A Critical Examination of the Ability of ISO 9000 Certification to Lead to a Competitive Advantage

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The ISO 9000 series of standards has formalized systems for evaluating the ability of any firm to consistently design, produce, and deliver quality products and services. Despite its widespread international acceptance, ISO 9000 is surrounded by controversy and criticism. The literature is clearly divided in its assessment of ISO 9000, which is viewed as either a variant of Total Quality Management (TQM) or a paper-driven process of limited value. The primary objective of this article is to address the competing views of the standard in an attempt to show that ISO 9000 certification can be leveraged into a competitive advantage.

The importance of managing quality requires that it not be dealt with on an ad-hoc basis. Only a properly implemented management system can provide protection from short-term actions which do not serve long-term goals. Daily details can impede an organization's long-term quality goals unless some formal quality management system clearly sets the requirements as a standard for daily activities. Such a systematic approach to quality management is at the heart of formal assessment processes such as ISO 9000 (Melnyk & Denzler, 1996). The ISO 9000 series of standards has formalized systems for evaluating the ability of any firm to consistently design, produce, and deliver quality products and services. Certificates issued worldwide are estimated at more than 95,000, and there are now companies in over 95 countries that have endorsed the ISO 9000 standards (Zuckerman, 1994a). By the end of 1995, there were over 8,100 registered sites in the U.S. alone. In a 1993 survey conducted for the National Association of Manufacturers, more than half of

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medium-to-large-sized U.S. firms expressed a serious interest in pursuing certification (Swamidass, 1995). ISO 9000 is rapidly becoming the nationally and internationally accepted quality standard.

The experience of an automotive electronics manufacturer in the Midwestern portion of the United States provides an example of the importance of ISO 9000. This manufacturer opened sales offices in France during the early 1990s to begin selling its products in Western Europe in order to become less dependent on one primary customer in the North American automotive marketplace. During their first year in Western Europe, they were unable to obtain serious consideration for future business. The European staff diagnosed the problem as one of name recognition among the automotive manufacturers in Western Europe. The company then purchased two companies in France which manufactured vehicle security alarm systems. The acquisition did improve the company's name recognition; however, they were still unable to obtain any new business. After almost 2 years in Western Europe, the company finally realized that they were not being considered for future business because their manufacturing facilities were not ISO 9000-certified, while their competitors' European facilities were. In Western Europe, ISO 9000 certification was an order qualifier. It was not until they achieved ISO 9000 certification that they finally started to obtain orders in Western Europe.

Despite its widespread international acceptance, ISO 9000 is surrounded by controversy and criticism. A widespread criticism of the ISO 9000 program is that it is not connected directly enough to product quality (Stavros, 1997). For example, a certified company can still have substandard processes and products because certification does not tell a company how to design more efficient and reliable products. Nor does certification require that firms demonstrate that their customers are satisfied. Additionally, a focus on documentation has, in itself, forced some managers to view ISO 9000 as nothing more than another paper-driven process for bureaucrats to approve. Therefore, ISO 9000 should not be viewed as a variant of Total Quality Management (TQM) or any other complete quality system. ISO 9000 only ensures that a quality system exists, and cannot guarantee its functionality (Curkovic & Handfield, 1996).

The primary objective of this article is to explore the implications of ISO 9000 for quality management. Developing a more accurate and realistic understanding of the implications of ISO 9000 certification will help alleviate some of the potential disappointments in the outcomes often associated with ISO 9000. The literature is clearly divided in its assessment of ISO 9000, which is viewed as either a variant of TQM or a paper-driven process of limited value. An examination of this international quality standard was inspired by recent visits to a number of manufacturing facilities. It was discovered that not only do many managers embrace the ISO 9000 criteria, they view it as a key to their present survival and future success. These managers insist that ISO 9000 is worth chasing, not only because their customers are demanding it, but also because ISO 9000 improves efficiency. Examples from these field visits will be used to critically challenge the criticisms commonly associated with ISO 9000.

The article is organized as follows. First is a review of the literature which has

examined the standard critically. Second, we address the criticisms associated with ISO 9000 using examples from managerial experiences. The research concludes with an evaluation of ISO 9000 which will help academics and practitioners become more accurately informed of its benefits and limitations.

WHAT IS ISO 9000?

The ISO 9000 series of quality standards was developed by the International Organization of Standards (ISO) in 1987, and has since become the international quality standard (Watson, 1992). This standard identifies the basic attributes of a firm's quality management system and specifies practical procedures and approaches to ensure that products and services are produced in accordance with the standards specified by the firm.

The ISO 9000 series is actually made up of five separate standards: (1) ISO 9000; (2) ISO 9001; (3) ISO 9002; (4) ISO 9003; and (5) ISO 9004. ISO 9001, 9002, and 9003 are conformance standards for quality assurance systems and relate to supplier–customer relationships. ISO 9000 and 9004 are guidelines and relate to the development of quality systems within the company. ISO 9001 is the most comprehensive and applies to facilities that design, develop, produce, install, and service their own products. ISO 9002 applies to firms that provide goods or services consistent with the specifications furnished by the customer. ISO 9003 applies to final inspection and test procedures only.

Firms pursuing ISO 9000 certification must follow a series of steps which, in turn, affects an organization's management of processes which hopefully impact quality. Unlike many industry standards, the ultimate objective of ISO 9000 is to raise the awareness and performance of quality throughout the value chain, and not only in operations (Zuckerman, 1994b). First, a firm determines which standards in the series are applicable to its situation. Next, a company-specific quality manual is developed, which provides a specific set of policies related to the implementation of quality standards. Finally, a full assessment follows, executed by an independent on-site team that verifies whether: (1) there is a procedure in place to measure quality; (2) there is a review process to monitor quality; and (3) there are qualified staff to carry out these policies. Table 1 explains what auditors will look for.

The ISO 9000 process directs managers to reexamine all their business processes which can impact quality, and identify any discrepancies between what employees are actually doing and what the documentation states should be done. For example, during the registration process, an organization must prove that it is following its own procedures for inspecting production processes, updating engineering drawings, maintaining machinery, calibrating equipment, purchasing material, training workers, and handling customer complaints (Eastman, 1995). In cases when a discrepancy exists, there are three possible actions: (1) retrain appropriate employees with respect to their process activities; (2) change the documentation to reflect what employees are actually doing; and (3) reengineer the entire process, retrain the employees, and change the documentation. The ISO 9000 standards focus on 20 specific aspects of a quality program, listed in Table 2. A company will fail the audit if any of these 20 subsystems is not present and functional.

Table 1. What Will the ISO Auditors Look For?

- Untagged scrap
- Tagged scrap not segregated from good parts
- Unidentified parts and materials
- Materials, supplies, and parts in unauthorized areas
- Damaged shipping containers
- Parts out of normal production process flow
- Poor housekeeping (dirt, dust, trash, etc.)
- Work and inspection instructions
- Adherence to procedures and instructions
- Condition of tools and equipment
- Use of processed tools and parts
- Unidentified gauges
- Calibration procedures and records
- Training records
- Preventative maintenance records
- Inspection and test records
- Surveillance records
- Correction and prevention of customer complaints
- Obsolete documents

Source: Ford Motor Company (1995).

CRITICISMS OF ISO 9000

The literature identifies several critical areas of a quality management system which are not included in the ISO 9000 requirements. The main criticisms center on a limited focus on continuous improvement and customer satisfaction, the cost of certifi-

Table 2. The 20 Aspects Covered in Section 4 of ISO 9000

1. Management responsibility
2. Quality system
3. Contract review
4. Design control
5. Document control
6. Purchasing
7. Purchasing of supplied product
8. Product identification and traceability
9. Process control
10. Inspection and testing
11. Inspection, measuring, and test equipment
12. Inspection and test status
13. Control of non-conforming products
14. Corrective actions
15. Handling, storage, packaging, and delivery
16. Quality records
17. Internal quality audits
18. Training
19. Servicing
20. Statistical techniques

Source: Breen, Jud, & Pareja (1993).

cation, the ability of a certified company to produce low quality output and the amount of seemingly unnecessary documentation.

Thousands of organizations in the U.S. have embraced TQM, ISO 9000, and numerous other initiatives in a massive effort to improve customer satisfaction (Sakofsky, 1996). However, U.S. firms are under the misconception that ISO 9000 registration is the foundation for a TQM program. Studies which have critically examined ISO 9000 determined that the criteria are really a subset of the requirements for full implementation of a TQM program (Bredrup, 1995; Curkovic & Handfield, 1996; Hoyle, 1994; Reimann & Hertz, 1994; Terziovski, Samson, & Dow, 1997). Therefore, the motivation and drive to improve competitiveness can be severely undermined if conformity efforts are not integrated within a broader, all encompassing quality management framework such as TQM. Thus, ISO 9000 is only a critical first step in implementing a TQM system. Table 3 summarizes the items which ISO 9000 makes no provisions for.

The senior standards policy group for the European Commission (EC) has also expressed concerns regarding the relative effectiveness of ISO 9000 as a tool to drive quality management (Zuckerman, 1994c). Moreover, members of the ISO standards committee have agreed with users that the ISO 9000 series is not connected directly enough to product standards. It is possible to have an ISO 9000 system and still manufacture poor-quality products. ISO 9000 requirements are such that a mass-inspection-oriented organization could easily become registered (Finlay, 1992). A certified company could have a very high percentage of defects; however, if non-conforming products were segregated and handled in accordance with documented corrective action procedures, the company could still be registered (Smith, 1993).

The costs and implementation issues, such as time and lack of regulation, have also been criticisms of ISO 9000 (Vloeberghs & Bellens, 1996). Even ardent supporters of ISO 9000 have accused the standards of being too costly and time consuming. A company can spend up to 18 months, and 7 man years, getting a single site ready for an audit (Henkoff, 1993). Registrars can then be on-site for up to 1 week, randomly testing salaried and hourly personnel. The cost of an audit for a

Table 3. Items Not Covered by ISO 9000

- Competitive comparisons and benchmarks
- Analysis and uses of company-level data
- Strategic quality and company performance planning process
- Quality and performance plans
- Employee involvement
- Employee well-being and morale
- Product and service quality results
- Company operational results
- Business process and support service results
- Customer relationship management
- Commitment to customers
- Customer Satisfaction Determination, Results, And Comparison
- Continuous improvement

Source: Curkovic and Handfield (1996).

small company is approximately US$50,000. This does not even include training costs, which may range as high as US$100,000–200,000 for a medium-sized facility (Curkovic & Handfield, 1996). In a study by Deloitte Touche (1993), the expense to prepare a medium-sized plant for certification was as low as US$50,000, and as high as US$1,000,000. The time also varied from 6 months to 2 years. And then the process does not even end if the certificate is issued. The process is repeated every 3 years, with less comprehensive audits occurring every 6 months to a year (Uzumeri, 1997).

Handfield and Ghosh (1994) observed firsthand the effects of ISO 9000 implementation at several organizations which are consistent with the criticisms in the literature. For example, a computer manufacturer described how the biggest cost associated with implementation was training. All 200 workers in the plant had to explicitly understand their process of documentation. When the auditing team arrived at the facility, it first spent 2 full days reviewing the documentation. The team then proceeded to interview employees at random, and followed the trail of a random customer through all of the processes; order entry, design, material purchasing, manufacture, assembly, inspection, and so on. This was done to determine whether the quality system documentation actually reflected employees' actions in practice. In the first audit, at least three discrepancies were found, and the audit team "failed" the facility which had to wait another 6 months before attempting another audit.

ISO 9000 has been criticized for its failure to assess the extent to which a company's planning processes and quality requirements are integrated into the firm's overall business planning. This criterion is particularly important for companies evaluating a supplier for a potential long-term partnering relationship (Stuart & Mueller, 1994). Furthermore, no set of ISO 9000 criteria is developed around the appropriateness of quality investments (e.g., their timing, degree of activity, level of investment, etc.) based on the total needs and strategic position of the company.

ISO 9000 fails to address a company's approach to selecting data and information for competitive comparisons and world-class benchmarks to support quality and performance planning and evaluation. Perhaps more importantly, ISO 9000 does not make any explicitly recognizable provisions for continuous improvement. Companies do not even have to include performance goals in regards to quality, cycle time, inventory, or delivery.

ISO 9000 does not argue strongly for customer-driven organizations. It does not recognize that firms will not be able to survive the global market if they cannot routinely guarantee their customers that the product or service provided is exactly as promised. ISO 9000 makes no provisions for how the company uses information gained from customers to improve customer relationship, management strategies and practices.

However, it is customers who have made ISO 9000 certification the world standard it is. The main reason that companies get ISO 9000-certified is because their customers are demanding it (Terziovski et al., 1997). According to Uzumeri (1997), "earning a certificate is attractive because it promises to be a cost-effective way to stay on a stakeholder's good graces or gain a place on a customer's bid list." ISO 9000 certification is often a minimal standard for a company to be certified as a sup-

plier to major industrial customers. In a study by the Science and Engineering Policy Studies Unit (1994) in the UK, customer pressure was the major reason for pursuing ISO 9000 certification. Even Motorola, one of the first major companies to win the Baldrige Award, is pursuing ISO 9000 registration for many of its plants around the world in response to customer demands (Henkoff, 1993). Many small and mid-sized companies in Europe are complaining that the ISO 9000 system of third-party assessment places the cost squarely on them and they would not even pursue ISO 9000 certification without pressure from industrial customers (Zuckerman, 1994c). Despite a governmental source of the ISO standards, ISO 9000 compliance is completely voluntary. The pressure to attain ISO 9000 certification is driven by customers and is not government-mandated (Karon, 1996).

For U.S. multinational firms that wish to compete internationally, ISO 9000 certification is the only recognized international quality standard. Even the Baldrige Award will not carry much weight in overseas markets because it is a U.S. quality award with limited recognition from overseas customers (Hockman, 1992). Furthermore, industries in the U.S. are standardizing their supplier quality certification programs based on the ISO 9000 criteria. As a global and generic guide for quality, ISO 9000 has spread across all industry sectors and sizes of companies (Ridley, 1997).

Many regard the adoption of QS 9000 and ARD 9000, which are derivations of ISO 9000, by the automotive and aerospace industries, respectively, as an affirmation of the principles behind the ISO 9000 quality standards. Seeing the European standards accepted and used by such large and influential manufacturers and suppliers has encouraged others to adopt and adapt the ISO 9000 standards for their purposes (Avery, 1995). For example, a quality certification program is currently being developed for tooling and equipment manufacturers called TE 9000 which is also derived from ISO 9000.

American software companies are currently preparing for the Japanese software specifications called JIS Z9901 which are based on ISO 9000 (Zuckerman, 1995). If JIS Z9901 is implemented, software companies with business in Europe and suppliers to major U.S. auto companies will have to meet these criteria to do business in Europe, Japan, and the U.S. automotive industry. Even NASA now requires its suppliers to be ISO 9000-certified, as does the Department of Defense (Karon, 1996). The National Science Foundation has developed a specialized quality program for the food and beverage industries which are also based on the quality management system requirements of ISO 9000 (Kerr, 1996).

The question then has to be raised: "If companies are not happy with the outcomes associated with ISO certification, then why do their customers require it?" The next section tries to address this question by illustrating the potential for ISO 9000 certification to lead to lasting improvements in a firm's competitive stance.

ISO 9000 as a Means of Achieving a Competitive Advantage

ISO 9000 has been widely criticized. However, in the course of interviewing managers and touring manufacturing facilities for a number of recent research projects, the authors have been repeatedly struck by the number of firms who embrace ISO 9000. Many times we were told that a new measurement system,

maintenance program, or significant improvement in quality was directly or indirectly due to becoming ISO-certified. What follows is an attempt to re-conceptualize ISO 9000 as a program that can lead to competitive advantage. We used our observations to help develop a structured interview protocol that addressed many of the issues raised in the literature.

METHODOLOGY

The purpose of this study was to identify why companies seem to embrace ISO 9000 even though the standards have been the subject of great debate and criticism. Since the focus of this research was exploratory in nature (rather than confirmatory), qualitative data collection methods were used. Field-based data collection methods were used to ensure that the important variables were identified. It also helped us develop an understanding of why these variables might be important (Eisenhardt, 1989). A small detailed sample fit the needs of the research more than a large-scale survey would have.

The method followed was similar to the grounded theory development methodology suggested by Glasser and Strauss (1967). In addition, suggestions made by Eisenhardt (1989), Miles and Huberman (1994), and Yin (1994) were also incorporated. The end result was a series of case studies in which each case was treated as a replication.

Sample Selection

Cook and Campbell (1979) suggested that random samples of the same population be used in theory testing research. However, the sample selected for qualitative research, such as in this study, should be purposeful and based on theoretical underpinnings (Eisenhardt, 1989; Miles & Huberman, 1994). The goal of this study was to identify variables that explain the popularity of ISO 9000 across manufacturing settings. Furthermore, the research set out to address a variety of ISO 9000 outcomes, as well as why some companies did not adopt the standard. In addition, other issues important to manufacturing strategy were addressed which would not have been served by limiting the sample solely to successful adopters of ISO 9000. Therefore, the sample included industries such as transportation equipment which the literature suggested would have a high, but not universal, rate of ISO 9000 adoption.

Interview Protocol

Eisenhardt (1989) suggested that a researcher should have a well-developed interview protocol before making the site visits. A structured interview protocol was used at all of the plants. The protocol covered a number of topics relating to technology adoption, manufacturing performance, performance measurement, and human resource support of manufacturing and quality management. The key area of interest for this research was ISO 9000 adoption as well as other quality certifications. Table 4 details the items in the protocol specifically pertaining to ISO 9000 certifi-

Table 4. Interview Protocol Questions Directly Pertaining to ISO 9000

- Is your plant ISO 9000-certified?
- Why are you (not) certified?
- If not certified, are you considering certification?
- What is your overall impression of ISO 9000?
- Has ISO 9000 improved the overall competitive stance of your plant?
- Specifically, how has ISO 9000 influenced the quality of your products?
- How has ISO 9000 influenced your ability to provide the level and types of service required by your customers?
- Please detail the types of documentation performed to be certified. Were these activities valuable?
- Please describe the types of continuous improvement activities performed at the plant. Has certification helped/hindered or not affected these efforts?
- Do you feel you have received a good return on this investment?

Note: Managers were asked to explain all of their answers.

cation. These items were primarily derived from the criticisms of ISO 9000 in the literature. In addition, we further developed the protocol based on our observations from previous research studies which included ISO 9000-certified companies which were satisfied with the outcomes. This constant updating of the protocol after each visit is a foundation of grounded theory development (Glasser & Strauss, 1967).

All respondents were asked if they were ISO 9000-certified. In addition, their reasons for certification (or for not being certified) were solicited. Of the 30 companies, 17 were certified, while 10 of the remaining 13 were considering certification. Finally, we discussed the outcomes of certification with those firms which were certified. This research is built primarily on the responses of the 17 firms that were certified. However, the comments and concerns of the non-certified firms were also used to help explain why firms may be reluctant to adopt the quality standard.

Qualitative theory building research is an iterative process (Eisenhardt, 1989; Miles & Huberman, 1994; Yin, 1994). Eisenhardt (1989) suggested that data collection and data analysis should be done simultaneously. In other words, the data from one case is collected and then analyzed before the next replication is performed. Improvements in the protocol can be made between replications by collecting data in this manner. Important issues that are raised in early cases can be included in the protocol for subsequent replications. This ability to refine and improve upon the protocol between cases is a significant advantage of this type of research. For the sake of clear explanation, the data collection and analysis are described separately in the following sections. However, the actual process was one where a case was collected, analyzed, the protocol was improved upon, and then the next case was collected.

Data Collection

The primary data collection was done using structured interviews in a field setting. Thirty plants in eight industries were visited over a 6-month period. In the sample of 30 installations (one installation per site), 22 different companies were represented. The plants were located in four mid-western states: (1) Michigan;

(2) Ohio; (3) Indiana; and (4) Illinois. All but two of the industries had multiple representatives.

Structured interviews at each plant generally took place with the plant manager as well as the personnel manager. At most plants, additional interviews also took place with company presidents or vice presidents, manufacturing engineers, quality engineers, CNC programming staff, purchasing managers, designers, and maintenance employees. At four of the smaller plants, interviews were limited to the plant manager or presidents.

Data were collected following a strict interview protocol that included a tour of the plant. The primary researcher was accompanied on 27 of the 30 visits by a second researcher who reviewed all field notes prior to final coding. The use of multiple respondents and multiple interviewers at almost every plant helped limit possible biases introduced by a single respondent and researcher. The field notes identified responses to all of the protocol questions, answers to other questions that were raised during the interview and plant tour, and other information such as company publications.

Data Analysis

The two main components of data analysis included within- and across-case analysis. Within-case analysis helped us examine ISO 9000 in a single context, while the across-case analysis served as a form of replication (Yin, 1994) where the constructs of interest in one setting were tested in other settings. One concern was controlling for the affects of the researchers' a priori beliefs as to the reasons why ISO 9000 was embraced. This was accomplished a variety of ways. First, the primary researcher wrote the field notes prior to coding. The secondary researcher, who also went to the plant, reviewed these notes. By using a variety of secondary researchers (five in total), none of whom knew the purpose of the research, a second unbiased person reviewed the notes. Any discrepancies between the primary researcher and the secondary researcher were clarified through follow-up contact with the respondent.

The second step taken was intended to mitigate against confirmation bias. That is, the amount of within-case analysis performed before the cross-case analysis was limited. Miles and Huberman (1994) note that the acts of coding and data reduction are actually forms of data analysis. In other words, the act of coding could lead to confirmation bias problems in future cases. Therefore, coding for within-case analysis was limited to categorizing the individual case on previously identified constructs and identifying interesting new issues to pursue at future sites. We were more open to alternative explanations raised in future replications by avoiding comparisons and model building early in the research.

The between-case analysis consisted of looking for patterns of firms' experiences with ISO 9000 across the various organizations. Between-case analysis is facilitated by using a variety of tools to reduce the amount of data and to display the data in a meaningful fashion (Miles & Huberman, 1994; Yin, 1994). Data reduction was done primarily through categorization. Categories were developed in two ways. First, a number of categories were formed based on the literature (i.e., costs of certi-

fication, lack of focus on continuous improvement). Then, concepts that interviewees identified as being related to ISO 9000 usefulness were compiled (i.e., focus on measurement). Through a process of combination, renaming, and redefining, the data was reduced to three main concepts that were most frequently noted as reasons for embracing ISO 9000.

RESULTS

The categorization process created three main concepts which were identified as: (1) ISO 9000 as a paper-driven process; (2) continuous improvement; and (3) cost. In other words, the vast majority of the issues raised and explanations offered for why companies were embracing ISO 9000 fit into one of these three categories. In addition, these categories encompass some of the major criticisms of ISO 9000. The following sections illustrate how companies turned what many perceived as shortcomings of ISO 9000 into a compelling picture of why ISO 9000 certification is so popular.

ISO as a Paper-Driven Process

One of the chief criticisms of ISO 9000 is the amount of paperwork involved. Not only do critics perceive the paperwork as excessive, they view much of it as unnecessary. The certification process forces companies to establish clear designations and the workings of their entire system has to be documented. Documents that they prepared included: (1) manuals which specified who was responsible for quality and how that quality would be achieved; (2) a manual that explained who would carry out quality procedures, what these procedures were, and when they were to be carried out; (3) job instructions that explained how quality assurance programs were to be performed; and (4) records that proved the system was working. Companies are forced to lay out a disciplined step-by-step approach to planning the quality of a product. For example, in developing products, companies have to conduct feasibility reviews, a process failure mode and effects analysis, and draft control plans which were all directly tied into the quality of their products.

Prior to ISO 9000 certification, procedures and lines of responsibility at many of the companies were informally established and explained to employees. The documentation process forced these companies to formally establish procedures, and to train all employees in them. The mere act of documentation has enabled companies to uncover problems in processes and to improve their competitiveness.

For example, a design engineer at an automotive supplier started his job prior to certification and realized 2 months into his job that he was working from engineering drawings which were outdated. The designs had been changed over a dozen times, but the original drawings were not updated because the supplier did not formally track and document changes. This delayed the customer's program and the supplier was not given consideration for future business because of the delay. The design engineer acknowledged that the certification process has prevented this from occurring again because everyone involved in the new product development process now

formally tracks and documents design changes as they occur. This has: (1) reduced new product development times; (2) reduced costs; and (3) most importantly, helped satisfy customers.

Another company which manufactured high-end quality office furniture for Fortune 500 companies was using a very informal and unstructured new product development process prior to ISO 9000 certification. The company felt that a regimented process would impede the creative contributions made by outside designers. However, when their customers demanded ISO 9000 certification (even for office furniture), the company was required to formalize their processes, to the disgruntlement of their artists. By formalizing the new product development process via documentation, the company has reduced the number of engineering changes made during the design process and has almost eliminated them once the product gets into production. This has reduced: (1) new product development times; (2) production start-up problems; and (3) costs.

Finally, many companies have used the documentation as a way of codifying knowledge. The formalized processes for engineering changes, process changes, maintenance and the like may seem like a burden. But for many companies, documentation provides a way to formally record lessons learned. Preventive maintenance manuals can be expanded to contain not just what repairs were made, but the symptoms that were used to diagnosis the problem, and any failed fixes. In other words, these lessons can be applied to future problems to reduce the amount of time the machine is down.

Continuous Improvement

ISO 9000 has been criticized because it does nothing to guarantee continuous improvement, which is the underpinning of TQM. However, there are many elements of ISO 9000 that can be used for continuous improvement. Companies are required to identify key process equipment and provide the appropriate resources for machine/equipment maintenance and develop an effective planned total preventive maintenance system. At a minimum, the system is required to include: (1) a procedure that described planned maintenance activities; (2) scheduled maintenance activities; and (3) predictive maintenance methods such as monitoring of uptime, correlation of SPC data to preventive maintenance activities, important characteristics of perishable tooling, etc.

Once again, some would criticize this as overly bureaucratic and paperwork driven. However, the formalized processes called to attention the need and opportunity for improvement projects such as: (1) unscheduled machine downtime; (2) machine set-up, die change, and machine changeover times; (3) excessive cycle time; (4) scrap, rework, and repair; (5) excessive use of floor space; and (6) excessive variation. All of these projects present opportunities to improve quality, time, cost, and even flexibility.

Registration forces companies to develop a set of appropriate measures and methodologies which many were not using and tracking previously. These included: (1) capability indices; (2) control charts; (3) cumulative sum charting; (4) design of experiments; (5) process flow analysis; (6) theory of constraints; (7) overall equipment effectiveness; (8) cost of quality; (9) parts per million analysis; (10) value

management; (11) problem-solving; and (12) competitive comparisons and benchmarks. Using these measures and methodologies can help create opportunities for improvement across many competitive dimensions, in addition to being a source for continuous improvement.

Without these measurement programs, improvement is haphazard, if it ever even occurs. Almost every manger mentioned the focus on measurement as one of the best features of certification. In one plant, they used the new measurement systems to track the incoming quality from their suppliers. It quickly became evident that of their 20 plus suppliers, only five or six were able to consistently meet due dates and quality targets. The company used this information as the basis of a supplier certification program (based on ISO 9000) which has helped them meet 99% of their delivery targets with no rejects, a significant improvement over their pre-certification numbers.

The companies expressed that the internal audits required by ISO 9000 ensured that their quality systems were performing as planned. They were continuously improving their procedures because the audits forced them to justify changes, and to be sure that they, at worst, remain where they were before. The internal audits ensured that they were doing what was documented. These internal audits were not surprise visits. Each activity audited received written notification of the time and scope of the internal audit. Internal audit frequencies depended on the activity being audited with some more frequently audited than others. The internal audits were identified as being an aspect of ISO 9000 which most companies were not formally or informally employing prior to registration. The internal audits have allowed them to continuously improve on their procedures.

Audits also meant that once or twice per year, an outside party looked at all of the company's procedures. There were usually two to three auditors on site for up to as many as 7 working days. Following an opening meeting, the auditors would review the quality manual and all referenced documents to verify that the quality system satisfied their standards. The audits provided objective feedback for opportunities to further improve procedures.

Another source for continuous improvement has been the focus of the certification process on training and skills assessment. Each company is required to establish and maintain documented procedures for identifying training needs and providing for the training of all personnel performing activities affecting quality. Personnel performing specific assigned tasks have to be qualified on the basis of appropriate education, training, and/or experience, as required. Appropriate records of training also have to be maintained.

Cost

The costs of getting and maintaining certification are also major issues for many companies. The certification process takes up valuable resources and, according to some critics has little pay-off. We will address two costs issues: (1) the actual costs of certification; and (2) the potential payoff.

For many companies, being ISO 9000-certified is actually a way to save money, even if they receive no quality benefits. The Big 3 automakers (General

Motors, Ford, and Chrysler) have scrapped their own quality certification programs in favor of a new joint standard called QS 9000 which is derived from ISO 9000. QS 9000 originally was not designed to apply to a broad range of suppliers; however, the document has already influenced quality assurance practices throughout the supply chain within and between industries. In addition to the Big 3, the heavy truck manufacturers such as Freightliner, Mack, Navistar, Paccar, and Volvo have imposed the QS 9000 standard on their first tier suppliers (Eastman, 1995). QS 9000 also inspired the aerospace industry to create its own ISO 9000-based quality standard called ARD 9000. Companies who are ISO-certified (or QS-certified) can do business with a large number of customers.

Companies without certification face two equally unpleasant circumstances. First is the possibility detailed in the beginning of the paper, the inability to get work. The second possibility is that the companies will have to get certified by each of their customers, individually. Rather than having a single certification that is recognized worldwide, they will need to go through each customer's unique program. These individual certification programs may be less expensive than ISO 9000 but over time, the cumulative costs could be much higher. In the end, the costs of not being certified will, especially for companies with international aspirations, be greater than the cost of being certified.

The other cost issue is the pay-off from ISO. Many of the small and mid-sized firms visited remember complaining that the ISO 9000 system of third-party assessment placed costs squarely on them. They pointed out that the vagueness left them prey to registrars and consultants who often charged exuberant fees to interpret the standards. Although the registration costs at all of the companies remained confidential to the interviewers, all of the companies estimated that they received a return on their investment within 1–2 years. This return occurred because the companies were making continuous improvements and able to win new business.

DISCUSSION

ISO 9000 does not have to be a paper-driven process that does not guarantee outcomes. We have found that companies who are willing to invest the time and energy into doing the process right can and do gain significant benefits. However, those companies which see certification as merely a game to get, or keep business, will not reap additional benefits.

ISO is not a complete TQM program, but it does contain important foundations for continuous improvement. Certified firms are forced to examine all of their processes. And while it is possible to document a poor process and get certified, many proactive firms have used the documentation stage as a tool to unearth and solve problems.

In addition, ISO 9000 forces firms to measure many things they may not have measured in the past. These measures are useful in both finding and solving problems. Without a proper measurement system, it is difficult to determine what is occurring and more importantly, how or if changes have effected performance.

Finally, ISO 9000 requires the training of all personnel in quality. At some firms, this training is perfunctory and has little impact on outcomes. However, firms

which use this time to train their employees in tools to assess quality and then make improvements will have increased the value of one of their most important resources.

Many of the criticisms of ISO 9000 seem valid on the surface. However, what we have observed is that companies who take advantage of the system will reap significant rewards. However, those who view certification as a nuisance will be missing out on an opportunity to improve their competitive stance.

CONCLUDING COMMENTS

Customer demands have and will continue to drive the acceptance of ISO 9000 and adaptations of it. Although many U.S. industries have not indicated that they will require their suppliers to become certified, many suppliers are seeking certification because they believe it will happen. It has already happened in the U.S. automotive, aerospace, and tooling industries. If well implemented, ISO 9000 can result in greater efficiencies, cost reductions, and improved productivity. Clearly, the extent of the improvements and the amount of savings depend on several factors independent of ISO 9000, including type of business, the size and complexity of the operation, and the nature of its quality management system prior to certification.

The ISO 9000 certification process forced companies to examine all areas to determine potential quality impacts and set improvement objectives. As companies explored territories which went beyond manufacturing, opportunities to improve quality and cut costs frequently turned up. As goals were set in areas outside the traditional manufacturing/quality arena, there was a reexamination of accepted norms and practices resulting in unanticipated business benefits.

ISO 9000 is a trend in quality management which cannot be ignored. In fact, for those companies which wish to remain competitive, and improve their quality systems, it can be an invaluable tool. Many managers warned that ISO 9000 registration can result in non-value-added costs if it is pursued only for its marketing appeal. The true commercial value associated with ISO 9000 can only be achieved when it is made consistent with a company's strategic direction. This means using the ISO 9000 standards as a foundation for a much broader system such as TQM. The experiences of these companies can serve as an illustration for organizations contemplating pursuing ISO registration. Through its standardization of quality systems, ISO 9000 can help an organization not only improve quality (and thus customer satisfaction), but also gain a competitive advantage in the international marketplace.

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