and its attitudes toward quality improvement. Part of this transformation is to provide leadership and "create an environment in which people can take joy in their work" (British Deming Association, 1989, p. 11). Most of these thoughts are contained to some degree within the intention of ISO 9001 Section 4.1 because of the link drawn between management responsibility and the overall success of the quality system.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	ISO TO DEMING
4.1 MANAGEMENT RESPONSIBILITY	●							Δ						●	21
4.2 QUALITY SYSTEM		▽												Δ	-3
4.3 CONTRACT REVIEW		▽													-3
4.4 DESIGN CONTROL						Δ			Δ						6
4.5 DOCUMENT CONTROL			▽		X								▽		-15
4.6 PURCHASING			▽	▽											-6
4.7 PURCHASER SUPPLIED PRODUCT															
4.8 PRODUCT IDENTIFICATION AND TRACEABILITY					Δ	Δ									6
4.9 PROCESS CONTROL						Δ									12
4.10 INSPECTION AND TESTING				X											-9
4.11 INSPECTION, MEASURING AND TEST EQUIPMENT				▽		Δ									
4.12 INSPECTION AND TEST STATUS															
4.13 CONTROL OF NONCONFORMING PRODUCT															
4.14 CORRECTIVE ACTION				Δ											3
4.15 HANDLING, STORAGE, PACKAGING, AND DELIVERY															
4.16 QUALITY RECORDS						Δ									3
4.17 INTERNAL QUALITY AUDITS															
4.18 TRAINING	●				Δ			▽							9
4.19 SERVICING							●					Δ			12
4.20 STATISTICAL TECHNIQUES															
DEMING TO ISO	18	-6	-12	Δ	9	Δ	9	3	-3	6	Δ	Δ	3	9	12

STRONG POSITIVE ● 9
 WEAK POSITIVE Δ 3
 WEAK NEGATIVE ▽ 3
 STRONG NEGATIVE X 9

1 CREATE CONSTANCY OF PURPOSE
 2 ADOPT THE NEW PHILOSOPHY
 3 CEASE DEPENDENCE ON MASS INSPECTION TO ACHIEVE QUALITY
 4 END THE PRACTICE OF AWARDING BUSINESS ON PRICE TAG ALONE...
 5 IMPROVE CONSTANTLY THE SYSTEM OF PRODUCTION AND SERVICE
 6 INSTITUTE TRAINING ON THE JOB
 7 INSTITUTE LEADERSHIP
 8 DRIVE OUT FEAR
 9 BREAK DOWN BARRIERS BETWEEN DEPARTMENTS
 10 ELIMINATE SLOGANS, EXHORTATIONS, AND NUMERICAL TARGETS
 11 ELIMINATE WORK STANDARDS (QUOTAS) AND MANAGEMENT BY OBJECTIVE
 12 REMOVE BARRIERS THAT ROB WORKERS OF PRIDE OF WORKMANSHIP
 13 INSTITUTE A VIGOROUS PROGRAM OF EDUCATION AND SELF-IMPROVEMENT
 14 PUT EVERYONE IN THE COMPANY TO WORK TO ACCOMPLISH... TRANSFORMATION
 ISO TO DEMING

Figure 5. ISO 9001/Deming 14 Points Relationship Matrix

Positive aspects of Section 4.1. This section begins the requirements portion of ISO 9001 with a clear statement of management responsibility.

Crawford (1988) writes:

The whole of this paragraph makes excellent sense, provided that the responsibility and authority are delegated to the right level. If fully understood and implemented, this requirement should also ensure that everyone will know what his job is. (p. 2)

The determination of proper delegation is made by an auditor during the registration evaluation. Management must demonstrate that employees at appropriate levels have been given the necessary authority to carry out assigned responsibilities.

Clear management responsibility for the system is a constant theme throughout ISO 9001. An interview subject features the management responsibility to manage in this quote from one of his clients:

From our viewpoint, all ISO 9000 said to us was, 'Have you developed good business practices? Does management instruct engineers and operators on what it wants? Does it have a means of measuring and reporting results?'

This is just sound business management. ISO 9000 forces management to manage [Louis Roberts, Director of Quality Assurance for Brand-Rex]. (Durand, 1992b, p.2)

In another interview, Jean-Claude Krynicky supported this idea by saying that one of the best benefits his organization received from registration to ISO 9002 was a clear assignment of responsibilities. This assignment was

outlined in a responsibility matrix made available for everyone (Krynicky, 1992).

Negative aspects of Section 4.1. Deming's system of profound knowledge lists an understanding of variation as an important responsibility of management. A criticism of ISO 9000 by Deming advocates is that the importance of variation is referred to sparingly.

The Standard fails to draw management's attention to the essential variability of processes, and hence of products. Consequently it conveys no idea of the benefits of reducing variation. (Crawford, 1988, p. 2)

A far greater omission as viewed by Deming advocates is the lack of a discussion of leadership:

There is no recognition of the need for management to provide leadership, nor of the purpose of leadership in the context of quality, i.e. to help people and their equipment to do a better job. (Crawford, 1988, p. 2)

This is reinforced by Phillip Willey (1990):

The word 'leadership' does not appear anywhere in BS5750. There is plenty about 'management responsibility' . . . but it is obvious that this is management and documentation of the system. (p. 6)

ISO 9001/Deming relationship assessment of Section 4.1. A +9 *strong positive* is assigned to the intersection between Section 4.1 and Deming point 1 because the standard clearly states management responsibility for the success of the system. Discussions with employees of registered companies reinforced the effect that the standard has of requiring managers to manage,

plan carefully, follow the plan, and avoid frequent, disruptive changes of direction to the organization. Although some Deming supporters criticize the lack of emphasis on leadership, the practical effect in registered companies is to bolster management obligation and provide leadership for the long term. A score of +3 *weak positive* is applied to point 7 to recognize this link but it is considered weak due to management focus of tactical system operation and not long term innovative leadership. This section does not go as far as Deming's concept of an aim for the system nor an integration of the elements of profound knowledge.

A +9 *strong positive* is assigned to point 14. Managers interviewed in registered companies frequently cited the positive aspect of the registration effort in enlisting all departments and employees in the effort to define, stabilize, and optimize the quality system.

4.2. Quality System

The supplier shall establish and maintain a documented quality system as a means of ensuring that product conforms to specified requirements. (ISO, 1992, p. 126)

A written quality manual is the primary manifestation of a quality system that an auditor of this section expects to review. In this section, the term quality system is not meant in the broad terms Deming describes in profound systems knowledge. As far as the ISO 9001 standard is concerned,

the term quality system pertains only to those factors that are likely to affect conformance to customer expectations.

Positive aspects of Section 4.2. This section requires "the preparation of quality plans and a quality manual in accordance with the specified requirements" (ISO, 1992, p. 126). A cross-functional effort is required to assemble the pertinent plans and to write the quality manual. This activity requires the review of existing processes and the assessment of their effectiveness. This review can provide the opportunity to analyze departmental interfaces and help identify inefficiencies in the process flow. Willey writes that the benefits of this cross-functional review is a result of ISO 9000 registration efforts but not necessarily a specific objective. "Industrial experience from introducing BS5750 certainly helps to break down barriers between departments and improve understanding. However, this is a fortunate result from BS5750 not a central aim" (Willey, 1990, p. 8).

Negative aspects of Section 4.2. Precise description of a quality system as procedures and processes may overlook the human organization and the essential characteristics that make a group successful.

[There is an] 'informal organization,' or the way the work gets done. There could be any and every combination of vertical, horizontal, and diagonal customer and supplier transactions. . . . Real organizations cannot, and should not, be described by the neat and orderly columns and rows, as graphically described by many of the organization charts that are seen in companies everywhere. (Scherkenbach, 1991, p. 11)

Conformity to requirements as the primary definition of quality is not in accordance with the Deming philosophy, and Section 4.2 refers to "ensuring that product conforms to specified requirements" (ISO, 1992, p. 126).

The meaning of nonconformity however is defined as 'the nonfulfilment [*sic*] of specified requirements.' BS5750 is thus capable of being interpreted as sustaining the short-sighted and dangerous view that quality improvement efforts can stop as soon as products or services have 'met the spec.' (BDA, 1989, p. 8)

Simply meeting specifications contradicts Deming's view that the obligation of management is to innovate, exceed customer expectations, and offer new and unique products or services. The quality system standards that have preceded ISO 9000 such as MIL Q-9858A and BS 5750-1979 have emphasized specifications as the definition of quality. John Betti of the Ford Motor Company is quoted by Deming:

We in America have worried about specifications: meet the specifications. In contrast, the Japanese have worried about uniformity, working for less and less variation about the nominal value - e.g., diameter 1 cm. (Deming, 1986, p. 49)

Deming also says, "Specifications are not wrong. They are just not sufficient" (Neave, 1990, p. 164). The accent of specifications and conformance to customer requirements is found throughout ISO 9001.

ISO 9001/Deming relationship assessment of Section 4.2. A -3 *weak negative* is applied to Deming point 2 because of the ISO 9001 description of quality primarily as conformance to requirements. This definition has been a

consistent one in industry and does not support adopting a new philosophy as Deming proselytizes. A *-3 weak negative* is also assigned to point 5 since conformance to specifications encourages a proclivity to inaction and inflexibility.

This section is rated *+3 weak positive* in relation to point 9. Several interview subjects mentioned improvement in communication within their corporations as a positive side effect of the registration process and documentation development. A rating of *+3 weak positive* also marks point 14. The awareness and participation of everyone is required to effectively sustain the quality system as required by Section 4.2.

4.3. Contract Review

The supplier shall establish and maintain procedures for contract review and for the coordination of these activities. (ISO, 1992, p. 126)

This short section states the supplier is responsible for assuring that the organization can provide the product or service that the buyer orders. This condition is in concert with the standard's definition of quality as conformance to customer requirements.

Positive aspects of Section 4.3. It is good business practice to completely understand the requirements of a contract and to assure they can be met. Efforts invested at the contract review stage can avoid

misunderstandings and mistakes further downstream in the service performance or product production operation.

Negative aspects of Section 4.3. Crawford (1988) believes the contract review stage is already too late for improvement or innovation in understanding customer requirements: "The weakness of this section is that it apparently contemplates that these necessary checks will be done when the contract already exists. We should encourage people to get them done at a much earlier stage" (p. 3). Deming advances further:

Success depends on how well a company evaluates the processes, products, and markets of today to figure out what the customer will want tomorrow, and whether a company has the management conviction to change accordingly. (Gabor, 1990, p. 19)

The definition of a customer extends to those who may not normally be considered such by an organization. These are potential customers, previous customers, or experts in the field who may have valuable insight for innovation (Scherkenbach, 1991).

ISO 9001/Deming relationship assessment of Section 4.3. This section is a simple statement expressing the need for a good relationship between supplier and customer. It is ranked -3 *weak negative* with respect to point 2 because it reinforces limited thinking of quality as conformance to specifications. It does not allude to the need of the organization to innovate

and provide product not conceived of by the customer. Deming writes that the customer does not contribute to innovation:

Where today are the makers of carburetors? There was a time when every automobile had a carburetor. How could it run without one? The makers of carburetors improved their product year by year. Customers were happy, loyal. What happened? Innovation. Came the fuel injector. . . . The moral is that it is necessary to innovate, to predict needs of the customer, give him more. (Deming, 1992a, p. 6)

4.4. Design Control

4.4.1. General - The supplier shall establish and maintain procedures to control and verify the design of the product in order to ensure that the specified requirements are met. (ISO, 1992, p. 127)

Section 4.4 expands the description of product characteristics to be based on negotiation between the buyer and seller. More elaboration is given as to specific activities expected during the design stage.

Positive aspects of Section 4.4. Because of the specific nature of the discussion regarding the design stages, Crawford (1988) writes that the standard provides more guidance than Deming:

Design is a subject on which the Standard offers (in the writer's view) much more advice, and more specific advice, than does Dr. Deming. Although the latter emphasises that quality must be built in at the design stage (Out of the Crisis, p. 49), specific advice on methods and procedures is scattered. (p. 3)

The standard details steps for activity assignment, organizational interfaces, design input, design output, verification, and change control (ISO, 1992,

p. 127). This advice reinforces the importance of the *plan* stage of the PDSA cycle.

Negative aspects of Section 4.4. ISO 9001 primarily discusses the design of the finished commodity and does not address the planning of the production processes which in turn heavily influence the final outcome (Crawford, 1988). The British Deming Association (1992) committee which wrote "Beyond ISO 9000" suggests that there are at least three things which will improve the standard in this section. They suggest:

First, it means . . . designing goods and services which will exceed expectations rather than just aiming to meet specified requirements. . . . Second, it means understanding that the product is at the mercy of the design and production processes. . . . Third, it means recognising that innovation . . . is an inseparable part of quality. (p. 7)

ISO 9001/Deming relationship assessment of Section 4.4. A +3 *weak positive* is assigned to point 5 because this section supports the use of the PDSA cycle. A +3 *weak positive* is also assigned to point 9 because the section discusses organizational boundaries as a potential problem:

4.4.2.2. Organizational and technical interfaces between different groups shall be identified and the necessary information documented, transmitted and regularly reviewed. (ISO, 1992, p. 127)

4.5. Document Control

4.5.1. Document approval and issue - The supplier shall establish and maintain procedures to control all documents and data that relate to the requirements of this International Standard. (ISO, 1992, p. 127)

Part 4.5 describes the requirement to control appropriate quality system documents and records. Proper authorization procedures are required to place documents into service, and methods to remove obsolete documents from use must be defined. Formal change control procedures are needed for modification of existing documentation.

Positive aspects of Section 4.5. Thorough review and control of quality system definitions and documents forces an evaluation of existing processes and procedures. These may never have been reviewed since they were written. Gaining control of documentation is good discipline for organizations without an established history of quality systems focus.

Negative aspects of Section 4.5. Interviewees frequently mentioned that the ISO 9000 standards' stress of control of documentation was restrictive and excessive. Deming writes, "Unnecessary paperwork is a serious loss. A lot of it originates in management's supposition that the cure for repetition of a mistake or fraud is more audit, more inspection" (Deming, 1992a, p. 15). Dr. Joyce Orsini (1992), who lectures at Dr. Deming's seminars, adds: "We create paperwork to cover ourselves. 'We did exactly what we were supposed to do' and then look to blame [when something goes wrong]" (p 4). The practice of excessive documentation originates in the theories of Frederick Taylor, the author of scientific management:

Taylor's assumption that an optimum system can be defined, and that there is enough information to define it, is directly contradictory to Deming's approach. Instead of trying to design an optimum system, Deming emphasizes the need to have a resilient system which can be improved over time. (Gluckman & Roome, 1990, p. 251)

If the assumption is made that a system can be completely described, then the emphasis of documentation logically follows.

ISO 9001/Deming relationship assessment of Section 4.5.

Documentation control is thoroughly investigated by registrars. A common auditing technique is to sample documents and verify actual practice of the procedures. If anomalies are found, further probing is done to determine the root cause of the discrepancy. A *-3 weak negative* is assigned to point 3 since the Deming approach stresses the need to understand and constantly improve the process, not concentrate on mistakes made in documentation control. The interview subjects' opinions are bolstered by a report in the March/April 1992 "Journal of European Business." This report lists the results of 1,040 nonconformities from ISO 9001 evaluations. Of these, the largest number of 18% are registered against Section 4.5 (Timbers, 1992, p. 23). Many people interviewed said the emphasis on rigid documentation seriously inhibited flexibility and responsiveness. Correspondingly, this section is judged *-9 strong negative* when compared to Deming point 5.

A score of *-3 weak negative* is given with respect to point 12. Rigid documentation and procedures are intended to eliminate as much as possible

the human element in a process, but in so doing reduce the opportunity for workers to exhibit creativity, innovation, and pride in their work.

4.6. Purchasing

4.6.1. General - The supplier shall ensure that purchased product conforms to specified requirements. (ISO, 1992, p. 127)

Purchased product is material which the supplier obtains to use in the manufacture of the product to the buyer's specifications. This clause pertains only to material that is used in the product or directly affects the quality of the manufacturing or delivery operation. Evidence of compliance to this section is accomplished through formal documentation which controls the choice and authorization of suppliers and subcontractors. Proof is necessary that the goods purchased meet the requirements of the requisition, is verified as such, and can be traced at any location in the manufacturing or delivery process.

Positive aspects of Section 4.6. This segment highlights the importance subcontracted or supplied components have in the quality of the finished product. Michael Payne (1992) in a telephone interview observed that Deming advocates in point 4 a close partnership with suppliers.

Negative aspects of Section 4.6. Crawford (1988) says:

This is a statement of conventional practice. As such, it relies on the common supposition that it is only necessary for the purchased product to meet specifications . . . and fails to recognise that product

drawn from several suppliers is likely to be more variable than product drawn from a single supplier. (p. 3)

Willey (1990) adds, "Choosing a supplier who can merely supply to the specification bars the way to continual improvement" (p. 4). Both of these statements affirm the limited scope of this section and the deficiency when compared to point 3.

ISO 9001/Deming relationship assessment of Section 4.6. A -3 *weak negative* is assigned to point 3 because paragraph 4.6.4, "Verification of purchased product," supports traditional source inspection. There is no mention of more sophisticated techniques to achieve consistent results such as statistical process control and sharing of process capability information.

A -3 *weak negative* is also assigned to point 4. Deming expressly encourages use of single suppliers because of reduced variation and the benefits accrued through stable work and good relationships. This concept is neither addressed nor discouraged by this clause, but the tone of the clause is legalistic in defining the relationship between supplier and purchaser. Without a single supplier philosophy, it is more difficult to achieve continual improvement and "reduce the number of sources, concentrating on the good ones, to lower the cost of variation" (BDA, 1992, p. 8).

4.7. Purchaser Supplied Product

The supplier shall establish and maintain procedures for verification, storage and maintenance of purchaser supplied product provided for incorporation into the supplies. (ISO, 1992, p. 128)

Section 4.7 applies if the buyer provides material that is used in the product and returned to the buyer.

ISO 9001/Deming relationship assessment of Section 4.7. This section is a contractual statement of good business practice. It is judged to have no direct positive or negative correlation to the 14 points.

4.8. Product Identification and Traceability

Where appropriate, the supplier shall establish and maintain procedures for identifying the product from applicable drawings, specifications or other documents, during all stages of production, delivery and installation. (ISO, 1992, p. 128)

The purpose of this clause is to identify components in the finished product. This may be necessary to remove a product from final assembly or to recall a product once it has been delivered. Product identification may be important during servicing as governed by Section 4.19.

Positive aspects of Section 4.8. Although the intention of this clause is primarily remedial, the information collected can be used to study and understand variation between suppliers and reduce the effect that this variation has on the finished product. This aids in improving supplier quality.

Negative aspects of Section 4.8. There are no apparent negative relationships to the Deming 14 points. This paragraph is similar to 4.7 in that it is a tactical contractual requirement.

ISO 9001/Deming relationship assessment of Section 4.8. The procedures required in this clause can be helpful if the data obtained is used to understand the capabilities of vendors and to achieve continual improvement. Thus, a +3 *weak positive* is appropriate for point 4 and point 5.

4.9. Process Control

4.9.1. General - The supplier shall identify and plan the production and, where applicable, installation processes which directly affect quality and shall ensure that these processes are carried out under controlled conditions. (ISO, 1992, p. 128)

Processes are defined through work instructions, monitored, controlled, approved by proper authority, and measured against workmanship standards. This short section also refers to special processes that may be difficult to verify.

Positive aspects of Section 4.9. Documented work instructions provide clear direction to workers concerning procedures. Deming mentions that "a job description must do more than prescribe motions, do this, do that, this way, that way. It must tell what the work will be used for, how this work contributes to the aim of the system" (Deming, 1992a, p. 42). The BDA (1992)

research committee suggests that rigidly documented work instructions are not sufficient:

Progress beyond that point requires further steps of getting more people personally involved in developing a deeper understanding of the processes and of what is meant by 'process control.' But many organisations lose out by failing to use the creativity and experience of their employees. (p. 8)

Negative aspects of Section 4.9. The basis of this paragraph is heavily influenced by the scientific management ideas of Taylor. The human element of pride in workmanship is lacking, and little is left to the creativity and flexibility of the worker.

ISO 9001/Deming relationship assessment of Section 4.9. Section 4.9 requires documented and defined processes but falls short of invoking continual improvement methods. Improvement will be a byproduct, not the objective of process control, thus Section 4.9 is rated +3 *weak positive* when compared to point 5.

A level of +9 *strong positive* is allotted for comparison to point 12. The standard places strong import on management's role in defining processes and providing necessary materials and working environment. These factors are influential in removing "barriers that rob workers, engineers, and managers of their right to pride of workmanship" (Deming, 1990, p. 6). A process concentration will lessen the tendency to exhort workers to do better and blame them when they cannot because of the system.

This section of the standard also warrants a high ranking with point 12 because of the requirement for workmanship standards. Deming writes, "How can anyone on the factory floor take pride in his work when he is not sure what is acceptable workmanship, and what is not, and cannot find out?" (Deming, 1986, p. 77). Section 4.9.d requires "criteria for workmanship which shall be stipulated, to the greatest practicable extent, in written standards or by means of representative samples" (ISO, 1992, p. 128). Section 4.9.a delineates management's responsibility to provide suitable equipment and working conditions (ISO, 1992).

4.10. Inspection and Testing

4.10.4. Inspection and test records - The supplier shall establish and maintain records which give evidence that the product has passed inspection and/or test with defined acceptance criteria. (ISO, 1992, p. 129)

Inspection and testing is required for receiving of material, in-process goods, final inspection and testing, and collection of records (ISO, 1992).

Positive aspects of Section 4.10. A system that defines quality in terms of specifications and conformance to requirements must rely on frequent inspections to assure compliance. In this context, this clause is compatible with the rest of the standard.

Negative aspects of Section 4.10. An entire section of the standard devoted to inspection and testing gives the impression that quality can be

inspected into a product. Deming has spent fifty years demonstrating that this is not so. This section also ignores the theory of process capability and perpetuates a view that ignores the knowledge of systems and PDSA (Crawford, 1988). To a company unsophisticated in the knowledge of variation, the procedures required in this paragraph could be detrimental.

Deming has a more enlightened approach to inspection than does BS5750. He urges everyone to improve their processes, products and services to the extent that it will cease to be necessary to depend on mass inspection to filter out defectives. Instead, inspections should be moved upstream into appropriate stages of the process and, when a state of statistical control or stability has been achieved, greatly reduced in frequency. (BDA, 1989, p. 11)

ISO 9001/Deming relationship assessment of Section 4.10. This clause directly contradicts the lessons of point 3 and is thus ranked as *-9 strong negative*. There is no acknowledgement of control and improvement of processes through statistical techniques. Modern manufacturing procedures such as just-in-time manufacturing (JIT) appear at odds with the intention of this clause. Use of these methods may require education and justification efforts with the registering auditor. For example, a JIT process will not require inspection of incoming materials.

4.11. Inspection, Measuring and Test Equipment

The supplier shall control, calibrate and maintain inspection, measuring and test equipment, whether owned by the supplier, on loan, or provided by the purchaser, to demonstrate the conformance of product to the specified requirements. (ISO, 1992, p. 128)

Good measurements require calibrated instruments of quantified accuracy traceable to a national reference device or intrinsic parameter. This section lists ten specific steps to be taken to assure accurate and repeatable measurements. The standard also requires the characterization of the measurement uncertainty and thereby the capability of equipment.

Positive aspects of Section 4.11. Most of the steps listed are based on other measurement standards and enumerate traditional good practice. The effect of this clause in the standard is to encourage a more thorough application of statistical methods to understand the process capability of the measuring equipment. "Statistical control of the measuring process itself is vital if the measurements are to be of use in improving the manufacturing processes" (BDA, 1992, p. 12). Reliable measurements of product specifications and processes is deemed so important that a separate standard addresses the subject. That standard is titled ISO 10012.1, "Quality Assurance Requirements for Measuring Equipment - Part 1: Metrological Confirmation System for Measuring Equipment."

Negative aspects of Section 4.11. The list of ten requirements are more tactical and specific than most other sections of the standard. Practice among registered companies indicates that because of this specificity, auditors expect to see only these procedures and none others used. This

detailed, prescriptive section inhibits innovation or development of alternative methods.

ISO 9001/Deming relationship assessment of Section 4.11. The amplification by a separate standard underscores the importance of measurement in specification and inspection. Measurement integrity is also important in understanding process capability and striving to reduce variation, but this is not described explicitly in ISO 9001. Some interviewees described the environment that is promoted by the prescriptive nature of this section as a mind set of minimal steps to be taken. Once those steps are accomplished, nothing more need be done. For these reasons, a rank of -3 *weak negative* is applied to point 3. An understanding of measurement integrity can help to determine process capability, the achievement of statistical stability, and narrowed dispersion, thus the rank of +3 *weak positive* with point 5.

4.12. Inspection and Test Status

The inspection and test status of product shall be identified by using markings, authorized stamps, tags, labels, routing cards, inspection records, test software, physical location or other suitable means, which indicate the conformance or nonconformance of product with regard to inspection and tests performed. (ISO, 1992, p. 129)

This very short section describes contractual requirements and operational tactics.

ISO 9001/Deming relationship assessment of Section 4.12. No correlation is assessed. This instruction is coherent with the meaning of quality as conformance to specifications.

4.13. Control of Nonconforming Product

The supplier shall establish and maintain procedures to ensure that product that does not conform to specified requirements is prevented from inadvertent use or installation. (ISO, 1992, p. 130)

The text describes nonconformity review and disposition requirements.

"This again is an unfortunately logical and necessary part of the Standard.

Every activity described represents waste and loss of productivity. Every activity carries a risk of leakage of nonconforming product to internal or external customers" (Crawford, 1988, p. 5).

ISO 9001/Deming relationship assessment of Section 4.13. This section is consistent with inspection methods of quality control. The requirements are operational tactics and are judged to have no correlation to the 14 points.

4.14. Corrective Action

The supplier shall establish, document and maintain procedures for . . . investigating the cause of nonconforming product and the corrective action needed to prevent recurrence. (ISO, 1992, p. 130)

Subparagraphs describe analysis, quality records, and the use of customer complaint information. Preventative action is determined by

analysis of the discrepancy and then followed by the application of controls to ensure effective maintenance.

Positive aspects of Section 4.14. The clause encourages "initiating preventative actions to deal with problems to a level corresponding to the risks encountered" (ISO, 1992, p. 130) thus suggesting a balance between tampering and fixing significant problems. Because this section promotes process improvement, it is "readily interpretable in accordance with the Deming approach" (Crawford, 1988, p. 5).

Negative aspects of Section 4.14. Identifying and recording nonconformance and then reacting is not as effective as the Deming philosophy of problem prevention through good process design (Willey, 1990). Willey (1990) also suggests that this section encourages "how to use the existing management system to deal with mistakes made; it does not offer advice as to how to prevent them" (p. 2). Deming writes strongly against this approach to quality control and calls it tampering: "P.R.R. - problem, report, and resolution. Actually, this system of management by results is tampering - making things worse" (Deming, 1990, p. 26).

ISO 9001/Deming relationship assessment of Section 4.14. In a less direct manner, Section 4.14 supports the idea of continual improvement and can be the basis for a more vigorous and proactive program. The temptation to tamper with a system must be avoided in the effort to demonstrate to an

auditor that corrective action is taken. This section is judged +3 *weak positive* corresponding to point 3 because it recognizes that nonconformities may be statistical special causes and that inspection is not a permanent solution to ensure product quality.

4.15. Handling, Storage, Packaging, and Delivery

The supplier shall establish, document and maintain procedures for handling, storage, packaging and delivery of product. (ISO, 1992, p. 130)

Section 4.15 defines handling, storage, packaging, and delivery in separate paragraphs.

ISO 9001/Deming relationship assessment of Section 4.15. This section defines contractual requirements and operational tactics. No correlation is assessed to the 14 points.

4.16. Quality Records

The supplier shall establish and maintain procedures for identification, collection, indexing, filing, storage, maintenance and disposition of quality records.

Quality records shall be maintained to demonstrate achievement of the required quality and the effective operation of the quality system. (ISO, 1992, p. 130)

Positive aspects of Section 4.16. The collection of records is effective if the records are analyzed and used for continual improvement in the PDSA cycle. Crawford (1988) observes that the tone of ISO 9001 implies that records are predominately of deviations, corrective actions, and

nonconformities. He says the records should consist "more and more of notes of the actions taken to bring processes into statistical control (detection and elimination of special causes). . . " (p. 6).

Negative aspects of Section 4.16. "It is easy to become swamped with useless data, especially when data collection is done without a clear purpose" (Scholtes, Joiner, Braswell, Finn, Hacquebord, Little, Reynard, Streibel, & Weiss, 1988, Section 5, p. 38). Besides asking why data is collected, what data is to be collected, and how it will be used, they suggest:

Imagine you have the data in hand: What could these data tell you? What will you do with the data? What will you do after that? Would another kind of data be more helpful? (Scholtes et al., 1988, Section 5, p. 38)

ISO 9001/Deming relationship assessment of Section 4.16. Data collected for the continual improvement of processes is a sound practice. If data is collected solely to meet the audit requirements of this section, that effort is a needless and burdensome exercise. This section is assessed +3 *weak positive* with point 5.

4.17. Internal Quality Audits

The supplier shall carry out a comprehensive system of planned and documented internal quality audits to verify whether quality activities comply with planned arrangements and to determine the effectiveness of the quality system. (ISO, 1992, p. 130)

The importance of the activity determines the frequency of audits with results reported to responsible management. Corrective action should be taken on the deficiencies that are discovered.

Positive aspects of Section 4.17. One positive aspect of audits is the visible commitment by management to the continued effectiveness of the quality system. An objective and impartial review by an independent person can disclose problems that are not obvious to those who are close to the daily operation (Crawford, 1988).

Negative aspects of Section 4.17. An audit against the existing quality system description promotes the status quo rather than encouraging modification and improvement (Crawford, 1988). Audits can be a stressful and unpleasant event and may encourage people to be less open if they fear punishment for mistakes that are discovered.

Auditing can be a powerful tool for determining the health of the management system. But it is too often carried out as a policing activity which induces fear in the people being audited, who then erect barriers to protect themselves. (BDA, 1992, p. 11)

An in-depth review can help determine the effectiveness of stable systems.

"Audits should be regarded as part of a continuous learning process,

contributing to the 'Study' stage in the 'Shewhart Cycle' of

Plan-Do-Study-Act" (BDA, 1992, p.11).

This section also requires "timely corrective action on the deficiencies found by the audit team" (ISO, 1992, p. 132) which if taken every time a mistake or nonconformity is identified results in tampering. This leads to the mistake of assuming a special cause was the source of the error when the deviation was due to common causes.

ISO 9001/Deming relationship assessment of Section 4.17. The practice of scheduled audits is an effective means of reaffirming management commitment in registered companies. This section is ranked +9 *strong positive* with respect to point 1 for the consistency of management practice that is engendered. A +3 *weak positive* grade is assessed against point 5 because the results of an audit may effectively be used for improvement of the system, but is not explicitly required.

Audits can be used against people and as an instrument of fear either intentionally or as a result of poor implementation. For this reason, this section is classified -3 *weak negative* in intersection with point 8. The potential for creating an environment in which information is falsified or held from management is quite likely when audits are considered punitive.

4.18. Training

The supplier shall establish and maintain procedures for identifying the training needs and provide for the training of all personnel performing activities affecting quality. Personnel performing specific assigned tasks shall be qualified on the basis of appropriate education, training

and/or experience, as required. Appropriate records of training shall be maintained. (ISO, 1992, p. 131)

This section is very short and is quoted in its entirety.

Positive aspects of Section 4.18. Training and education are critical elements in the success of a quality system. Education as cited in this section is, however, not meant in as extensive a way as Deming uses the term in the system of profound knowledge.

Negative aspects of Section 4.18. The implication in this paragraph is that training applies only to work procedures and activities that directly affect production. Other dimensions such as the education of management concerning the significance of variation can only be inferred. "Training is mentioned in BS5750 but not education except in the rather woolly statements that properly 'qualified people should be employed'" (Willey, 1990, p. 10). The intention of this clause is good and recognizes management's responsibility to train employees, but falls far short of Deming's theory of training and education. "As is common, the Standard blurs the distinction between *training*, i.e. skills and vocational aspects, and *education*" (BDA, 1992, p. 12).

ISO 9001/Deming relationship assessment of Section 4.18. Because this clause specifically requires management to provide training about the job, it is ranked +9 *strong positive* with point 6. Management's responsibility is

made clear to provide training for roles that affect the quality of the product. A rank of +3 *weak positive* is assayed against point 12 since poor training is a barrier to pride in workmanship. No relationship is assessed against point 13 because the scope of this section is not extensive enough to include the concept of "a vigorous program of education and self-improvement" (Deming, 1990, p. 6).

4.19. Servicing

When servicing is specified in the contract, the supplier shall establish and maintain procedures for performing and verifying that servicing meets the specified requirements. (ISO, 1992, p. 131)

This quotation is the complete clause.

ISO 9001/Deming relationship assessment of Section 4.19. This is a statement of the contractual requirement regarding customer needs after installation or delivery. No ranking is assigned to the 14 points.

4.20. Statistical Techniques

Where appropriate, the supplier shall establish procedures for identifying adequate statistical techniques required for verifying the acceptability of process capability and product characteristics. (ISO, 1992, p. 131)

The section is quoted in its entirety.

Positive aspects of Section 4.20. This section acknowledges that statistical tools may be useful in determining process capability and product characteristics.

Negative aspects of Section 4.20. The negative aspects of this paragraph are in what it does not expressly say:

This is an inadequate and opaque statement. It shows no understanding of concepts and methods which have been used effectively for half a century. Nor does it recognise any need for stable and predictable processes as the basis for maintaining and improving quality. But at least the subject is mentioned. (Crawford, 1988, p. 6)

Tools applied without proper knowledge in order to meet the standard can be quite useless. In writing "as appropriate," the interpretation of appropriateness is left to negotiation between the auditor and supplier and does not imply a strong requirement. "Statistical *techniques*, on their own, are of very limited use. What is needed is statistical *understanding* (part of what Deming calls *Profound Knowledge*)" (BDA, 1992, p. 13).

ISO 9001/Deming relationship assessment of Section 4.20. A +3 *weak positive* is ranked with point 3 because proper application of statistical methods can lessen the necessity of mass inspection. The standard gives no guidance to this effect, however.

A +3 *weak positive* is assessed for point 5 because statistical tools may be used for continual improvement. The standard does not go as far as requiring the use of statistical tools. The relationship to point 10 is by inference. Statistical knowledge will help management understand the futility of setting numerical targets to objectives for which processes are not capable. For this reason, a rank of +3 *weak positive* is placed with point 10.

Similarly, the same rank is placed in intersection with point 11 since a greater understanding of variation and process capability will lead to a more enlightened use of process metrics.

ISO 9001 Compared to the Elements of Profound Knowledge

One method of summarizing Deming's philosophy is by use of the 14 points. The previous section provides an evaluation of the relationship between ISO 9001 and those points. A different perspective is gained by comparing the twenty sections of the standard to the four elements of Deming's system of profound knowledge. The standard is a list of requirements addressing the expectations of the buyer about the supplier's quality system, whereas the system of profound knowledge is a high level summary of philosophy. Although meant for different purposes, a comparison between the two demonstrates the extent to which the standard attains the more comprehensive Deming philosophy of quality.

Almost all of the elements of the standard apply to the heading of systems. Only a few deal with knowledge or variation and none with psychology. This is not unexpected considering that the intent of the standard is to provide the minimum basis for a quality system and not a comprehensive definition of TQM.

The two Sections 4.1 and 4.18 reference the theory of knowledge in an oblique manner. The role of management, in the Deming philosophy, is to

provide leadership gained by an appreciation and application of the principles of the theory of knowledge. Other than a clear indication of management responsibility for the fulfillment of customer obligations, leadership is not discussed by the standard. The standard refers to training in Section 4.18, but does not address the broader notion of the integration of knowledge through education.

Discussion about the psychology of human organizations is not included in the standard because the standard is meant to be a contractual requirement. The implementation and maintenance of ISO 9000 registration is a very high visibility effort in the companies represented by the managers interviewed. "People get cynical about programs that come and go" (Ranney, 1992, p. 5). Because constancy of purpose is frequently missing in quality programs, employees can feel the same cynicism about ISO 9000 registration. They may think it is just the latest management fad, a thought that is echoed throughout the interviews.

The idea of trust is mentioned in DIS 9004-4.2, "Guidelines for Quality Improvement: Addendum to ISO 9004," which is in draft stage and not yet published. "Trust is essential if everyone is to be involved in identifying and following up on opportunities for improvement" (ISO, 1991, p. 7). Trust is mentioned in the context of communication and teamwork. Willey (1990) writes, "The passing reference to motivation of personnel [in ISO 9004] hardly

scratches the surface and, contains a reinforcement of the very fear that

Deming is talking about" (p. 7):

Employees should be made aware of the advantages of proper job performance at all levels, and of the effects of poor job performance on other employees, customer satisfaction, operating costs and the economic well-being of the company. (ISO, 1992, p. 131)

The twenty sections of ISO 9001 are categorized in Table 5 according to the element of profound knowledge to which they refer.

Analysis

Dr. Deming's Opinion of ISO 9000.

Dr. Deming was introduced to the ISO 9000 standards in 1988 by Jack Crawford of the British Deming Association. At first, Deming seemed to feel the standards could be a useful start towards a more comprehensive quality system, but since then he has become more harsh in his judgement according to the Director of Research of the BDA (Neave, 1992). This researcher asked Dr. Deming his opinion of the ISO 9000 standards on July 21, 1992 and was told the following:

They are horrible. Quality by inspection. There is no substitute for knowledge. They were adopted without knowledge. Very little chance to learn. Meanwhile: a lot of damage. We talk about quality and lots of people don't know what we're talking about. Five, six, seven years from now, what would you consider quality. Quality has different meanings to different people. What do you mean by quality? (Deming, 1992c, p. 3)

Table 5

Comparison of ISO 9001 to the System of Profound Knowledge

<p style="text-align: center;">SYSTEMS</p> <p>4.2 QUALITY SYSTEM 4.3 CONTRACT REVIEW 4.4 DESIGN CONTROL 4.5 DOCUMENT CONTROL 4.6 PURCHASING 4.7 PURCHASER SUPPLIED PRODUCT 4.8 PRODUCT IDENTIFICATION AND TRACEABILITY 4.9 PROCESS CONTROL 4.10 INSPECTION AND TESTING 4.11 INSPECTION, MEASURING AND TEST EQUIPMENT 4.12 INSPECTION AND TEST STATUS 4.13 CONTROL OF NONCONFORMING PRODUCT 4.14 CORRECTIVE ACTION 4.15 HANDLING, STORAGE, PACKAGING AND DELIVERY 4.16 QUALITY RECORDS 4.17 INTERNAL QUALITY REVIEWS 4.19 SERVICING</p>	<p style="text-align: center;">VARIATION</p> <p>4.20 STATISTICAL TECHNIQUES</p>
<p style="text-align: center;">THEORY OF KNOWLEDGE</p> <p>4.1 MANAGEMENT RESPONSIBILITY 4.18 TRAINING</p>	<p style="text-align: center;">PSYCHOLOGY</p>

When this researcher asked for further elaboration, Dr. Deming was equally cryptic, referring again to the ISO 9000 standards as quality by inspection. His response to questions is frequently short and terse. He typically won't answer direct questions but will answer a question with a question, a Socratic method (Petty, 1991).

Crawford (1988) writes about the conflicting philosophies of the ISO 9000 standards and Deming:

The underlying philosophy of the Standard is indicated by two passages from Section 1 [of ISO 9001] - 'Scope and Field of Application.'

a) 'The requirements . . . are aimed primarily at preventing nonconformity' (Para 1.1).

b) 'Confidence in product conformance can be attained by adequate demonstration of certain suppliers' capabilities' (Para 1.2). (p. 1)

The "objective of 'conformance' limits the horizons of the Standard" (Crawford, 1988, p. 1), and Crawford contrasts this limited scope with two ideas of Deming's teaching. The first is continuous improvement and the second is that quality can be considered separately from innovation (Crawford, 1988). The draft version of DIS 9004-4.2 does detail quality losses in terms of customer satisfaction and the "loss of opportunity to add more value for the customer" (ISO, 1991, p. 4). Deming teaches a change in management philosophy, and "BS5750 [ISO 9000] is specifying a system of statements, written policies, processing instructions, assessment procedures and traceable records" (Willey, 1990, p. 9).

Summary of the ISO 9001/Deming Comparison Matrix

Analysis of the rows. The graphic representation of Figure 5 shows overlaps and voids between the ISO 9001 standard and the 14 points of Dr. Deming. Some rows have no symbols marking a relationship, and these are sections specifying contractual requirements and tactics. The sections are 4.7, 4.12, 4.13, 4.15, and 4.19. They deal with purchaser supplied product, inspection and test status, control of nonconforming product, handling and storage instructions, and after-sale servicing. These subjects do not represent core factors of a quality system, but are consistent with a buyer's expectations in a requirement specific document.

Each symbol represents a numeric relationship of +9, +3, -3, or -9. The sum of the scores in each row is listed in the last column of Figure 5. The highest score of +21 is given to 4.1 which describes management responsibility. Equal ratings of +12 are assigned to 4.9 which addresses process control, 4.18 listing training requirements, and 4.20 which encourages the use of statistical techniques. The most negative score of -15 is assessed against Section 4.5 which details document control procedures. The next most negative score of -9 is against Section 4.10 on inspection and testing.

Analysis of the columns. The only column with no relationship symbol is point 13 which discusses education and self-improvement. The maximum positive score of +18 is given to point 1 which describes constancy of

purpose. The next most positive score of +12 is assigned to point 14 which requires everyone to be active in achieving the needed transformation. The most negative score is assessed for point 3 which warns against reliance on inspection to achieve quality.

Summary of the Positive Aspects of ISO 9000

Affinity diagram methods were used to summarize the positive aspects of the standards that were determined through both research and interview of experts. This method groups ideas from many sources and looks for common categories, or affinities, between the ideas. The following topics resulted from this affinity diagram analysis.

ISO 9000 provides a clear organizational goal. Most subjects interviewed agreed that the efforts required to achieve ISO 9000 registration provided a clear, easily identifiable, objective and rallying point for an organization. TQM is more difficult to describe and it is hard to determine if it has been successfully implemented. "TQM is more intangible and harder to motivate people toward" (Payne, 1992, p. 1). Management responsibility in providing tangible objectives is reinforced by the high score of +21 assigned to Section 4.1 in Figure 5.

The standards are a codification of good practice. A recurrent theme among experts interviewed is that the standards represent a "codification of good practice" (Durand, 1992a, p. 2). John Burr (1992) writes, "ISO 9004 is

the foundation upon which to build a quality system" (p.2). Donald Marquardt (1992) supports the idea that the standards represent good practice:

The key to competitiveness is disciplined use of quality systems. The ISO 9001/9002 requirements are good business practices that will benefit any organization; a generic, no-nonsense approach. (p. 3)

As Marquardt (1992) has depicted in Table 4, an important element of good practice is the PDSA cycle which can promote continual improvement if properly applied. Continued use of good practices is assured by internal and third party surveillance audits. These audits effectively reinforce the good practices laid out in the standards (Krynicky, 1992). Paul Roberts describes this aspect of reinforcement: "ISO is the wedge to keep you from slipping back, not a means of taking you forward" (Roberts, 1992, p. 1).

The standards lead to further growth. These standards can be a simple beginning of a sophisticated transformation to a mature quality system. Market pressure and competitive forces that require registration can introduce quality systems thinking to a company. "The crisis of the market is forcing company management to do something that we in the quality field have been espousing for thirty years" (Burr, 1992, p. 2). "ISO 9000 can be viewed as the key that opens the door to all the remaining opportunities of TQM, and the full Deming philosophy embracing his fourteen points" (Marquardt, 1992, p. 2). Ian Durand expresses these ideas in a graphic shown in Figure 6.

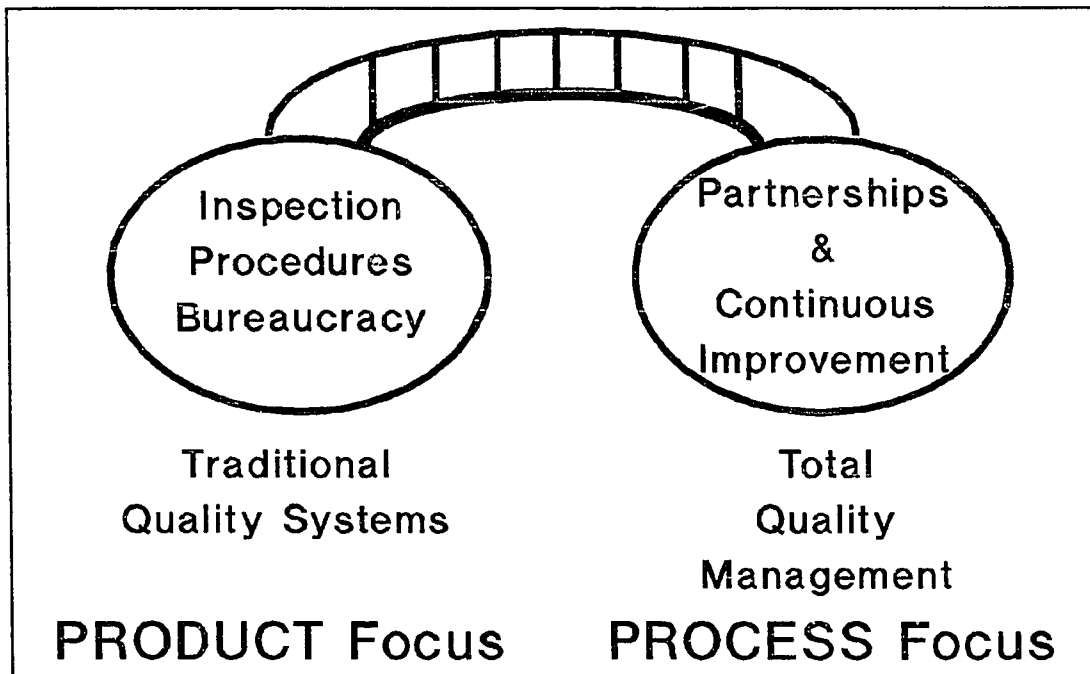


Figure 6. ISO 9000: Product to Process Focus Bridge
Source: Durand (1992b) [Correspondence].

Summary of the Negative Aspects of ISO 9000

Lack of customer satisfaction focus. Customer satisfaction is not stressed although the ISO 9000 standards define quality in terms of specifications and conformance to requirements. Fitness for purpose is used in the ISO 9004 guideline as a definition of quality in customer requirements. "It will not suffice to have customers that are merely satisfied. An unhappy customer will switch [Deming]" (Neave, 1990, p. 30). The omission in ISO 9000 of customer satisfaction as a distinct concept is deliberate:

Notably absent in the ISO Standard are specific references to quality results and customer satisfaction. . . . That omission is intentional. It

exists in most, if not all, quality system standards devised for widespread compliance by large numbers of companies. Developers of standards for this purpose generally hold that judgment of resulting quality should be considered by producer and customer but should not be codified by the elements of a quality system. (Peach, 1991, p. 77)

Customer satisfaction and the need to exceed expectations is central to many definitions of a quality centered TQM organization. One way to stress this aspect is by saying that quality management's goal is to delight the customer.

Certainly, there is nothing in BS5750 [ISO 9000] to lead the user to anything approaching the interpretation of Deming by Joiner Associates: 'A company should strive to delight their customers, giving them more than they imagined possible. Your bosses may be ecstatic, the Board of Directors blissful and your company may be considered a legend on Wall Street. But, if your customers are not delighted, you have not begun to achieve quality. (Willey, 1990, p. 2)

The DIS 9004-4.2 document stresses customer satisfaction as an aspect of measuring quality costs:

It is important to estimate even difficult to measure quality losses such as the loss of customer goodwill and the failure to fully realize human potential. (ISO, 1991, p. 8)

Exceeding customer expectations is accomplished through continuous innovation, an idea not overtly promoted in the ISO 9000 standards. "A company may nibble away on improving production of old product designs, but never get around to designing new products to please customers, or to addressing administrative issues in addition to technical ones" (Peach, 1991, p. 70).

Over-emphasis of documentation. An auditor will determine what an organization says are its methods to meet the requirements of the standard and then verify that these methods are practiced. Documentation in the form of written procedures is the most common evidence sought by auditors to evaluate the practice of an organization. Deming also encourages the use of operational definitions to precisely describe processes. However, to counterbalance an excessive emphasis on fixed and rigid procedures, Deming notes: "Sub-processes need not be clearly defined and documented: people may merely do what needs to be done" (Neave, 1990, p. 126). A concern about excessive documentation requirements was expressed by several interview subjects; one made the point that over-documentation "lock[s] in a superfluous old . . . system" (Cowan, 1992, p. 1).

Continual improvement is not promoted. A frequent criticism of the standards by people interviewed is the lack of discussion about continual improvement as a necessary component in a quality system. Similar to the criticism regarding lack of customer satisfaction focus, continuous improvement has been intentionally left out of the standard:

The committee judged it inappropriate to insert a contractual requirement for continuous quality improvement into a universal quality system standard, thus mandating it as a norm for industry worldwide. (Peach, 1991, p. 79)

In a telephone interview, Peach reiterated this point and added the committee was concerned about setting a criterion that would be too difficult for companies in third world countries to meet (Peach, 1992, p. 1).

Scherkenbach (1991) writes that continual improvement is based on many of the control elements required by ISO 9000: "I do not want to be misinterpreted here, so I will emphasize that the Method of Continual Improvement builds on the good characteristics of both Detection and Prevention" (p. 62). Willey (1990) writes, "It is difficult not to conclude that the commitment to constant improvement is central to Deming while peripheral and incidental to the BS5750 [ISO 9000] approach" (p. 5). Quality improvement is discussed in the draft document DIS 9004-4.2: "The responsibility and leadership for creating the environment for continuous quality improvement belong to the highest level of management" (ISO, 1991, p. 5).

Registration becomes the singular objective. Some companies will become registered because of customer demand and market pressure. The registration status by itself becomes a singular motivation, and an interviewee said that this a poor reason to implement a quality system (Ollivier, 1992, p. 1).

One of the biggest traps is for companies to become too orientated towards the ISO standards and the accreditation process and myopically see this process as a means to an end. . . . This so called ISO standard

myopia can manifest itself in many ways. . . . If a lot of marketing pressure is applied by top management with lip-service commitment, and business contracts are at stake, a cosmetic system may be implemented that is so superficial that it is unlikely to be followed in the months following registration. (Mulder, 1991, p. 458)

Hooper (1992) forcefully emphasizes this point in his correspondence: "Any quality approach implemented for form and not substance is useless" (p. 1).

Roberts (1992) said that if registration is the primary objective, there will be an emotional letdown in the organization once it is achieved which will lead to difficulty in sustaining the essential quality systems components (p. 2).

Relationship to business metrics is not apparent. Neither Deming's methods nor the ISO 9000 standards can easily be linked to traditional business metrics of profit, shipments, or growth. There seems no demonstrable correlation between countries that have had mature registration systems for a period of time and financial metrics in their economies (Ollivier, 1992). This apparent disconnection requires parallel systems within organizations (Krynicky, 1992). One system is for financial performance metrics; the other is to sustain the ISO 9000 registration status. A good quality system should not have this division, and because some perceive it necessary, there is evidence of a weakness in the ISO 9000 standards.

The further key function of financial management is also not covered; but again everyone would agree that its quality is critical to the survival of most organisations. (BDA, 1992, p. 5)

Registration does not assure good products. European managers who were interviewed expressed a concern that registered suppliers to ISO 9000 brought no assurance of improvement in the quality of the purchased product. Some spoke of their own experience in dealing with registered suppliers that advertised their registration status but continued to turn out shoddy product (Roberts, 1992). Others said they cannot rely on ISO 9000 registration as being an indicator of good supplier quality (Ollivier, 1992).

The Importance of Auditor Consistency

The requirement documents of ISO 9001, ISO 9002, and ISO 9003 are written in short and cryptic language. The translation of that language into practice is the task of the auditor who reviews an applicant's quality system. The success of the ISO 9000 standards is, as a result, dependent upon the crucial role of auditors.

This subject was discussed in interviews and many said they were seeing considerable inconsistency between auditors of differing agencies and countries. Ollivier (1992), who is responsible for registration in several European countries, said in his experience the auditors and registrars are very inconsistent, but he felt in time they will harmonize their practice. Durand (1992) also described his experience with a wide variation of sophistication in auditors. Roberts (1992) said that he is concerned about the power of the auditor to establish an absolute rule that employees are

reluctant to question. This degree of inconsistency and improperly trained auditors is also observed in the U.S. by Randall (1992).

Evidence of auditors' enthusiasm to go beyond the standard and establish their own criteria is observed in the following quotation:

We found that the auditors compensated for this [lack of continuous improvement] through rigorous, strict interpretation of the corrective action clauses. *They placed a much higher level of importance on the corrective action clauses than the standards themselves seem to imply [italics added].* (Dzus, 1991, p. 44)

Girvin (1992) describes an unsophisticated auditor as a "nit-picker suffering from a fatal case of tunnel vision who puts everything on paper but nothing in perspective" (p. 855).

Auditor consistency is crucial to the success of the ISO 9000 standards in improving quality systems. Reviews that placed significance only on what is documented and clearly observable neglect the human element and the unknowable figures.

The audit's unwritten standard is that if all plant personnel were suddenly replaced, the new people could continue making the product exactly as before. (Kerr, 1992, p. 36)

Comparison of the ISO 9001/Deming 14 Points Relationship Matrix and

Interview Results

The first column of Table 6 lists the highest and lowest ranking items from the ISO 9001/Deming 14 points relationship matrix. The affinity categories, resulting from interviews and literature research, are entered in

Table 6

ISO 9001/Deming 14 Points Relationship Matrix Compared to Interview Results

ISO 9001/Deming 14 Points	Interview Affinity Categories
<p><u>POSITIVE:</u></p> <p><i>4.1 Management Responsibility</i> } <i>Pt. 1 Constancy of Purpose</i> } <i>Pt. 14 Everyone</i> } <i>4.9 Process Control</i> } 4.18 Training 4.20 Statistical Techniques</p>	<p><u>POSITIVE:</u></p> <p><i>Clear Organizational Goal</i></p> <p><i>Codification of Good Practice</i></p> <p> </p> <p>Open Door for Future Growth</p>
<p><u>NEGATIVE:</u></p> <p><i>4.5 Document Control</i> } <i>4.10 Inspect and Test</i> } <i>Pt. 3 Cease . . . Inspection</i> }</p>	<p><u>NEGATIVE:</u></p> <p><i>Over-emphasis of Documentation</i></p> <p><i>Continual Improvement Lacking</i></p> <p> </p> <p>Lack of Customer Satisfaction Focus</p> <p>Registration ... Sole Objective</p> <p>Link to Business Metrics Lacking</p> <p> </p> <p>Registration Doesn't Assure Good Product</p>

column two. This synopsis shows there are at least two positive and two negative sets of topics in common.

The positive factors can be grouped into two categories. The first category combines Section 4.1 and points 1 and 14 with the statement that "ISO 9000 provides a clear organizational goal." Management commitment and the involvement of everyone in the organization is a factor that encourages a well defined and managed quality system. This effect agrees well with the teachings of Deming. The second grouping is Section 4.9 and the belief among interview subjects that the standards represent an index of best practices. Section 4.9 discusses process control and definition, a major element in understanding systems, which is a factor of Deming's system of profound knowledge.

Two categories discuss factors not conducive to the teachings of Deming. Section 4.5 matches interview results expressing concern among users that the standards unduly emphasize documentation. The second combines section 4.10 and point 3 with the interview subject's criticism that continual improvement is not a factor in the evaluation. Continual improvement must be inferred from the discussion in the standards about the disposition of nonconformities, but this passing reference is far from being a central focus of the quality system.

Summary

The history of the development and intent of the ISO 9000 standards is reviewed in this chapter. Interview methodology is described that was used to gain further insight into the structure of the standards and their relationship to the teachings of Deming. The ideas of Total Quality Management and the relationship to the Deming ideology is discussed. A detailed description of the ISO 9001 standard reviews each section against the 14 points of Deming and the system of profound knowledge. An analysis details Deming's comments on the standard and the positive and negative aspects discovered in the course of the research. Finally, the importance of auditor and registrar consistency is expressed. These findings are summarized with conclusions in the following chapter.

Chapter 5

Conclusions and Recommendations for Further Study

Review of Research Hypothesis

The research hypothesis is repeated here for the convenience of the reader:

1. The ISO 9000 quality system standards are not a complete guide to use for achieving Total Quality Management.
2. The standards conflict with or neglect several important elements of TQM as described by Dr. W. Edwards Deming.
3. Rapid acceptance of these standards without additional management changes may be detrimental to the broad success of TQM principles.

The results described in chapter 4 demonstrate that the collected teachings of Dr. Deming exceed in scope and intention those of the ISO 9000 standards. The first hypothesis proposition states that the standards are not a complete guide to use for achieving Total Quality Management and this statement is supported by these results. The research conducted probes more deeply the intention of the writers of the standards and confirms this statement of the hypothesis.

Confirmed in chapter 4 is the fact that the standards conflict or neglect completely several elements of TQM as described by Dr. Deming. The research also discovered that Deming objects to the simple label of TQM for such a complex concept. The second hypothesis proposition is still valid

because TQM is a management movement that is recognized by several authors and supported by the cited definitions. The hypothesis statement should be changed from a comparison of TQM to a transformation to a new philosophy of quality management to be consistent with Dr. Deming's ideology.

BS5750 [ISO 9000] concentrates on establishing an adequate system of quality management in order to achieve conformance of a product or service to a given or implied specification. The Deming approach aims at transforming management so as to achieve 'constancy of purpose for continuous improvement.' (BDA, 1989, p. 1)

The Deming philosophy, since it reaches much further than the Standard, is more difficult to apply. The standard provides a conveniently structured package of measures and handy checklists. Deming offers mainly theory and concepts, and asks the manager first to understand them and then to work out how they should be applied to his particular business. (BDA, 1989, p. 12)

The third hypothesis proposition states that rapid acceptance of these standards without additional management changes may be detrimental to the broad success of TQM principles. This proposition is the most difficult to support because of the wide variation in application of the standards, but research and interview results lead to a qualified support of the statement. Rapid acceptance of the ISO 9000 standards can have several positive effects. As Marquardt (1992) writes:

In my judgment, the ISO 9000 series is having more beneficial influence on quality, nationally and internationally, than any of the other individual thrusts. Not perfect, not fully comprehensive, but a practical

no-nonsense approach that is getting good results and is showing the way to further benefits. (p. 2)

A major benefit of the standards is to provide a strong foundation for a more comprehensive quality system and in so doing set the stage for future transformation to the more idealized vision of Dr. Deming. The idea of holding the gains is depicted in Figure 7 from "BS 5750: The End or the Beginning" by the British Deming Association. Alternately, it has been shown

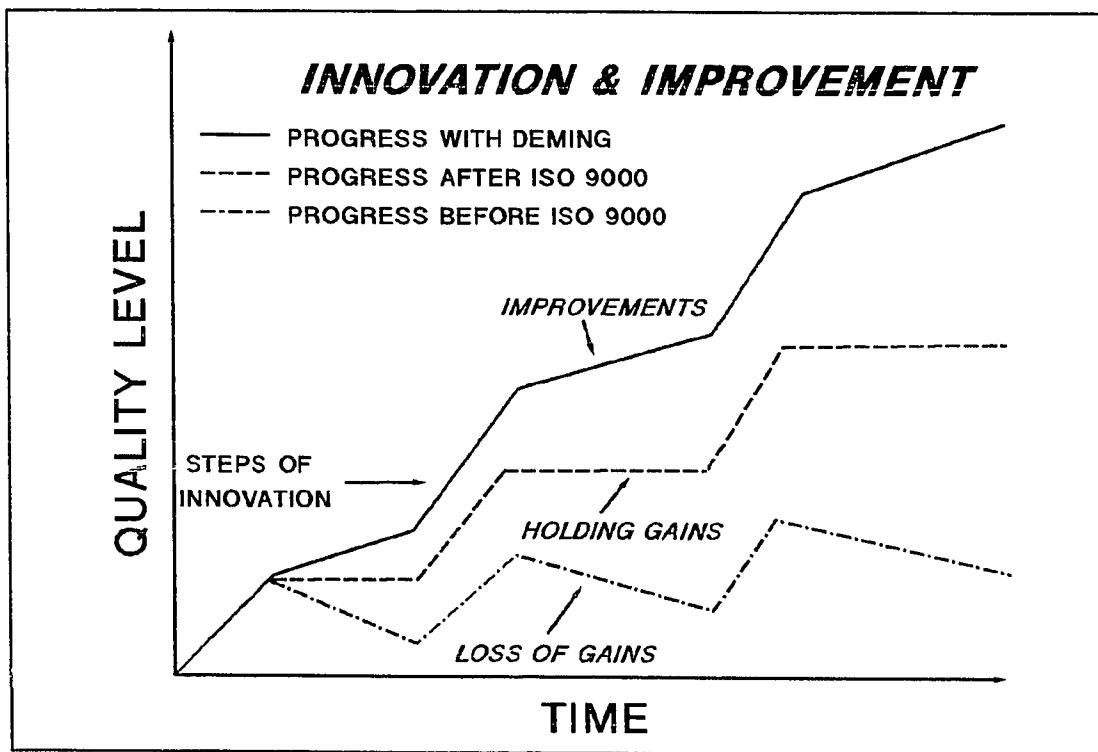


Figure 7. Holding the Gains

Source: BDA (1989), "BS 5750: The End or the Beginning?" p. 19 [adaptation].

that poor implementation of the standards can lead to an inflexible, rigid system that does not encourage continual improvement.

There seem to be few negative consequences from appropriate application of the standards, although they are judged by the research to be not comprehensive enough for a Deming compatible quality system.

Professor Kerridge says that registration to the standards may provide at the very least yet another distraction:

Time is always a problem, in the untransformed organization. Everyone is too busy fire-fighting, or 'having another reorganization.' The most recent addition to the list of reasons for not learning is 'too busy installing ISO 9000.' (Kerridge, 1992, p. 176)

Research Conclusions

This researcher concludes that the ISO 9000 standards do not provide sufficient guidance for a company that wishes to evolve to Total Quality Management. Furthermore, the standards fall far short of the management transformation described by Dr. Deming which far exceeds the intention and scope of the standards.

Compliance to the ISO 9000 standards is not incompatible with the teachings of Dr. Deming. Clear benefits accrue as a result of the disciplined effort to comply to each of the sections of the standard. These benefits derive primarily from a clear and easily described objective for the organization along with a summary of good practices. These practices are a

collection of tools that hold the gains of improvement that result from a complete and thorough review of all processes and procedures.

The difficulty with the standards occurs if registration and compliance are the only objective of management. Given the growing popularity of the standards, this is a likely possibility as registration to the ISO 9000 standards becomes a requirement to conduct business. The standards used alone without any other comprehensive quality system guidance will yield three key deficiencies which may result in business failure. The first is an inflexible system due to the emphasis in the standard on rigid documentation and control. The second is the lack of continual improvement especially if the competition is guided by such concepts and they benefit from improved productivity and lower costs. The third inadequacy is the lack of innovation which can lead to business loss as competitors provide new products and services that do not emerge from rigid adherence to the limiting principles of customer satisfaction and conformance to specifications.

The most significant variable in the success or failure of these standards is found in registrar consistency. If auditors are not consistent, and customers realize that a registration from one agency is not as meaningful as one from another, the credibility of the ISO 9000 standards will be undermined. If auditors do not adopt a new management philosophy similar to that taught by Deming, past experience would indicate that the

implementation of quality systems will gravitate to fixed, rigid, and legalistic frameworks in order to satisfy their needs. ISO 9000 will be a step backward for the philosophies of W. Edwards Deming if implementation and interpretation of the standards is done poorly by the registering bodies.

Opportunities for Further Study

This researcher suggests three areas for further study. The first is to study correlations between business success and ISO 9000 registration. The United Kingdom offers a good basis of several thousand registered companies and a history of the active use of quality system registration requirements by buyers. Several people interviewed expressed concern that there is no correlation between traditional management financial measures, such as market growth and profit, and the ability of a company to achieve and sustain ISO 9000 registration status.

The second area of opportunity for further study is of the auditor and registrar accreditation systems. Internationally recognized registrars have strict systems that evaluate their effectiveness. Auditor inconsistency can seriously impair the effectiveness of the standards. A study of this factor and what can be done to avoid a lessening of credibility of the standards would be valuable.

Perhaps the most intriguing possibility for further study is the nature of the ISO 9000 standards as a fad or passing subject of interest. The research

of Dr. Deming revealed that many of the quality system tools, such as statistical process control, have been used for many years and were successful in improving material production in World War II. Although the effectiveness of these tools was demonstrated by the war effort, they fell into wide disuse when the economic climate in the U.S. changed in the 1950s. It is possible the ISO 9000 standards could have a similar rise and fall in popularity.

Summary

The subject of this thesis is a factor that may have significant impact on the way business is conducted worldwide. Quality systems and techniques for quality control and assurance are not new subjects, but the high visibility enjoyed by the ISO 9000 quality systems registration standards is unprecedented. The 1987 introduction of the standards by the International Organization for Standardization may become a significant milestone in management history. It remains to be seen if the old habits of legalistic application of standards, a "tell me what to do" attitude on the part of registrants, and widely varying auditor sophistication will damage the credibility of these standards in the next few years. It is this researcher's opinion that the ISO 9000 standards will suffer many of these afflictions at first, but will ultimately survive as users of the standards become more aware of the philosophy behind them. It may take one or two more generations of

these standards to achieve this level of understanding, but the financial and productivity advantages of management quality techniques, along with an ever increasing expectation in the marketplace, are too strongly established to be cast easily aside.

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Appendix A
Interview Subjects

<u>Subject</u>	<u>Interview method</u>
Abell, Roy TRW Commercial Steering Division Director of Quality (Member U.S. Technical Advisory Group ISO TC/176) Lafayette, IN.	(Telephone)
Burr, Dr. John T. Assistant Professor Rochester Institute of Technology Center for Quality and Applied Statistics Rochester, NY.	(Correspondence)
Cowan, Will Hewlett-Packard Corporate ISO Program Manager Palo Alto, CA.	(In person)
Deming, Dr. W. Edwards Consultant Washington, DC.	(In person)
Durand, Ian Service Process Consulting, Inc. (Member, U.S. Technical Advisory Group ISO TC/176, strategic planning committee) Edison, NJ.	(Telephone, correspondence)
Hooper, Jeff AT&T Corporate Quality Office Quality Director (Vice Chair, U.S. Technical Advisory Group ISO TC/176) Holmdel, NJ.	(Correspondence)

Huttemann, Dr. Thomas J. (In person)
Eastman Kodak
Unit Director, Corporate Metrology
Rochester, NY.

Krynicky, Jean Claude (In person)
Hewlett-Packard
Quality Assurance Manager
Paris
France

Locke, John W. (In person, correspondence)
American Association for Laboratory Accreditation
President
Gaithersburg, MD.

Marquardt, Donald W. (Correspondence)
Donald W. Marquardt & Associates
(Chairman, U.S. Technical Advisory Group to ISO TC/176)
Wilmington, DE.

Neave, Dr. Henry (Telephone, correspondence)
British Deming Association
Director of Research
Nottingham
United Kingdom

Ollivier, Pierre (Telephone)
Hewlett-Packard
Customer Support Europe
Quality Assurance Manager
Eybens
France

Payne, Michael (Telephone)
Hewlett-Packard
Quality Manager
United Kingdom Customer Support
Bracknell
United Kingdom

Peach, Robert
Robert Peach & Associates
(Chairman of ISO 9004 writing committee)
La Grange Park, IL.

(Telephone, correspondence)

Randall, Richard C.
GE Electronic Services
National Quality Manager
Norcross, GA.

(In person)

Roberts, Paul
Wavetek Company
Quality Assurance Manager
Norwich
United Kingdom

(In person)

Appendix B

Interview Script

1. Introduce myself and describe purpose of thesis.
2. Are you familiar with ISO 9000?
In what capacity?
3. Are you familiar with the works of Deming?
If you know Deming personally, do you know what he thinks about ISO 9000?
4. Do you believe ISO 9000 and Deming's teachings are compatible?
Why or why not?
5. What are the positive aspects of ISO 9000?
6. What is missing in ISO 9000 that should be there?
7. Is ISO 9000 good for a company without a well established TQM program?
8. Does ISO 9000 present conflicts for a company practicing TQM by Deming's principles?
9. What role do you believe auditors and registrars will play?
Will there be consistency problems?