1995

Perceived importance of ISO 9000 factors as indicators of quality in industrial technology related programs at four-year state regional universities

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PERCEIVED IMPORTANCE OF ISO 9000 FACTORS AS INDICATORS OF QUALITY IN INDUSTRIAL TECHNOLOGY RELATED PROGRAMS AT FOUR-YEAR STATE REGIONAL UNIVERSITIES

A Dissertation Submitted
In Partial Fulfillment of the Requirements for the Degree of Doctor of Industrial Technology

Approved:

Dr. Mohammed F. Fahmy, Advisor
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Dr. Shahram Varzavand, Member
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Floyd L. Olson
University of Northern Iowa
May 1995
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Abstract

Industry has often used a quality standard known as ISO 9000. No evidence has been located demonstrating the applicability of an industrial quality model to a singular academic department. The problem of this study was to determine if the guidelines for ISO 9004-2 could have been considered appropriate for Industrial Technology related programs and how they could have been used to indicate quality within such programs.

The purpose of this study was to seek knowledge relating the importance of ISO 9004-2 guidelines to audit and/or improve the quality management of Industrial Technology related departments at 4-year state regional universities. This information was sought by surveying the opinions of deans, chairs and faculties of Industrial Technology related programs at 4-year post-secondary institutions.

Limited response questions were asked to assist in determining the appropriateness of ISO 9004-2 guidelines to departments. Open questions were asked of participants to determine whether departments currently had systems in place to meet ISO 9004-2 guidelines, and if so, to determine what systems were in place.

Responses to the first 14 factors reflected strong agreement regarding the appropriateness of those factors to the management of their Industrial Technology Departments. However, the 15th factor identified by the researcher (the use of a statistical method to predict student success) rated well below the norm, and thus has been considered inappropriate for use in the management of Industrial Technology Departments.
Respondents also indicated reasons why they felt a factor was or was not important to the management of their department. These reactions have been listed as clearly as possible for the reader's review. Based on the results of the survey, about 34% of the respondents have in use the top rated 14 factors of ISO 9004-2, while about 28% of the respondents were developing these quality management systems, and approximately 32% noted a need for the factors but did not have them in place yet. About 6% of the respondents felt no need for the guidelines of ISO 9004-2 in the management of their Industrial Technology Departments.
ACKNOWLEDGEMENTS

It is important to me to thank my wife Sally for her continued encouragement and assistance, along with the nudging of my children Kristen, Gretchen, and Erica. I would also like to thank my friends Teresa Hall and Greg Saueressig for their help and confidence in my abilities. I gratefully acknowledge the assistance of my committee members, especially the chair of my committee, Dr. M. Fahmy.
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CHAPTER 1
THE RESEARCH PROBLEM

Quality has become of primary importance to 4-year post-secondary educational institutions, much as it has been the focus in the industrial environment of the world's economies. In the educational setting, this concern for quality has often focused on placement, curriculum, laboratories, faculty qualifications, and research capabilities.

In 1987, the International Organization for Standardization issued an official document known as ISO 9000, a comprehensive treatise designed to substantiate quality management programs in companies and organizations within the industrial sector (Lamprecht, 1992; Rothery, 1991). In 1992, this same organization issued the latest in a series of updates to the standard known as ISO 9004-2 guidelines, which focused on quality in the service sector. A constituent of the service sector to which the updated standard has been considered appropriate to apply quality management was education (International Organization for Standardization, 1992; Rothery, 1991). The concept of applying ISO 9004-2 guidelines to the education setting may be a logical step for higher education, particularly Industrial Technology programs where prior understanding of the importance of ISO 9000 to industry has been integrated into the curriculum.

The International Organization of Standardization established ISO 9000 as a global set of standards to assure a minimal system of quality management in industrial
companies (Inglesby, 1992; Ingman, 1991e; Lofgren, 1991; Mullin, 1992b; Soslow, 1992). This set of standards was intended to verify that a quality management system was planned by corporate executives and implemented throughout the levels of management within a company (Inglesby, 1992).

It should be noted that ISO 9000 was not intended to certify the quality of a product, but rather to establish that a minimum quality management system was in place and documented throughout the organization, from production line employees to top level management (Ferguson, 1992; Vermeer, 1992). The concept of certifying a system or process tailored to the individualities of a company has created difficulty as previous quality programs typically focused on the quality attributes of specific products. The concept of a systemic approach to quality management rather than the traditional quantifiable methods used for specific manufactured products has created some difficulties and misunderstandings. However, certification under the ISO 9000 umbrella required that management accept this standard unreservedly with proof of the company’s good faith by documentation of their system of quality management. The rewards for adoption of ISO 9000 were vast, not the least of which was laying out a framework of responsibility for quality measures that incorporated empowerment to all members of the organization.

The concern for quality in the management of higher education institutions has long been of interest to the customers of higher education- the students, taxpayers, and organizations hiring graduates (Spanbauer, 1992). According to Parnell (1990)
quality standards in administration, teaching, and research have been essential to education and of importance in satisfying goals set by administration and faculty.

In 1987, Spanbauer pointed out that assessment of academic programs to determine quality standards in public higher education were a rarity. As the themes of product quality and quality management permeated industry, higher education responded by incorporating quality topics into curriculum, conducting applied research in Total Quality Management, and functioning as a knowledge/training resource for industry. Noting the rewards of quality management within industry, higher education sought to assimilate these techniques into academic administration.

In the early 1990s Seymour (1991a) documented the benefits and frustrations of 22 campuses who were implementing a Total Quality Management model into their institutions. Also in 1991, Marchese discussed the results from eight colleges and universities who had incorporated Total Quality Management and Malcolm Baldrige Award criteria into the operations of their campuses. The concepts of industrial quality management practices have been adopted by a number of higher education institutions.

Spanbauer (1992) documented the successful implementation and execution of an industry-based quality management system for administration and faculty in the accomplishment of objectives at a technical college. He utilized industrial standards for organizing, critiquing, and improving the management of that institution. Results indicated the standards were effective and substantial improvements were noted.
Statement of the Problem

American industry has widely accepted, adopted, and utilized the ISO 9000 series of standards as they pertain to the quality of management systems. The successful utilization of the ISO 9000 series of standards in a post-secondary educational setting has yet to be documented. Since the ISO 9004-2 guidelines were developed specifically for the service industry, the logical link from industry to post-secondary higher education would be through Industrial Technology programs, given their previous exposure to industrial practices and prior ISO 9000 industrial standards.

The problem of this study was two-fold: (a) to determine if ISO 9004-2 quality guidelines were appropriate for integration into Industrial Technology programs and (b) how would these guidelines have been utilized to verify quality management objectives within such programs. Since other industrial quality models such as Total Quality Management (Comesky, McCool, Byrnes, & Weber, 1991; Kendrick, 1993b; Marchese, 1991; Seymour, 1991a, 1991b, 1991c) and the Malcolm Baldrige Award criteria (Kendrick, 1993a, 1993c; Lemons, 1992; Placek, 1992; U.S. Department of Commerce, 1993) have been applied to the post-secondary educational setting, it was considered appropriate to study the potential application of a newer quality model, ISO 9004-2 guidelines, and their ability to assess and/or improve quality management within Industrial Technology programs.

Although Total Quality Management practices, the Malcolm Baldrige criteria, and ISO 9000 complement and occasionally overlap each other in terms of
applicability, each has been developed as a unique standard to accomplish contrasting results through distinctly different methods. These different methods of achieving quality have been used consecutively to improve the quality of an organization.

Research Questions

The study sought information regarding ISO 9004-2 guidelines for use in Industrial Technology programs and the utilization of these standards to verify quality objectives. The researcher was expecting that the 3 groups would respond differently, as will be explained in the results. The research will attempt to answer the following:

1. What are the differences in perceptions in measurements of quality between the three population categories (dean, department chair, and faculty) based on 15 factors as defined by ISO 9004-2 guidelines?

2. To what extent have ISO 9004-2 guidelines been implemented in Industrial Technology Departments as perceived and reported by the three population categories?

3. What are the differences in perceptions of level of implementation of ISO 9004-2 guidelines in Industrial Technology Departments between the three population categories?

4. How can the guidelines identified by ISO 9004-2 be used to indicate quality management within Industrial Technology related programs at 4-year post-secondary institutions?
Statement of Purpose

The purpose of this study was to seek knowledge regarding the relevance of an industrial management model (ISO 9000) and its ability to audit and/or improve the quality of management of Industrial Technology related departments at 4-year state regional universities. The results warranted the consideration of ISO 9004-2 guidelines for improving the quality of management within Industrial Technology related departments.

Significance of the Study

As with any service provider, quality in the management of education institutions is not only expected, but leadership in the testing and application of new quality management theory is anticipated. Universities, in particular, are being drawn into the quality management platform by the same initiatives that have benefitted American industry in the past 10 years.

Additionally, university management must show receptivity to potential methods for productivity improvements given the current political climate that has little tolerance for waste and mismanagement. To date, the favored methods for improving quality in the post-secondary educational setting have focused on Total Quality Management (TQM) and to a lesser extent, Malcolm Baldrige Award criteria.

Total Quality Management techniques and Malcolm Baldrige Award criteria have been successfully integrated into the post-secondary higher education environment and have been gaining broad acceptance as potential methods for quality

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improvement. ISO 9000 certification criteria are the next step on the path to the quality of management in higher education. No evidence has been discovered suggesting that ISO 9000 certification criteria, specifically ISO 9004-2 guidelines, have been applied to a higher education institution or in direct relation to an Industrial Technology related department.

Assumptions

Assumptions made in the accomplishment of this study were:

1. The pursuit of quality management is a goal of Industrial Technology related departments.

2. Administrative and faculty personnel of Industrial Technology related departments were able to perform a self-assessment concerning the appropriateness of ISO 9000 to the operations and management of their departments.

Delimitations

This study was conducted based on the following delimitations, and the results of this study applied only to these programs:

1. Participants in the survey were administrators (deans and chairs) and faculty at 4-year post-secondary Industrial Technology related programs at state regional institutions graduating students with Industrial Technology related degrees (Dennis, 1993-94).

2. To prevent bias toward institutions that had multiple departments in the area of Industrial Technology, only the department with the closest curricular area to
Industrial Technology was surveyed or if there was more than one, only the largest (determined by number of faculty members) was included in the study.

3. Interpretation of the responses was accomplished by the researcher.

4. Results were based on the responses received during the survey process and applied only to the participants included in the study.

Terms

Several terms used in this study were identified for consistency:

Chair(s)—to include chairperson(s), chairwoman, chairman, head(s), coordinator(s).

ISO—International Standards Organization, officially known as the International Organization of Standardization.

ISO 9000 Standards—include ISO 9000, 9001, 9002, 9003, and 9004. The series of standards is often known as the ISO 9000 standards, implying any standard included in the series, as well as the whole series inclusive.

Participant—also known as respondent.

Q90 or Q91—the U.S. term for the international ISO 9000 standards.

Quality—the features and characteristics of a service that bear on its ability to satisfy stated or implied needs.

Registered—refers to ISO 9000, can also be known as being certified, accredited, or having met registration requirements without actually having applied for registration, certification, or accreditation.
Research Budget

Due to the recent release of the ISO 9004-2 guidelines, research has involved extensive seminar attendance and purchases, rather than typical computer and library searches. Additionally, much traveling from out-of-state has been included in the total due to numerous committee meetings necessitated by the relative recentness of ISO 9004-2 guidelines and the unexampled application of these guidelines to Industrial Technology. The estimated expenditures for this study were detailed in Appendix A.
CHAPTER 2
REVIEW OF THE LITERATURE

Introduction

A review of the literature provided information related to quality issues in higher education, management quality trends in North American industries, historical perspectives of ISO 9000 in industry, ISO 9000 methodology and similarities between ISO and other quality models. Also reviewed were management policy and practice in higher education, quality model applications in higher education and Industrial Technology Departments as a vehicle for quality management implementation.

Management Quality Issues in Higher Education

Attempts in the early 20th century at post-secondary institutions to improve quality by imitating industrial management practices were often a failure. Although these practices led American industry to world leadership, the same practices offered little benefit to higher education institutions. The attempts were generally ill-conceived and not well executed, as will be discussed in the following paragraphs.

Following World War II, a concern for efficiency and effective management methods was voiced by institutions as they focused on rapid expansion to meet the needs of returning servicemen. But in the rush to expand educational opportunities for the newly expanded student population, little attempt was made in higher education to improve the quality or management of educational institutions, but to multiply the already existing system (Mood, Bell, Brownlee, Bogard, & McCloskey,
During this period, goals were rarely identified or followed by higher education institutions because this was not considered necessary nor beneficial since there were more students clamoring for a college education than there were institutions to serve them (Kerr, 1991).

More recently, when taxpayers have balked at increasing their taxes, the resultant budget cuts have been blamed for lowering the quality of education (Hill, 1991). This was in spite of tuition at public universities increasing 13% in 1991 and 10% in 1992, according to a study by the College Board, an association of 2800 higher education institutions (Public U's tuitions rise 10%, 1992).

Birnbaum (1989) explained that universities have not been rational in a business-sense as they have attempted to adapt to a changing world. Rather they have been made extremely complex and have become even more bureaucratic. Interactions and decisions within the university environment have been intricate and loosely coupled, with the outcomes frequently left to chance. The alternative courses of action taken by administrators to improve quality or systems as well as their predicted outcomes have been uncertain. This has caused administrators to forego efforts to maximize results in favor of merely finding an acceptable solution. As a result, many university systems have been suboptimized.

The need for assessing and improving quality in the educational setting has been documented. Education has responded to this need by joining the quality movement and implementing Total Quality Management, Malcolm Baldrige, and
Deming philosophies into the operations of higher education institutions. As stressed by Bogue in 1992, quality can be defined, can be measured, and can be used to improve educational systems. The move by some institutions to adopt TQM strategies to their universities has rapidly gained momentum in the 1990s and has established guidelines for implementation (Comesky et al., 1991; Marchese, 1991; Seymour, 1991a, 1991b, 1991c; Spanbauer, 1987, 1992). This process has been further refined to improve the curriculum in both industry and education (Kendrick, 1993b). The researcher has observed that conferences, seminars, and training sessions have become cottage industries by brokering services to train educators on implementation methods for TQM, Malcolm Baldrige, Deming, and other quality methodology specifically geared for the educational setting.

History of ISO 9000 Standards

The ISO 9000 standards were the first international standards for quality in management and were modeled on British National Standards 5750 used in Britain's defense equipment industry (Chynoweth & Roberts, 1992; Kuhn, 1991; Lamprecht, 1992; Rothery, 1991). The ISO 9000 set of standards were developed by a technical committee composed of a worldwide delegation. In addition to having established the standards, this committee has been meeting regularly to consider revisions.

The standards were designed as a document applicable to all industries of all nations. One of the strengths of the ISO 9000 series was their design as a self-assessment tool with the intent of later being used for third-party certification.
(Lamprecht, 1992). The standards were not to certify the quality of a product (Ingman, 1991c, 1991d; Lamprecht, 1992), but rather to certify the quality of the management system (Baldwin, 1993; Ferguson, 1992; Rabbitt, 1992; Vermeer, 1992).

As a quality system certification in management, the standards certified that a system was in place, fully implemented, and inspected by an independent party to meet minimal world requirements for maintaining management quality and consistency (Gosch, 1992; Sprow, 1992). The ISO 9000 series were intended to be complementary to statutory and customer requirements, but not as substitutes for them (Harral, 1992b).

Kirchenstein (Ferguson, 1991) stressed that ISO 9000 standards were not intended to standardize quality systems across industries or even company locations, but rather were intended to be customized according to the quality and management needs of each industry, organization and/or company. According to Burrows (1992), this has created confusion about their use because the quality system was intended to be individually tailored to a company’s or organization’s needs. Additionally, many organizations were stymied in the pursuit of certification when they found that there was no template to follow. ISO 9000 even allowed a company or organization to develop language appropriate for its specific industry (Lamprecht, 1992; Rabbitt, 1992).

Quality and quality of management have become of concern to industries, organizations and countries around the globe. The Baldrige Award in the U.S.
(Kendrick, 1993a, 1993c), the Deming Prize in Japan, and a newly established award for quality in the European Economic Community (Kochan, 1992) have demonstrated how the quality of management has been recognized around the globe in the industrial setting.

Management Quality and ISO 9000 in Industry

This emphasis on management in a quality manner has been precipitated by the need for industry to move into the global marketplace. In order to succeed in the global marketplace, changes and improvements in management methods were usually necessary, including quality systems (Albin, 1991; Deutsch, 1993; Jasany, 1991; Piciacchia, 1991; Placek, 1993).

This pursuit of management in a quality manner has gained global support with the acceptance of ISO 9000 standards by over fifty countries (Baldwin, 1993; Byrnes, 1992). Acceptance of this set of standards has been rapid since 1987 with over 22,000 companies certified worldwide as of September, 1992. The number of companies who have sought registration has been increasing since 1991 at an exponential, rather than a linear rate (Chynoweth & Mullen, 1992; Schmidt, 1992) indicating the need as well as the benefits of ISO 9000 certification.

Although the U.S. and Japan have been more advanced in the development of formal quality standards than Europe, both have been resistant to utilizing the ISO 9000 standards (Berkman, 1990; Dambrot, 1992, Pirret, 1992). As recently as the early 1990s, many U.S. companies were not convinced of the advantages of the
standards. In part, this reluctance in the U.S. was due to the difficulties of incorporating the registrar system into national quality activities (Stratton, 1992).

The standards were also adopted as a national standard for quality by the countries of eastern Europe (Garner, 1991) and New Zealand (McFadyen & Walsh, 1992). Hong Kong has been pushing for 10% of its 50,000 factories to be certified (Slovick, 1991). As of 1992, over 15,000 firms in the European Economic Community had been ISO 9000 registered, while only a few hundred companies in the U.S. had completed registration (Lamprecht, 1991; Pirret, 1992).

The need to pursue certification in the U.S. has been fueled by overseas customer demands (Constance, 1991; Gosch, 1991; Greene, 1991; Ross, 1992). It became common for contractual agreements to demand certification as a requisite to doing business with a company (ISEA Communiqué, 1992). U.S. companies found their business in the European Economic Community, Canada, Australia (Bodinson, 1991; Boznak, 1991), Taiwan, Hong Kong, mainland China, Israel, and elsewhere (Garner, 1991) to have been at risk due to a lack of certification.

With acceptance of ISO 9000 certifications in the European Economic Community (EEC), many U.S. companies were forced to implement the standards against their will (Bodinson, 1991; Boehling, 1990; Burr, 1990; Jasany, 1991; Tatum & Heller, 1991; Vasilash, 1991). With over 350 million consumers, the EEC was the largest single market in the world and this has been a strong force behind acceptance of the standards (Garner, 1991; Moormann, 1992; Sprow, 1992). Hockman (1991)
and Kirchenstein (Ferguson, 1991) reported that manufacturers failing to meet the standards risked having their product(s) banned for impo^ to the EEC. This ban has been considered extreme considering the standards were not mandatory.

ISO 9000 Implementation in the United States

Multinational companies based in the U.S. such as Dupont, Eastman Kodak (Kemezis, 1992), and ICI Films (Benson, 1991) were introduced to ISO 9000 standards through their European operations, which facilitated a rapid certification of their American divisions. Other U.S. companies achieved Q90 certification through defining and implementing a uniquely American system of quality management. Companies such as AT&T (Klock, 1990), GE Fanuc, Data General, Compaq Computer (Dutton, 1992), and Hewlett-Packard (Graham, 1991) have been successful at achieving Q90 certification with this uniquely American system.

Conglomerates in the chemical industry (Hunter, 1992; Roberts, 1992) and the oil/gas industries (Schindler & Lamprecht, 1992) have taken the lead among U.S. industries seeking accreditation. In 1992, the standards had a strong impact on the automotive industry when a truck manufacturer required suppliers to conform to ISO 9001 or 9002 by 1994 (Arch Associates, 1992).

U.S. service industries have not embraced the guidelines as vigorously as service industries in England despite the benefits (Mullin, Chynoweth, & Roberts, 1992). As of 1992, the U.S. service industry that has demonstrated the most activity in seeking certification has been the hotel and resort industry (Mullin et al., 1992).
U.S. government organizations who have adopted the standards have included the Department of Defense (DOD) (Boehling, 1990), the Food and Drug Administration (Saunders, 1992), the Occupational Safety and Health Administration (Lamprecht, 1992), the American National Standards Institute, as well as the American Society for Quality Control (Marquardt, 1992). The DOD has replaced specific military standards with ISO 9000 criteria (Greene, 1991; Lamprecht, 1991).

The pursuit of quality in management has transcended international boundaries and ISO 9000 has been considered applicable regardless of political and economic differences. Due to the benefits, ISO 9000 has continued to be adopted in countries around the world (Lamprecht, 1992; Rothery, 1991) despite hesitation in the United States.

ISO 9000 Certification Methodology

As one of the first prerequisites to certification, management was to have committed to management quality through its mission statement (Ferguson, 1992; International Organization for Standardization, 1992; Nuland, 1990a). Management was then to have formulated a strategic plan that specified the scope of the business, the current status of the quality system, a ranked order of tasks or benchmarks, and cost projections for the program (Jackson, 1992). Management was then to have defined the requirements for equipment, processes, and quality management tools (Dzus, 1991; Rothery, 1991). In conclusion, the initiation of activity to achieve ISO 9000 certification was to have rested on the shoulders of management.
For certification ISO stated it was necessary to have a policy which defined the quality responsibilities and a documentation of systems and processes. It relied on a company to have decided how to implement a standard and to interpreted the criteria relative to their industry and company (Lamprecht, 1992; Rothery, 1991). According to Lamprecht (1992), it was best for a company to have rephrased the requirements into questions regarding compliance to apply the criteria to company operations.

Hartman (Ferguson, 1992) explained that ISO 9000 standards provided for a system of five components: a team concept, employee involvement, use of recognized quality improvement techniques, good communications, and a good training program. Because of the team concept and the required employee involvement, implementation of the standards usually required changes in management style (Chynoweth & Roberts, 1992).

Upper management of a company was to have (a) set the quality direction, (b) resolved quality issues, (c) set specific objectives and reviewed results, and (d) provided resources for the accomplishment of the program. Middle management was expected to have (a) provided procedures and work instructions, (b) provided equipment and training, (c) measured quality performance and follow-up, and (d) established corrective and preventive action.

All employees of the company were expected to have (a) known the company quality policies, (b) understood customer requirements, (c) understood quality requirements, (d) followed quality procedures, (e) utilized and maintained work
instructions, (f) personally been responsible for their work, (g) identified and
corrected errors, and (h) improved products and work processes. Every employee or
workgroup was to have had responsibility for quality (Dutton, 1992). When a
company decided to accept the standards, every employee was to have known their
role (Rothery, 1991; Sprow, 1992). The criteria were for settling disputes by
creating an agreement on quality (Ingman, 1991b).

Implementation of the standards forced a company to record its management
system and ensured that specific actions or procedures were not overlooked
(Ferguson, 1992). It provided procedures and records which measured improvement
(Schmidt, 1992). In summation, ISO 9000 required a company to document what
they were doing and do what they said in writing they were doing (DiMaria, 1992;

A quality manual was also a requirement of the system and was to be updated
on a regular basis. This manual was to contain sample documents and full
documentation of processes and decision-making procedures related to quality. The
manual was intended to specify procedures for documentation and documentation
control (Dzus, 1991; International Organization for Standardization, 1992; Lamprecht,
1992; Rothery, 1991; Soslow, 1992), and was to be updated at all times.

Inglesby (1992) believed that if a company had a documented quality
improvement program with process control procedures in place and viewed quality as
the number-one factor in its success, ISO 9000 certification was achievable. A
quality audit procedure was used as a form of self-assessment (International Organization for Standardization, 1992; Lamprecht, 1992; Rothery, 1991) similar to that required for the Malcolm Baldrige Award (Carey, Neff, & Therrien, 1991; Ingman, 1991a, 1991g; Lemons, 1992). An organization was not required to prove compliance with all 20 clauses of the ISO standards. Rather, an organization had the prerogative of ignoring or labeling "Not Applicable" any clause which did not specifically apply to their operations (Lamprecht, 1992; Rothery, 1991).

A wide variety of applications have been created for ISO 9000 criteria during its short history. Some companies have sought certification as a means of creating a quality program where there wasn’t one (Timbers, 1992). Other industries have adopted the standard as operating procedure for their quality program (Blumberg, 1991/92).

Advantages and Disadvantages of ISO 9000 Certification

One of the major advantages of the ISO 9000 standards was that they were developed as a ready-made system that was generic and applicable to all types of businesses and services (Baldwin, 1993; Kalinosky, 1990; Rothery, 1992; Soslow, 1992). As such, they were considered common-sense and understandable by the common worker. The standards required everyone in the organization to continuously strive to meet customer requirements by doing their tasks right the first time and perpetually attempting to achieve higher levels of quality performance (Soslow, 1992; Sprow, 1992).
According to Dutton (1992) and Wolak (1993), preparing for ISO auditing and accreditation was worthwhile for many companies because it caused the organization to evaluate how it did things. By requiring system consistency and recording it to assure it was consistent, problems were easier to solve (Greene, 1991; Ramsay, 1992). Adding traceability to the process enabled management to assign responsibility and to track performance, thus assuring conformity (Rothery, 1991).

Another major advantage of certification was regular maintenance and updating at 5-year intervals (Byrnes, 1992; Hagigh, 1992; Harrewijn, 1991; Marquardt et al., 1991). Certification required continuous company assessment (Fletcher, 1991; Soslow, 1992) and additional visits by the accreditation team if certification of the facility was marginal (Chynoweth & Roberts, 1992).

Companies who sought registration found advantages such as market advantage (Rothery, 1991) and increased market share (Ferguson, 1992). Also documented were reduced maintenance costs, standardization of operations, and expedited government agency inspections (Mullen, 1992a). A reduction of customer quality audits saved costly time and resources (DeAngelis, 1991; Lofgren, 1991). As in the case of the Malcolm Baldrige Award, these advantages were often accomplished through the utilization of self-assessment without actual inspection by a third-party (Lofgren, 1991; Ramsay, 1992; Wöerner, 1991).

Companies that completed registration have documented higher satisfaction ratings from customers and a better understanding of operations (Heller, 1992).
Reduced operating costs have been achieved as well as increased on-time deliveries, reduced cycle times, increased yields, increased competitiveness (Marquardt, 1992), and reduced product costs (DeAngelis, 1991). From a financial point of view, companies have reported a consistently high rate of return on their investment (Sprow, 1992).

Less tangible advantages such as improved employee communication have been noted (Ingman, 1991f). Improved training procedures have resulted in employees that understand their jobs better, had a supportive attitude, and were more motivated (DeAngelis, 1991). This created a reduction in mediocrity which in turn resulted in an advantage over competitors (Burrows, 1992; Cornick & Barre, 1991; Inglesby, 1991; Nuland, 1990b).

The benefits of pursuing registration have been well documented in the industrial sector (DiMaria, 1992). At the head of this list has been the opportunity to gain an independent view of the company’s quality system as well as increased customer satisfaction, and improved employee morale. By having a checklist to detect and remedy quality system weaknesses, companies documented method deficiencies and developed plans for removing deficiencies. The benefit of cost containment has assisted in a competitive edge in the marketplace and created a national/international reputation for quality and quality management as well as cost effectiveness. Many companies in the U.S. have broadcasted the accomplishment of registration by advertising in industrial-related publications and local newspapers.
Recognition of certification has increased as the standards have become more widely accepted (Fletcher, 1991). But as Deming (Lamprecht, 1991, p. 17) stated, "You don't have to do this - survival is not compulsory."

Similarities between ISO 9000 and Other Quality Models

Many have found ISO 9000 not much different than MIL-Q-9858 (a military standard), TQM, or the Deming approach (a 12-step quality improvement technique developed by W. Edwards Deming). Since ISO 9000 has similar features to military standards and the Deming approach when coupled with TQM, many companies have adopted ISO 9000 as their standard quality program (DiMaria, 1992; Flott, 1992, Rabbitt & Bergh, 1992).

ISO 9000 has been considered similar to TQM because it has often led to a sharing and exchange of information across previously impenetrable departmental barriers. It has also been considered similar to Deming's philosophies because a company was required to plan what they did, do what they said, and record that they had done it, as well as audit for compliance and effectiveness (Lamprecht, 1991). Many companies have utilized ISO 9000 as a step on the ladder to the Malcolm Baldrige Award (Garner, 1991).

ISO 9004-2 for Service Industries

As a model for service industries (an example of which was education) ISO 9004-2 has both quantitative and qualitative characteristics (Rothery, 1991). The quantitative characteristics were (a) waiting time, (b) delivery time, (c) accuracy of
service, (d) completeness of service, and (e) accuracy of billing. The qualitative characteristics were (a) credibility, (b) accessibility, (c) security, (d) responsiveness, (e) courtesy, (f) comfort, (g) aesthetics, and (h) hygiene.

The following components were listed by Rothery (1991) as components of an ISO 9004-2 system:

1. A responsibility and commitment to a quality policy from top management. The characteristics included (a) identification of the customers' needs (stated or implied), (b) a system of preventive action, (c) minimization of quality costs, and (e) the creation of a collective will for quality service review.

2. The operational elements of the system were specified as (a) a market assessment, (b) obligations and brief synopsis, (c) service design specifications and delivery criteria, (d) quality control specifications, and (e) service performance analysis.

The market assessment was to identify the resources needed for implementation. This limited an organization from offering a service if it did not know what the market already offered and how well the service met the needs of the customer. An organization was not expected to meet the guidelines if the standards were too high or unrealistic. Service design was the conversion of the service brief into specifications. This defined the process responsible for delivery of the service.

In the section on quality control, the organization was to have measured and controlled the processes within its manufacturing environment. This was determined
by (a) an analysis of the system, (b) identification of key activities, (c) a system of measurement, and (d) the design of actions to make adjustments as necessary. The service performance analysis was to provide a continuous system of appraisal, feedback, and adjustment. This included (a) supplier assessment, (b) customer reaction, (c) complaints, (d) feedback and (e) audits. This was to result in seeking areas where improvements gave the most benefits. Changing market attributes which affected service would have been identified, as well as missing controls, and opportunities for future change.

3. The standard sought a work environment which fostered excellence, stability, and security. The standard identified training, education, and employee motivation as methods to achieve this.

4. As with all other aspects of ISO 9000, documentation was demanded at all stages. This included a quality manual, plans, and records of activities which required measurement.

Registration to any ISO 9000 standard was to be perpetual as long as the requirements were satisfied. In addition, ISO 9000 was developed to be complementary to TQM, Malcolm Baldrige, and other quality systems (Harral, 1992a).

Management Quality and Administrative Methods in Higher Education

A variety of opinions have emphasized that higher education has faltered in the quality of its administration and service (Chapman & Carrier, 1990; Lamfers, 1991;
Matthews & Norgaard, 1984; Purcell, 1992; Seymour, 1991b, 1991c). The belief is common that the quality of 4-year post-secondary schools has drastically undermined the ability of the U.S. to compete globally (Public Broadcasting Service, 1991; Spanbauer, 1992). When defining quality, effective education has been considered to be more than information delivered by a knowledgeable lecturer (Bourke, 1990).

Studies have shown that quality in education has varied widely in countries throughout the world (Brett, 1992; UNESCO, 1985; U.S. ed. spending average, 1992) and that these differences have affected the global economy. Much as the quality and effectiveness of technical education has been considered responsible for the economic growth of Japan (Toyoda, 1987), the quality of American higher education has been considered as negatively affecting the competitiveness of the U.S. (Bowen, 1982; Lamfers, 1991; Purcell, 1992; Spanbauer, 1992).

Several means have been considered for overcoming budget cuts and their effect on the quality of education. Liaisons between manufacturing and education have been established and have been mutually beneficial (Deutsch, 1993; Fairweather, 1988; Lynton, 1984; Matthews & Norgaard, 1984; Public Policy Center, 1986; Purcell, 1992). Alliances have encouraged educational institutions to perform research for industry through internships, coop programs, and having industrial managers teach university courses while being paid by industry. These alliances have often enhanced the recent economic competitiveness of the U.S. in the global marketplace of the 1990s (Fairweather, 1988; Lynton, 1984; Spanbauer, 1992).
Problems Identified as Quality-Related in Higher Education

Factors that have influenced the flexibility of academic leaders have been listed as (a) federal and state controls, (b) greater involvement by courts, (c) additional layers of governance (compared to industry), (d) fewer opportunities for growth, (e) questions about the importance of various missions, and (f) less acceptance of authority in general (Birnbaum, 1989). These factors have often constrained opportunities to display leadership as traditionally understood.

The problem in singular academic departments was not that goals weren't able to be identified, but that there were simultaneously a large number of conflicting goals. There was no obvious goal comparable to money or profit as in business. The three often articulated missions of teaching, research, and service generally created diversity, conflict, and a general loss of priority with no easily identifiable outcome. This problem was exacerbated by unclear or conflicting mission statements for departments, colleges, and the institution as a whole (Birnbaum, 1989).

Although the quality of higher education has come under attack by the American population and the legislature, no specific quality standard has been identified as tenable (Hendricks, 1992). In large part, this has been because of a lack of understanding about what universities were and how their effectiveness was measured. This has created an attitude of questioning and mistrust (Birnbaum, 1989; Goheen, 1969). According to Meyer and Rowan (1983), the more the college has been viewed as conforming to societal expectations about what it was doing and how
it was doing it, the more likely the college was perceived by the public to be successful.

Morgan (1986) observed that this lack of change was due to cybernetic controls that affected the operation of higher education institutions. These cybernetic controls were identified as self-correcting mechanisms that provided negative feedback to participants when things were not going well. This allowed the institution to detect and correct errors when something happened in an undesirable direction, so that something else automatically happened to bring it back on course. The cybernetic college was unlikely to have rationally calculated in advance the probable outcomes of the new activities it selected.

Cybernetic institutions have operated without an identifiable leader and have reacted to long term problems with short term solutions. Cybernetic systems have worked in higher education, although no one seems to know how or why, and because they have worked they have been difficult to change (Birnbaum, 1989).

Ashapa concluded in 1991 that the management atmosphere of education has not been as good as the equipment, technology, or delivery systems. Specific inadequacies in higher education have been pointed out, such as how rarely academicians had training in the management of their institutions (Lazerson & Wagener, 1992). This lack of training was not inclusive according to Tinsley, Secor and Kaplan (1983), as women who sought roles in educational administration often attended summer institutes for training in management skills and leadership.
Specific constraints to leadership have been (a) the greater involvement by faculty, (b) faculty collective bargaining, (c) greater goal ambiguity, (d) the fractionation of the campus into special interest groups, (e) the involvement of trustees, and (f) the bureaucracy and specialization of administrators (Birnbaum, 1989). These factors have had a serious impact on the initiation of a quality management program at the 4-year post-secondary level.

Quality at higher education institutions has seldom focused on the quality of management (Spanbauer, 1987). An exception to this was when Spanbauer (1987, 1992) stated that an institution should have demonstrated by example that it was a model of quality before teaching quality in its classes.

Spanbauer stressed this at his institution, since classes were offered to local industries relating to quality and quality management, that it was essential that the college itself be a model of quality and quality management. His college demonstrated by example that it was knowledgeable in quality and the quality of management.

Lynton (1984) believed that higher education institutions have become creatures of habit performing activities that have little value except convenience. Keller (1983, p. 5) felt that "They constitute one of the largest industries in the nation but are among the least businesslike and well managed of all organizations." In contrast, many have believed that higher education institutions exhibited diversity, accessibility, and quality that were without parallel (Birnbaum, 1989).
Examples of Quality Models in Higher Education

The TQM model that was adopted by several universities in 1992 created an attitude where faculty, staff, and administrators acknowledged customer satisfaction as a useable index of quality (Seymour, 1991a, 1991c). Results indicated success with this industrial quality model.

In an effort to improve the quality of higher education, accreditation was established as a means of certifying institutions and programs in technology (Accreditation Board for Engineering and Technology, 1990; National Association for Industrial Technology, 1990). Even though the National Association for Industrial Technology (NAIT) has been dedicated to the establishment and maintenance of curricula of Industrial Technology in its accreditation process, it has not included the quality of management as a part of its process (National Association of Industrial Technology, 1990).

In Industrial Technology, quality has remained a consistent goal. From the initiation of the National Association of Industrial and Technical Teacher Educators (NAITTE) in 1937 and NAIT in 1965 to the current mission statement of both organizations, the pursuit and need for quality has been clear and consistent (Evans, 1988).

As identified by Naisbitt (1982) in Megatrends, the post-secondary institutions known for excellence during the 1980s were characterized by a bottom-up rather than a trickle-down trend (Gilley, Fulmer, & Reithlingshoefner, 1986). This demonstrated
the impact faculty had in causing a change in the quality of management. In those programs implementing quality of management, what worked for one academic department was likely to have been harmful to another. Sophisticated management techniques have often made the situation worse (Birnbaum, 1989). Two structures that existed in parallel (the dualism of an administrative hierarchy and a faculty structure), with neither having a consistent pattern of organization, operation, or delegation has been blamed for causing unclear missions.

The methods for changing educational administrations and instruction have been ineffective in the 1990s (Levine et al., 1989; Matthews & Norgaard, 1984). Maybe this was why academe created quality awards and processes similar to the Baldrige Award criteria and Total Quality Management (TQM) (Marchese, 1991; Placek, 1992; Spanbauer, 1992).

There were almost no examples of formal quality processes being used in higher education in the 1980s (Spanbauer, 1987), despite the changes expected in the 1990s (American Production and Inventory Control Society, 1991; Parnell, 1990). No group was strong enough to dominate within the institution, so upper administration was usually not able to play an authoritative role (Birnbaum, 1989).

Attempts to improve the quality of management in higher education have included the Resource Allocation and Management Program (RAMP). Initiated by Exxon, it expected liberal arts colleges and universities to make changes in their management practices. These included a redefinition of authority and responsibility, a
definition of objectives, a system of continuous comparison of achievements to objectives, and reviews of all options before a decision was made (Baldridge & Tierney, 1979).

Another effort, the "Total Quality Management University Challenge," offered top corporate leaders the opportunity to teach academicians what they knew about building continuous quality improvement into their companies (Kendrick, 1993b). TQM was one method identified as a way to change management practice. When a university adopted TQM, it was expected the culture would shift to a quality driven, customer oriented, and a constantly improving team (Marchese, 1991). Early in the process, this was not considered helpful in improving higher education due to the uniqueness of educational institutions compared to industrial enterprises (Van, 1992).

In 1992 the TQM University Challenge involved eight universities (Carnegie Mellon, Georgia Tech, MIT, North Carolina State, Purdue, Rochester Institute of Technology, Tuskegee, and the University of Wisconsin-Madison) as well as industrial representatives from IBM, Milliken, Motorola, Procter & Gamble, and Xerox. Each institution dispatched up to 100 professors in business and engineering, as well as top administrators and key support personnel for a learning session on TQM. By the end of 1992, most of the eight universities had begun an internal quality assessment based on the Malcolm Baldrige National Quality Award criteria and were showing significant improvement in quality efforts (Meade, 1993).
When participants of the TQM University Challenge were interviewed, they agreed that it was easier to integrate total quality into the administrative functions of their universities than to adapt the philosophy to their educational mission. Many universities addressed the faculty concerns of TQM through cascading (teaching total quality from the top down). This was considered necessary by administrators due to a lack of incentive from faculty (Meade, 1993).

Another study undertaken by Seymour identified the effectiveness of TQM strategies at 22 public and private colleges and universities. Results indicated that this allowed for the empowerment of employees with positive effects. The change in work climate resulted in excellent morale and an improvement in the quality of the institution. In large part, this shift in attitude was created by decisions based on fact rather than intuition, tradition, and notions of "this is how we do things around here" (Seymour, 1991a, p. 11). Measuring effectiveness was the purpose of the study performed by Seymour. According to him, despite minor setbacks, there was an overall improvement that made the effort worthwhile.

Specific objectives were identified in the model by Spanbauer (1987, 1992) based on the principles of Deming, Juran, and TQM. This model set a pattern for measuring institutional effectiveness. An article by Bogue in 1992 stressed that quality had been defined, measured, and used for improvement at some educational institutions. Bogue's opinion was reinforced in 1992 when Spanbauer documented proof through surveys, audits, and evaluations of the Quality First program at Fox
Valley Technical College that industrial-based measures were applicable to education. This was accomplished in spite of faculty and administrators that had fought the implementation of quality processes in the management of that institution (Spanbauer, 1987).

Although academics in Europe and Japan have been considered experts on quality (McGovern, 1991), according to Spanbauer (1992) being an expert in quality and utilizing its premises in higher education were separate issues. The Quality First process used at Fox Valley Technical College and the TQM and Malcolm Baldrige Award criteria used at 22 universities have been the few documented industrial quality processes used in education (Marchese, 1991; Seymour, 1991a; Spanbauer, 1987).

Resistance to Change in Higher Education

According to Ikenberry (1992), accomplishing quality has required establishing priorities, which was supported by Spanbauer in 1987 and 1992 when he stated that implementing quality at higher education institutions involved a mission, philosophy, and a strategic direction. A self-evaluation was recommended for critiquing a department and has proven successful in this use. In fact, for accreditation purposes, self-assessment has become a requirement (Accreditation Board for Engineering and Technology, 1990; National Association of Industrial Technology, 1990).

Developing a mission, philosophy, and a strategic direction has been an uncertain process for most colleges and universities. This was often because as long as academic organizations kept their goals ambiguous and abstract, they were agreed
on, but when they were specifically stated and attempted to be put into operation, conflict occurred. Since colleges and universities have often not known what they were trying to do in determining specific missions, philosophies, and strategic directions (in other words, goals), they often did not know how to achieve these goals either (Baldridge, Curtis, Ecker, & Riley, 1974).

Resistance has been common by faculty and administrators to any change in the status quo and this has created an attitude of arrogance and protection which often prevented new management practices from successfully being implemented (Argyris & Schon, 1974; Mayhew, 1970; Spanbauer, 1987). Because the characteristics of academic institutions were not similar to business institutions, an attempt to improve or change the management of universities has been found to reduce rather than increase the institution's effectiveness (Birnbaum, 1989). As Birnbaum points out, maybe universities were successful because they were poorly managed and attempts at traditional management processes would have diminished their effectiveness. No doubt incorporating quality methods involved a vision and the creation of a mission statement with specific action steps to overcome the varying degrees of resistance and pain (Chacon, 1985; Lynn, 1990). This resistance to change has been described well by Spanbauer (1992) at his institution.

**Resistance to Change**

Resistance was often the result of (a) not understanding or agreeing with the goals of the institution, (b) not having a commitment to removing the errors in the
organization, (c) not performing strategic planning, or to (d) a lack of recognition for
doing a job well. Resistance to change has also been caused by a reluctance to use
private sector practices in public education and the fact that most administrators and
managers were former teachers who had excellent teaching credentials but lacked
leadership experience (Birnbaum, 1989).

Resistance to change has been blamed on a belief that traditional management
theories have not applied to educational institutions (Birnbaum, 1989). This has been
explained by considering the university as a system composed of smaller systems and
as part of a larger system. As such, an educational institution has received inputs
from its environment, transformed them, and returned them to the environment. As
an open system, it had boundaries that were relatively permeable, caused by
interactions between the environment and system elements which were dynamic and
nonlinear. This resulted in no direct relationship between inputs and outputs.

**Overcoming Resistance to Change**

Spanbauer (1992) cited reasons for overcoming this resistance, such as
satisfied customers, increased enrollments, falling attrition rates, and an improved
graduate placement rate as well as significant cost savings. These reasons were
verified through the use of audits, surveys, and reviews. The benefits of a quality
model have also been verified by Seymour (1991a) in a study of TQM implementation
in educational organizations. He reported one institution where quality principles in
student affairs had improved the matriculation rate to nearly 80%.
Spanbauer's (1992) analysis of service quality and the planning model he helped initiate in 1985 have highlighted the need for a mission, a philosophy, strategic directions, administrative guidelines, allocation plans, and evaluation of results. These same components of a quality system have been identified by the use of ISO 9000 standards (International Organization for Standardization, 1990, 1992; Lamprecht, 1991; Rothery, 1991).

The need to have had commitment from senior management, to have created teams that communicated freely, and to have a means for management to meet goals have been common to educational management as a service industry and industry as a whole (International Organization for Standardization, 1992; Spanbauer, 1992). The model developed by Spanbauer (1987, 1992) which incorporated the philosophy of industry leaders in quality (such as Crosby, Deming, Juran, Albrecht, Zemke, and Hayes) has been ideally suited to adaptation of ISO 9000 standards (International Organization for Standardization, 1987, 1990, 1992).

Management in an Industrial Technology Department

The Dean of an academic department such as Industrial Technology has been responsible for formulating policies and presenting them to the department chair, department faculty and/or university president for consideration. It has traditionally been the Dean's responsibility to satisfy customer expectations (Spanbauer, 1992). But usually these customer needs (of students, employers, and taxpayers) were not easily identifiable (Goheen, 1969).
It has usually been the Dean’s responsibility to change the educational focus and practice of the faculty (Blackwell, 1966). This often made the Dean the buffer between the institutional level: Board of trustees and presidents, and the technical level: research, teaching and service by faculty (Birnbaum, 1989).

Department chairs have often been termed middle managers (Blau, 1973; Tucker, 1981), although they were seldom selected for their management abilities or expertise (Bennett, 1983; Cardozier, 1987; Tucker, 1981). At some institutions, prior management experience was a liability (Green, 1988). The duties of the chair have often been influenced by the political activities of a faculty union, which limited the leadership that was demonstrated. This also tended to limit the accountability and responsiveness to the customers that it served (Kemerer & Baldridge, 1975).

The faculty role in the governance and operation of a department has been well documented. Faculty have had a prominent role in the policies, decisions, and ongoing activities of determining and accomplishing the mission and duties of an academic department (Schuster, Wheeler, & Associates, 1990). Faculty were frequently considered members of management rather than mere employees of the institution or department (Bowen & Schuster, 1986).

Summary

Contrary to those who have stated that industrial measures were not applicable to higher education (Birnbaum, 1989; Tucker, 1981), the principles and processes of industrial management have proven to be increasingly pertinent and relevant. This
was because of the same need for efficiency and effectiveness, to have productively and effectively utilized limited resources, and the concept of judgement on quality of service (Freedman, 1987; Spanbauer, 1987, 1992; UNESCO, 1984; Westmeyer, 1990).

Good quality has been demonstrated by an increase in customer satisfaction and cost containment after the application of industrial management concepts to the educational setting (Spanbauer, 1992). These benefits have been documented as a result of the Quality First program, TQM, and Malcolm Baldrige criteria.

Davis' (1990) view that since one cannot stop the world, one should prepare his/herself for the future has been especially appropriate for institutions of higher education entering the 1990s. Large multi-campus state regional universities have proven they were the innovators of change and have been recognized for the impact they have had on improving quality in the educational setting (Kaplan, 1976).

Although ISO 9000 standards were originally adopted for manufacturing industries, ISO 9004-2 guidelines (released in August, 1992) were intended for service industries, an example of which was education (International Organization of Standardization, 1992; Rothery, 1991). To date, no reference has demonstrated the application of ISO 9000 standards to any area or institution of higher education. Service industries in England have been certified to ISO standards, but no record of a service industry certification has been recorded in the U.S. as of September, 1992 (Lamprecht, 1992).
The fundamental differences concerning management between government institutions and businesses has been blamed for preventing educational institutions from being managed like businesses. While government institutions, including educational entities, have been described and managed as bureaucracies and often blamed for having had no accountability, businesses have often been forced to change their management styles to stay competitive on a global scale and to make profit for owners or stockholders. Recently, the similarities between government institutions and businesses have allowed current quality methods and practices that originated in industry to have been utilized in government as well as industry (Osborne & Gaebler, 1992).
CHAPTER 3

METHODOLOGY

Introduction

This chapter describes the methods and procedures utilized to conduct this study. This study was descriptive in nature and focused on identifying instances in Industrial Technology departments at post-secondary 4-year institutions where a quality management standard had been applied.

Research Tradition

The integration of quality principles and techniques to existing systems has to an extent been considered subjective in nature. In controlled settings, the process may lend itself to traditional scientific inquiry. Theory tends to be value-laden (Howe, 1985) and personal interest is difficult if not impossible to set aside, particularly when broaching the topic of quality in education.

Most information gathered for this research was anecdotal, and as such, was of immeasurable value when determining the level of quality in management present within Industrial Technology Departments, as well as the applicability of ISO 9004-2 guidelines to a singular academic department.

The researcher identified all Industrial Technology related departments within the boundaries of the United States which graduated students in the area of Industrial Technology as the target population. This described and created a natural setting without attempting to manipulate variables (Gloeckner & Gerst, 1994). Technology
educators in particular have proven adept at utilizing research in responses and analysis as a form of understanding the learning environment.

Definition of the Population

The population for this survey was limited to the deans, chairs, and one faculty member of 130 Industrial Technology related departments at 4-year post-secondary institutions (Dennis, 1993-94). These 130 institutions were identified by being Industrial Technology related and having graduated students with Industrial Technology related degrees. To prevent bias toward institutions with multiple departments in the area of Industrial Technology, only the department with the closest curricular area to Industrial Technology was surveyed, or if there was more than one, only the largest (determined by the number of faculty) was included in the study.

Sample

The sample for this study included 390 persons grouped into three categories: 130 deans of colleges that included Industrial Technology Departments, 130 chairs of Industrial Technology Departments, and 130 faculty members of Industrial Technology Departments. Chairs identified in the Industrial Teacher Education Directory as being associated with Industrial Technology related departments were selected by stratified random sample.

Instrumentation

The instrument for this study (see Appendix C) was a survey consisting of three parts and was developed by the researcher. The format of the survey paralleled
a self-assessment audit created by Lamprecht (1992). As a pre-certification instrument, it was intended to indicate the readiness of an organization to achieve certification, but not to grant certification (Lamprecht, 1991). Although ISO 9004-2 guidelines were intended for service organizations such as education, the development of the survey required formulating language appropriate for higher education (Lamprecht, 1992).

The survey was used due to its familiarity in educational institutions and its strength as an information-gathering tool (Balsley & Clover, 1988). A mailed survey also offered the advantage of seeking responses from a much larger group than a personal interview would have allowed (Brusaw, Alred, & Oliu, 1987). The only generalizations that occurred were by finding similar opinions among participants.

The survey was intended to gather the perceptions of the deans, chairs, and faculties of Industrial Technology Departments at 4-year post-secondary Industrial Technology related programs. An analysis by the researcher of the 19 factors of the ISO 9004-2 guidelines was prepared by cross-referencing information from the International Organization for Standardization (1987, 1992) and Rothery (1991). From these 19 factors, 15 were considered by the researcher to be appropriate for educational institutions and were interpreted with language and illustrative comments in a manner considered understandable by persons in institutions of higher education.

The interpretations made by the researcher with regard to the ISO-9000 standard as it applied to higher education should be noted. The "product" that was
produced in the manufacturing setting was interpreted as a successful graduate of the Industrial Technology program. The "manufacturing process" was interpreted as the educational process designed to create a graduate. The "equipment" used in the manufacturing process became the administrators and faculty used to deliver the education to the student. "After-sales servicing" was interpreted as post-graduation servicing. "Quality in procurement" was interpreted as the hiring of faculty and administrators at the educational institutional setting.

The first part of the survey was the attitude assessment portion of the instrument and integrated current perceptions of the ISO 9004-2 guidelines into 15 goal statements: (a) administrative leadership, (b) commitment to quality, (c) internal feedback, (d) costs of quality, (e) marketing strategy, (f) curriculum development, (g) hiring decisions, (h) teaching quality, (i) student outcomes, (j) measurement, (k) system failure, (l) placement and continuing education, (m) documentation, (n) continuous improvement and (o) statistical measures for success. Participants were requested to evaluate each interpreted factor of the ISO 9004-2 guidelines considered appropriate for education with responses limited to a 5-degree Likert scale. The respondent was requested to strongly agree (5), agree (4), remain neutral (3), disagree (2), or strongly disagree (1) with the applicability of each goal to the management of their Industrial Technology Department.

The goal statements were validated as being representative of ISO 9004-2 guidelines by mailing a copy of the 15 factors to 50 administrators and faculty asking
them to interpret the standard for use in education. The responses from these persons was analyzed to determine whether changes in the structure of the survey were justified, while still conforming to ISO 9004-2 guidelines. Based on this feedback, several questions were reworded to clarify meaning.

The second part of the survey assessed the degree to which the participants perceived that their respective department had implemented the factor as stated. The respondents were asked to evaluate implementation on a four level scale ranging from "Already developed, Being developed, Needs to be developed" to "Not needed."

The third portion of the instrument was provided for the respondent to add pertinent comments in an open question format. The open response portion of each goal statement was designed to offer the participant an opportunity to express his or her opinion. This has shown to have a motivational effect on the participant, as well as demonstrating the participant's interpretation. Open questions have also allowed the participant a wider range of responses according to Ary, Jacobs, and Razavieh (1990). Although the responses were complex, the participant had the opportunity to demonstrate knowledge about the issue or to expound on a formulated opinion (McCallon & McCray, 1975; Richardson, Dohrenwald, & Klein, 1965). The open question format has been considered appropriate where information was not available from other sources (McCallon & McCray, 1975). This combination of limited and free response questions has been considered effective in exploratory instances (Ary et al., 1990; McCallon & McCray, 1975).
Data Collection

Approval was obtained from the University of Northern Iowa Human Subjects Committee (see Appendix B). During April 1994, the survey was mailed to the 390 selected deans, department chairs, and randomly selected faculty members at 130 4-year post-secondary institutions located throughout the U.S. The mailing included an introductory letter and the survey instrument. A pre-addressed return envelope with a code number was also included. Using the coded envelope system, the initial response and the follow-up reminder yielded a response rate of 24%.

Following the initial response, over 40 telephone calls were conducted by the researcher to members of the survey population who had not returned their survey. This did not yield additional responses, but indicated that these potential respondents had no intent to return the survey. Reasons for this will be discussed later.

Data Analysis

The research question format was used as opposed to an hypotheses. This was due to the lack of previous research or analysis of industrial quality management practices to academic departments (i.e., Industrial Technology) at 4-year post-secondary educational institutions.

The research questions for this study were identified as follows:

1. What are the differences in perceptions in measurements of quality between the three population categories (dean, department chair, and faculty) based on 15 factors as defined by ISO 9004-2 guidelines?
2. To what extent have ISO 9004-2 guidelines been implemented in Industrial Technology Departments as perceived and reported by the three population categories?

3. What are the differences in perceptions of level of implementation of ISO 9004-2 guidelines in Industrial Technology Departments between the three population categories?

4. How can the factors identified by ISO 9004-2 guidelines be used to indicate quality management within Industrial Technology related programs at 4-year post-secondary institutions?

The statistical techniques used to test the research questions included measures of central tendency and variability calculations for the responses to ISO 9004-2 guidelines. The statistical procedure used for the variables was the analysis of variance (ANOVA), with the level of significance established at alpha = 0.10 due to the exploratory nature of the research and the lack of a justifiable hypothesis (Witte, 1989). This study was intended to be applied science with the results to have practical usefulness and application, rather than pure or hard science (Balsley & Clover, 1988). The Scheffe’ method was used for post-hoc testing for significant differences. The statistical software package used was Statview II (Abacus, 1992).

Variables of the Study

For the quantitative analysis portion of the study, the dependent variables were the perceptions of the respondents as measured on the 5-point Likert scale. For data
analysis, the ANOVA design was used because the data could be treated as if it were on an interval scale. The Scheffe' procedure was used for post-hoc testing for significant differences.

The independent variables of the study were: (a) job classification (categorical variable): dean, department chair, faculty member, (b) Industrial Technology related department implementation of quality (a categorical variable identified as already developed, being developed, needs to be developed, or not needed), and (c) the 15 factors of ISO 9002-4 guidelines as defined by the researcher.
CHAPTER 4

THE SURVEY

The survey was based on the 19 factors of ISO 9004-2 guidelines considered appropriate for educational institutions (International Organization for Standardization, 1987, 1990, 1992; Rothery, 1991). Of the original 19 factors approved by the International Organization of Standardization, 15 were considered appropriate for post-secondary education based on a survey mailed randomly to 50 individuals composed of deans, chairs, and faculty not included in the final survey. These 15 factors were interpreted by the researcher to use diction appropriate to the staff of Industrial Technology Departments at post-secondary, state regional institutions.

The 20 factors identified for inclusion in the document were briefly outlined in Appendix E. The first factor considered appropriate for education was the paragraph of Q91 (4.1) that referred to management responsibility. This factor directed upper management to identify the need for a management quality system within the company or firm, and subsequently link this need with the goals and objectives of the company.

Management was to have spearheaded the quality activities and monitored their progress. By including this factor, it was expected to have identified which populations were able to recognize definite administrative responsibilities relative to a management quality system. This factor related to Question 1 of the survey.

The second factor of ISO 9004-2 guidelines considered appropriate concerned the understanding of quality system principles by all employees (4.2 of Q91). The
ISO standards specified that to work together as a team, it was the responsibility of all employees to have shared a common understanding of quality system principles. This factor related to Question 2 of the survey, but was intentionally changed to specify administrators and faculty.

The third factor of ISO 9004-2 guidelines considered appropriate was the need for a method of internally auditing the quality system (4.17 of Q91). This internal auditing was to have kept everyone discussing the system and utilizing the data gathered to continuously improve the system. This factor related to Question 3 of the survey.

The factor which considered cost considerations was also considered applicable. The economics were considered realistic and the need to have understood its impact on the system was important for all employees (the researcher identified both administrators and faculty). This factor related to Question 4 of the survey.

The fifth factor involved factor 4.3 of Q91, which involved quality in marketing efforts. As in all other factors of ISO 9000 standards, the specific aspects of marketing documented for accreditation were left for interpretation by the individual institution. In the survey, the researcher has listed two examples of marketing efforts. This was done to assist the respondents in understanding the meaning of the factor. This factor related to Question 5 of the survey.

The next factor involved the need for quality in specification, design of the product and manufacturing processes in an industrial facility (4.4 of Q91). As
interpreted for higher education, this became an identification of the major and/or curriculum for the Industrial Technology major. This factor related to Question 6 of the survey.

The seventh factor of ISO 9004-2 guidelines (4.6 of Q91) involved quality in procurement. In the manufacturing setting, this typically would have involved procurement of raw materials as well as procurement of processing machinery. In the educational setting, the researcher interpreted this factor to involve the hiring of faculty and administrators. This factor related to Question 7 of the survey.

The next factor identified quality in the production process in manufacturing and industrial settings (4.9 of Q91). The researcher interpreted this to have meant quality in the teaching process in higher education. This related to Question 8 of the survey.

The ninth factor (4.8 of Q91) referred to the need for material control and traceability in the industrial setting. The researcher interpreted this to include the design and tracking of student progress throughout the learning process. This related to Question 9 of the survey.

The 10th factor referred to the inspection and testing of the product in manufacturing for purposes of verifying quality or conformance to specifications (4.10 of Q91). The researcher interpreted this to mean the measuring and testing process necessary for verification of a quality education. This related to Question 10 of the survey.
The researcher interpreted the factor relating to the control of nonconforming product in manufacturing (4.13 of Q91) to have equated to the need to identify students not meeting the requirements for graduation in higher education. This related to Question 11 of the survey.

The need for a quality system in after-sales servicing in the industrial setting (4.19 in Q91) was interpreted by the researcher to have meant post-graduation services for students. This related to Question 12 of the survey.

The section of Q91 which referred to document control in the industrial setting (4.5) was interpreted as the need for a quality system in documentation and records in the higher education setting, especially as it related to utilizing paperwork to infuse information into the system. This related to Question 13 of the survey.

Section 4.18 of Q91 referred to the need for continuous personnel training in the industrial setting. The researcher chose to limit this training in the higher education setting to faculty and administrators, although to follow the spirit of ISO 9000 it would have included all employees of an institution of higher education. This factor related to Question 14 of the survey.

The factor which related to the use of statistical methods in section 4.20 of Q91 was intended for predicting the rate of nonconforming product and the failure rate of the materials and other resources in the manufacturing process. This was interpreted to have applied to a statistical measurement for predicting the success rate of students. This related to Question 15 of the survey.
CHAPTER 5

RESULTS

All results have been presented in tabular form for clarity and to shorten textual explanations (Mancuso, 1990). A profile for each population was developed and then compared between the three categories of respondents, as well as determining a cumulative response and noting observable trends. Results were represented to the nearest percentage. Appendix F illustrates the response rate.

Each returned survey was ranked according to the general attitude of the respondent (whether or not the respondent tended to agree or disagree with the appropriateness of ISO 9004-2 guidelines for the management of their department). Observable trends were compared between the categories of respondents, as well as by individual question between the respondents.

The summarization portion of the survey addressed instances where Industrial Technology related departments were currently achieving a factor of ISO 9004-2 guidelines. It also sought to identify instances where departments were meeting the guidelines and how they were accomplishing this.

The summarization highlighted agreement as well as differences between the deans, chairs and faculty surveyed. This emphasized difficulties that would have occurred if a department had pursued utilization of ISO 9004-2 guidelines at that time. This methodology was intended to benchmark the applicability of ISO 9004-2 guidelines in Industrial Technology Departments at 4-year institutions.
General Characteristics of the Results

Respondents indicated the appropriateness of ISO 9004-2 guidelines for the management of their Industrial Technology Department, as well as measures of quality of management that were currently being used within their department. Respondents were also asked to describe the applicability of ISO 9004-2 guidelines to their Industrial Technology Department on a 5-point Likert scale, where 5 indicated a strong agreement with the applicability of that factor, 4 indicated agreement, 3 indicated neutrality, 2 demonstrated disagreement, and 1 indicated a strong disagreement with that factor.

The response rate was 24% when the entire population was considered, but this was significantly hampered by not performing a pre-screening to determine the number of departments involved in a quality management program or interested in becoming involved in a quality management program. When the researcher followed up the survey with over 40 telephone calls to elicit additional responses, the most common response was that their department or institution was not interested in quality management, or another common response seemed to be a lack of interest in the survey because quality of management was not understood at their institution.

The number of chairs responding was more than twice as high as either deans or faculty. The number of deans and the number of faculty who responded were similar. The effect of this was noted by the researcher and was compensated for in the results.
As shown in Appendix F, the most responses were received from chairs of Industrial Technology related departments. Respondents tended to answer a majority of the statements on the survey, with 0 to 8% of the respondents not answering any individual question. This established a high item completion rate among respondents.

Research Question One

1. What are the differences in perceptions in measurements of quality between the three population categories (dean, department chair, and faculty) based on 15 factors as defined by ISO 9004-2 guidelines? This research question was seeking responses to the 15 identified factors of ISO 9004-2 guidelines considered appropriate for an Industrial Technology Department.

Survey Question One

This statement addressed the need for administrators to have developed a leadership role and have taken responsibility for a quality program in the department. This factor was directly related to the original industrial version of the ISO 9000 document, which required that upper management take responsibility for and steer the quality of management direction within their industrial organization. From the original ISO 9000 document, management was expected to have translated the primary goals into a set of quality objectives and activities. Management was further expected to have documented this with a written quality policy, which defined the responsibility, authority, and interrelation of all personnel whose work affected quality. Management was also to have determined timely audits to insure the
suitability and effectiveness of the quality system and assured that records were maintained of this activity.

This statement set the tone for the remainder of the survey and generally received rather strong replies in the open response portion that supported the Likert scale portion of the survey. The results of this statement are shown in Table 1.

Table 1

Responses to Survey Statement 1—"It is necessary that administrators develop a leadership role and take responsibility for the development of a quality program within the Industrial Technology Department."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strngly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutrl (3)</th>
<th>Disagrd (2)</th>
<th>Strngly disagrd (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean(20)</td>
<td>13(65%)</td>
<td>3(15%)</td>
<td>2(10%)</td>
<td>2(10%)</td>
<td>0(0%)</td>
<td>4.35</td>
<td>1.04</td>
<td>2.33</td>
</tr>
<tr>
<td>Chair(49)</td>
<td>29(59%)</td>
<td>19(39%)</td>
<td>1(2%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0.57</td>
<td>0.54</td>
<td>0.08</td>
</tr>
<tr>
<td>Fac(25)</td>
<td>15(60%)</td>
<td>9(36%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>1(4%)</td>
<td>4.48</td>
<td>0.87</td>
<td>0.17</td>
</tr>
<tr>
<td>Total(94)</td>
<td>57(61%)</td>
<td>31(33%)</td>
<td>3(3%)</td>
<td>2(2%)</td>
<td>1(1%)</td>
<td>4.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of the ANOVA test are shown in Table 2. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.
Table 2

Analysis of Variance of Survey Statement 1

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>0.71</td>
<td>0.36</td>
<td>0.61</td>
</tr>
<tr>
<td>Within groups</td>
<td>91</td>
<td>52.79</td>
<td>0.58</td>
<td>p = 0.54</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>53.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Two

This statement of the survey stated that all administrators and faculty needed to have made a firm commitment to the quality program. The responses to this portion of the survey demonstrated an especially strong belief by the respondents that a commitment was needed to the quality system, with deans and faculty having the highest percentages of neutral responses. From the original industrial version of the ISO 9000 document, this commitment was expected by all workers in an industrial environment, but for purposes of this survey only those personnel being surveyed were asked about their commitment.

The high percentage of respondents to this statement, as well as the high mean score demonstrated how strongly this factor was recognized for its importance. It should be noted that not a single respondent disagreed and that a relatively high percentage of respondents chose to respond to this factor. The results of this survey statement have been shown in Table 3.
Table 3

Responses to Survey Statement 2—"All administrators and faculty need to make a firm commitment to the quality program."

<table>
<thead>
<tr>
<th>Position (number replied)</th>
<th>Strongly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutral (3)</th>
<th>Disagreed (2)</th>
<th>Strongly disagreed (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean (20)</td>
<td>13 (65%)</td>
<td>5 (25%)</td>
<td>2 (10%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>4.45</td>
<td>0.95</td>
<td>0.21</td>
</tr>
<tr>
<td>Chair (51)</td>
<td>39 (76%)</td>
<td>10 (20%)</td>
<td>2 (4%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>4.73</td>
<td>0.53</td>
<td>0.08</td>
</tr>
<tr>
<td>Faculty (26)</td>
<td>19 (73%)</td>
<td>4 (15%)</td>
<td>3 (12%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>4.62</td>
<td>0.70</td>
<td>0.14</td>
</tr>
<tr>
<td>Total (97)</td>
<td>70 (72%)</td>
<td>19 (20%)</td>
<td>8 (8%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>4.60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As evidenced by the results of the survey, this factor of the ISO 9004-2 guidelines was considered of importance by the respondents in the management of their department. This factor had one of the higher response rates for the survey (see Appendix F). It appears from Appendix H that this factor had one of the higher agreement rates of any factor in the survey. From Table 3, it can be seen that no respondent chose to disagree with this factor, and only 8% chose to be neutral regarding this statement.

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. Shown in Table 4 are the results of the ANOVA test. The results were not significant, indicating there were no significant differences between the 3 groups surveyed. This supports the data in Appendix H.
Table 4

Analysis of Variance of Survey Statement 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.11</td>
<td>0.56</td>
<td>1.21</td>
</tr>
<tr>
<td>Within groups</td>
<td>94</td>
<td>43.26</td>
<td>0.46</td>
<td>$p = 0.30$</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
<td>44.37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Three

This question stated that internal scrutiny and feedback functions should have been established within the department. The results are shown in Table 5.

Table 5

Responses to Survey Statement 3—"Internal scrutiny and feedback functions should be established within the Industrial Technology Department."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strngly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutrl (3)</th>
<th>Disagrd (2)</th>
<th>Strngly disagrd (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean(20)</td>
<td>9(45%)</td>
<td>7(35%)</td>
<td>4(20%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.25</td>
<td>0.79</td>
<td>0.18</td>
</tr>
<tr>
<td>Chair(49)</td>
<td>27(55%)</td>
<td>21(43%)</td>
<td>1(2%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.53</td>
<td>0.54</td>
<td>0.08</td>
</tr>
<tr>
<td>Fac(24)</td>
<td>14(58%)</td>
<td>9(38%)</td>
<td>1(4%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.54</td>
<td>0.59</td>
<td>0.12</td>
</tr>
<tr>
<td>Total(93)</td>
<td>50(54%)</td>
<td>37(40%)</td>
<td>6(6%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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There was general homogeneity among responses, as shown by the ANOVA test in Table 6. The ANOVA test was conducted to test the difference between the 3 groups of respondents. There were found to be no significant differences between the 3 groups surveyed.

Table 6

Analysis of Variance of Survey Statement 3

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.27</td>
<td>0.64</td>
<td>1.69</td>
</tr>
<tr>
<td>Within groups</td>
<td>90</td>
<td>33.91</td>
<td>0.38</td>
<td>p = 0.19</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>35.18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Four

This question stated that administrators and faculty should have been familiar with the costs of the quality system. The results have been shown in Table 7. Although the results appeared to demonstrate a strong agreement with this factor, the data in Appendix H indicates that the costs of the quality system (statement 4) were not as important as the commitment (statement 2) or the leadership demonstrated by management (statement 1). No respondent chose to disagree with this factor of the ISO 9004-2 guidelines, although a higher percentage than previously shown appeared neutral.
Table 7

Responses to Survey Statement 4—"Administrators and faculty should be familiar with the costs of the quality system (i.e., as related to budget restraints)."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strongly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutral (3)</th>
<th>Disagreed (2)</th>
<th>Strongly disagreed (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean (20)</td>
<td>6(30%)</td>
<td>7(35%)</td>
<td>7(35%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>3.95</td>
<td>0.83</td>
<td>0.19</td>
</tr>
<tr>
<td>Chair (47)</td>
<td>19(40%)</td>
<td>24(51%)</td>
<td>4(9%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.32</td>
<td>0.63</td>
<td>0.09</td>
</tr>
<tr>
<td>Fac (25)</td>
<td>12(48%)</td>
<td>10(40%)</td>
<td>3(12%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.36</td>
<td>0.70</td>
<td>0.14</td>
</tr>
<tr>
<td>Total (92)</td>
<td>37(40%)</td>
<td>41(45%)</td>
<td>14(15%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between groups of respondents, the ANOVA test was conducted, with the results shown in Table 8. Significant differences were noted.

Table 8

Analysis of Variance of Survey Statement 4

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>2.33</td>
<td>1.16</td>
<td>2.41*</td>
</tr>
<tr>
<td>Within groups</td>
<td>89</td>
<td>42.92</td>
<td>0.48</td>
<td>p = 0.10</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>45.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .10

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The Scheffe test was used and the results are displayed in Table 9. The test was conducted because of the $F$ value in the ANOVA test. It was found that deans' responses were significantly lower than chairs and faculty (if we are willing to accept a relatively large Type I error). This was not unexpected due to the propensity for administrators to consider themselves the managers of costs. This was not significant at the 0.10 level, but was significant when $0.10 < p < 0.25$. Statistical tables show $p$ at the 0.10 level (with 2; 80 degrees of freedom) to be 2.37 and $p$ at the 0.25 level (with 2; 80 degrees of freedom) to be 1.41.

Table 9

Survey Statement 4—Comparison Between Ranks Regarding Responses

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe $F$-ratio</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>-0.37</td>
<td>1.98</td>
<td>$0.1 &lt; p &lt; 0.25$</td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>-0.41</td>
<td>1.94</td>
<td>$0.1 &lt; p &lt; 0.25$</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>-0.04</td>
<td>0.03</td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Five

This question related to the importance of having developed a marketing strategy within the department. This related directly to the original industrial version of ISO 9000 guidelines. The results have been indicated in Table 10.
Almost 75% of the respondents strongly agreed with this factor of the ISO 9004-2 guidelines and almost 95% of the respondents agreed, so it appeared that marketing strategies were recognized as an important component of management for departments. This was reinforced when over half of the respondents felt that a good marketing strategy was not currently in place in their department, but needed to be developed (see Appendix I). It appeared that the marketing function was as important to the management of an Industrial Technology Department as to an organization in the industrial setting. The ISO 9004-2 stressed the importance of an overall strategy for marketing, rather than just doing some marketing.

Table 10

Responses to Survey Statement 5—"It is important that marketing strategies (i.e., student recruitment, public relations) be established within the Industrial Technology Department."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Stringly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutrnl (3)</th>
<th>Stringly Disagrd (2)</th>
<th>Disagrd (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean (18)</td>
<td>11 (61%)</td>
<td>4 (22%)</td>
<td>2 (11%)</td>
<td>0 (0%)</td>
<td>1 (6%)</td>
<td>4.39</td>
<td>0.92</td>
<td>0.22</td>
</tr>
<tr>
<td>Chair (51)</td>
<td>39 (76%)</td>
<td>9 (18%)</td>
<td>2 (4%)</td>
<td>1 (2%)</td>
<td>0 (0%)</td>
<td>4.67</td>
<td>0.74</td>
<td>0.10</td>
</tr>
<tr>
<td>Fac (25)</td>
<td>19 (76%)</td>
<td>5 (20%)</td>
<td>0 (0%)</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
<td>4.68</td>
<td>0.69</td>
<td>0.14</td>
</tr>
<tr>
<td>Total (94)</td>
<td>69 (74%)</td>
<td>18 (19%)</td>
<td>4 (4%)</td>
<td>2 (2%)</td>
<td>1 (1%)</td>
<td>4.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A high percentage of respondents agreed with this statement, possibly because most academic departments and institutions have established marketing functions within the last 20 years. Many departments have not been forced to be an active agent in the marketing strategies of their department within the institution and the researcher has recognized that this may have accounted for the 5% of respondents who remained neutral and 2% who disagreed.

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. Shown in Table 11 are the results of the ANOVA test. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.

Table 11

Analysis of Variance of Survey Statement 5

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.16</td>
<td>0.58</td>
<td>1.00</td>
</tr>
<tr>
<td>Within groups</td>
<td>91</td>
<td>53.05</td>
<td>0.58</td>
<td>p = 0.37</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>54.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Six

This stated it was imperative that the aspects of a quality program should have been considered when specifying and/or designing a major or curriculum. From the
original industrial version of the guidelines, this related to the need to have considered quality in production when designing a product or service. Fewer respondents agreed with this statement than any previous factor, with deans tending to disagree with this statement more strongly. The results have been shown in Table 12.

Table 12

Responses to Survey Statement 6—"It is imperative that the aspects of a quality program be considered when specifying and/or designing a major or curriculum."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strngly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutrl (3)</th>
<th>Disagrd (2)</th>
<th>Strngly disagrd (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean(17)</td>
<td>8(47%)</td>
<td>5(29%)</td>
<td>1(6%)</td>
<td>2(12%)</td>
<td>1(6%)</td>
<td>4.00</td>
<td>1.28</td>
<td>0.31</td>
</tr>
<tr>
<td>Chair(51)</td>
<td>35(69%)</td>
<td>13(25%)</td>
<td>2(4%)</td>
<td>1(2%)</td>
<td>0(0%)</td>
<td>4.61</td>
<td>0.67</td>
<td>0.09</td>
</tr>
<tr>
<td>Fac(25)</td>
<td>13(52%)</td>
<td>10(40%)</td>
<td>2(8%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.44</td>
<td>0.65</td>
<td>0.13</td>
</tr>
<tr>
<td>Total(93)</td>
<td>56(60%)</td>
<td>28(30%)</td>
<td>5(6%)</td>
<td>3(3%)</td>
<td>1(1%)</td>
<td>4.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. Shown in Table 13 are the results of the ANOVA test. The results were significant. Chairs and faculty appeared to be more involved with the development of curriculum and majors than deans. This observation is partially supported by the data in Table 14, which shows that chairs tended to be more supportive than deans.
Table 13

Analysis of Variance of Survey Statement 6

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>4.72</td>
<td>2.36</td>
<td>3.64*</td>
</tr>
<tr>
<td>Within groups</td>
<td>90</td>
<td>58.32</td>
<td>0.65</td>
<td>p = 0.03</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>63.03</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10

The Scheffe test was used to test for differences between pairs of groups.

The results are shown in Table 14. Deans were found to be lower than chairs and faculty (at the indicated p value). This was not unexpected because deans are more removed from the process when designing a curriculum or major.

Table 14

Survey Statement 6—Comparison Between Ranks Regarding Responses.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>-0.61</td>
<td>3.64</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>-0.44</td>
<td>1.51</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>0.17</td>
<td>0.37</td>
<td></td>
</tr>
</tbody>
</table>
Survey Question Seven

This factor stressed that when hiring an administrator or faculty, it was important to consider whether they could have worked within the parameters of the quality system. The respondents tended to agree with this factor. The deans who responded that they disagreed with this factor were not of high frequency. The responses are illustrated in Table 15.

Table 15

Responses to Survey Statement 7—"When hiring a new administrator or faculty person, it is important to consider whether that person can operate within the bounds of the established quality system."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strngly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutrl (3)</th>
<th>Disagrd (2)</th>
<th>Strngly disagrd (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean (19)</td>
<td>8(43%)</td>
<td>5(26%)</td>
<td>4(21%)</td>
<td>0(0%)</td>
<td>2(11%)</td>
<td>3.90</td>
<td>1.29</td>
<td>0.30</td>
</tr>
<tr>
<td>Chair (49)</td>
<td>24(49%)</td>
<td>19(39%)</td>
<td>4(8%)</td>
<td>2(4%)</td>
<td>0(0%)</td>
<td>4.33</td>
<td>0.80</td>
<td>0.11</td>
</tr>
<tr>
<td>Fac (23)</td>
<td>13(56%)</td>
<td>8(35%)</td>
<td>2(9%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.48</td>
<td>0.67</td>
<td>0.14</td>
</tr>
<tr>
<td>Total (91)</td>
<td>45(49%)</td>
<td>32(35%)</td>
<td>10(11%)</td>
<td>2(1%)</td>
<td>2(4%)</td>
<td>4.24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. Shown in Table 16 are the results of the ANOVA test. The results were significant, indicating there were significant differences between the 3 groups.
Table 16

Analysis of Variance of Survey Statement 7

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3.83</td>
<td>1.91</td>
<td>2.40*</td>
</tr>
<tr>
<td>Within groups</td>
<td>88</td>
<td>70.30</td>
<td>0.80</td>
<td>p = 0.10</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>74.13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10

The Scheffe test was used to discover differences between pairs of groups. The results are shown in Table 17. It was found that the deans were significantly lower than chairs and faculty, if we are willing to accept 0.10 < p < 0.25. This was expected because of the dissatisfaction higher ranks often have with those hired.

Table 17

Survey Statement 7--Comparison Between Ranks Regarding Responses

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>-0.43</td>
<td>1.60</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>-0.58</td>
<td>2.22</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>-0.15</td>
<td>0.23</td>
<td></td>
</tr>
</tbody>
</table>

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**Survey Question Eight**

This factor referred to the need for the concepts of quality to have been incorporated into teaching. Of the respondents, 93 responded to this statement, with an unusually high number being neutral. Faculty tended to respond more frequently in agreement than either chairs or deans, while deans and chairs tended toward neutrality. The response rate tended to be lower than most other statements in the survey. The responses have been shown in Table 18.

**Table 18**

Responses to Survey Statement 8—"The concepts of a quality system need to be incorporated into the teaching process."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strongly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutral (3)</th>
<th>Disagreed (2)</th>
<th>Strongly disagreed (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean (19)</td>
<td>8 (42%)</td>
<td>7 (37%)</td>
<td>3 (16%)</td>
<td>1 (5%)</td>
<td>0 (0%)</td>
<td>4.16</td>
<td>0.90</td>
<td>0.21</td>
</tr>
<tr>
<td>Chair (51)</td>
<td>32 (63%)</td>
<td>12 (23%)</td>
<td>5 (10%)</td>
<td>2 (4%)</td>
<td>0 (0%)</td>
<td>4.45</td>
<td>0.83</td>
<td>0.12</td>
</tr>
<tr>
<td>Fac (23)</td>
<td>19 (83%)</td>
<td>3 (13%)</td>
<td>0 (0%)</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
<td>4.74</td>
<td>0.69</td>
<td>0.14</td>
</tr>
<tr>
<td>Total (93)</td>
<td>59 (63%)</td>
<td>22 (24%)</td>
<td>8 (9%)</td>
<td>4 (4%)</td>
<td>0 (0%)</td>
<td>4.45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of the ANOVA test are shown in Table 19. The results showed that the dean and faculty differed significantly in their responses.
Table 19

**Analysis of Variance of Survey Statement 8**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3.53</td>
<td>1.77</td>
<td>2.67*</td>
</tr>
<tr>
<td>Within groups</td>
<td>90</td>
<td>59.59</td>
<td>0.66</td>
<td>p = 0.08</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>63.12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10

The Scheffe test was conducted to discover differences between pairs of groups. The results in Table 20 show a significant difference between the 3 groups, with deans being lowest and faculty the highest, if 0.10 < p < 0.25. This was expected due to the closeness of faculty to the teaching process.

Table 20

**Survey Statement 8--Comparison Between Ranks Regarding Responses**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>-0.29</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>-0.58</td>
<td>2.66</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>-0.29</td>
<td>0.99</td>
<td></td>
</tr>
</tbody>
</table>
Survey Question Nine

This statement of the survey referred to the need for the process of student learning to have been designed and tracked to ensure that quality concepts were incorporated throughout the higher education learning environment. From the industrial version of ISO 9000 guidelines, this factor was intended to provide a verification of the quality process through tracking and documentation. Over 50% of the respondents strongly agreed with this factor as being important to the management of their department and 90% agreed overall. Agreement with this statement was strongest from the faculty and weakest with the deans. The responses have been shown in Table 21.

Table 21

Responses to Survey Statement 9—"The process of student learning must be designed and tracked to insure that quality concepts are incorporated."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strngly agreed</th>
<th>Agreed</th>
<th>Neutr</th>
<th>Disagrd</th>
<th>Strngly disagrd</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean(17)</td>
<td>7(41%)</td>
<td>6(35%)</td>
<td>4(24%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.18</td>
<td>0.81</td>
<td>0.20</td>
</tr>
<tr>
<td>Chair(48)</td>
<td>25(52%)</td>
<td>18(38%)</td>
<td>3(6%)</td>
<td>1(2%)</td>
<td>0(0%)</td>
<td>4.35</td>
<td>0.86</td>
<td>0.13</td>
</tr>
<tr>
<td>Fac(25)</td>
<td>15(60%)</td>
<td>9(36%)</td>
<td>1(4%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.56</td>
<td>0.58</td>
<td>0.12</td>
</tr>
<tr>
<td>Total(90)</td>
<td>47(52%)</td>
<td>33(37%)</td>
<td>8(9%)</td>
<td>1(1%)</td>
<td>1(1%)</td>
<td>4.36</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results have been shown in Table 22. This indicated that there was no significant difference between the 3 groups surveyed.

Table 22

Analysis of Variance of Survey Statement 9

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.55</td>
<td>0.77</td>
<td>1.25</td>
</tr>
<tr>
<td>Within groups</td>
<td>87</td>
<td>53.61</td>
<td>0.62</td>
<td>p = 0.29</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>55.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Ten

This statement referred to the need for a measuring and testing process to have been established and adhered to in order to guarantee the incorporation of quality. Although testing has been an integral part of learning, the concept of measuring and adhering to a system seemed to confuse a high number of respondents. The concept of calibration of tests was omitted when formulating language for education. This measuring, testing and calibration process was considered an important component when complying to ISO 9000 guidelines in the industrial sector. The responses have been illustrated in Table 23.
Table 23

Responses to Survey Statement 10---"A measuring and testing process must be established and adhered to in order to guarantee the incorporation of quality."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strongly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutral (3)</th>
<th>Disagreed (2)</th>
<th>Strongly disagreed (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean (19)</td>
<td>7 (37%)</td>
<td>4 (21%)</td>
<td>6 (32%)</td>
<td>2 (10%)</td>
<td>0 (0%)</td>
<td>3.84</td>
<td>1.07</td>
<td>0.25</td>
</tr>
<tr>
<td>Chair (48)</td>
<td>19 (40%)</td>
<td>23 (48%)</td>
<td>3 (6%)</td>
<td>3 (6%)</td>
<td>0 (0%)</td>
<td>4.21</td>
<td>0.82</td>
<td>0.12</td>
</tr>
<tr>
<td>Fac (25)</td>
<td>10 (40%)</td>
<td>11 (44%)</td>
<td>2 (8%)</td>
<td>0 (0%)</td>
<td>2 (8%)</td>
<td>4.08</td>
<td>1.12</td>
<td>0.22</td>
</tr>
<tr>
<td>Total (92)</td>
<td>36 (40%)</td>
<td>38 (41%)</td>
<td>11 (12%)</td>
<td>5 (5%)</td>
<td>2 (2%)</td>
<td>4.04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results are shown in Table 24 and were not significant, indicating there were no significant differences between the 3 groups surveyed.

Table 24

Analysis of Variance of Survey Statement 10

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.84</td>
<td>0.92</td>
<td>0.99</td>
</tr>
<tr>
<td>Within groups</td>
<td>89</td>
<td>82.28</td>
<td>0.93</td>
<td>p = 0.37</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>84.12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Survey Question Eleven

This statement referred to a system having been established which identified students who had not met the requirements for graduation. This factor seemed a part of the post-education process for most respondents and was likely the reason for a higher agreement rate. No explanation was apparent from the other portions of the survey for the high disagreement among deans. The responses have been shown in Table 25.

Table 25

Responses to Survey Statement 11—"A system must be established to identify students not meeting the requirements for graduation."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strongly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutr</th>
<th>Disagrd (2)</th>
<th>Strongly disagrd (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean (20)</td>
<td>10(50%)</td>
<td>5(25%)</td>
<td>2(10%)</td>
<td>3(15%)</td>
<td>0(0%)</td>
<td>4.10</td>
<td>1.12</td>
<td>0.25</td>
</tr>
<tr>
<td>Chair (48)</td>
<td>29(60%)</td>
<td>18(38%)</td>
<td>0(0%)</td>
<td>1(2%)</td>
<td>0(0%)</td>
<td>4.56</td>
<td>0.62</td>
<td>0.09</td>
</tr>
<tr>
<td>Fac (24)</td>
<td>17(71%)</td>
<td>7(29%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.71</td>
<td>0.46</td>
<td>0.10</td>
</tr>
<tr>
<td>Total (92)</td>
<td>56(61%)</td>
<td>30(33%)</td>
<td>2(2%)</td>
<td>4(4%)</td>
<td>0(0%)</td>
<td>4.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results are shown in Table 26. The results were significant, indicating there were significant differences between the 3 groups surveyed.
Table 26

Analysis of Variance of Survey Statement 11

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>4.43</td>
<td>2.22</td>
<td>4.23*</td>
</tr>
<tr>
<td>Within groups</td>
<td>89</td>
<td>46.57</td>
<td>0.52</td>
<td>p = 0.02</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>51.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10

The Scheffe test revealed that deans were significantly lower than faculty and chairs when we accept a relatively large Type I error. This is shown in Table 27. This was expected due to the distance administrators have from the testing process.

Table 27

Survey Statement 11--Comparison Between Ranks Regarding Responses

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>-0.46</td>
<td>2.89</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>-0.61</td>
<td>3.86</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>-0.15</td>
<td>0.33</td>
<td></td>
</tr>
</tbody>
</table>
Survey Question Twelve

This portion of the survey stated that a system must be established to provide post-graduation, placement, and educational updating services. The responses are shown in Table 28. Although 75% of the respondents agreed with this statement, chairs tended to disagree at a higher rate than the other respondents and their frequency tended to be noticeable to a degree not seen previously in this study. Most of the responses from the open portion of the survey which supported this factor stressed the accomplishment of this by the Continuing Education or Community Services Department(s) within their institution, rather than through the Industrial Technology Department.

Table 28

Responses to Survey Statement 12—"A system must be established to provide post-graduation, placement and educational updating services to students."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strngly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutrl (3)</th>
<th>Disagrd (2)</th>
<th>Strngly disagrd (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean(19)</td>
<td>8(42%)</td>
<td>8(42%)</td>
<td>3(16%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.26</td>
<td>0.73</td>
<td>0.17</td>
</tr>
<tr>
<td>Chair(48)</td>
<td>22(46%)</td>
<td>17(35%)</td>
<td>3(6%)</td>
<td>5(10%)</td>
<td>1(3%)</td>
<td>4.13</td>
<td>1.06</td>
<td>0.15</td>
</tr>
<tr>
<td>Fac(24)</td>
<td>14(58%)</td>
<td>6(25%)</td>
<td>3(13%)</td>
<td>1(4%)</td>
<td>0(0%)</td>
<td>4.38</td>
<td>0.88</td>
<td>0.18</td>
</tr>
<tr>
<td>Total(91)</td>
<td>44(49%)</td>
<td>31(34%)</td>
<td>9(9%)</td>
<td>6(7%)</td>
<td>1(1%)</td>
<td>4.26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of this ANOVA test are shown in Table 29. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.

Table 29

Analysis of Variance of Survey Statement 12

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.05</td>
<td>0.52</td>
<td>0.57</td>
</tr>
<tr>
<td>Within groups</td>
<td>88</td>
<td>80.56</td>
<td>0.92</td>
<td>(p = 0.57)</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>81.60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Thirteen

This statement referred to the importance of assuring that paperwork and documents were handled and progressed through the system in a consistent manner each and every time. Although most respondents agreed that a better system was necessary, many devalued this statement due to a stated dislike for paperwork. The responses are shown in Table 30.

Since almost 90% of the respondents agreed, it was initially supposed that this factor would have rated high in implementation in Industrial Technology Departments. But in fact, 52% of the respondents stated that this system was currently being
developed or needed to be developed in the management of their Industrial Technology Department. About 44% of the respondents felt that this system was in place and when evaluating the open portion of the survey, it was obvious that the effectiveness of many of these systems was highly questionable.

Table 30

Responses to Survey Statement 13—"It is important to assure that paperwork and documents are handled and progressed through the system in a consistent manner each and every time."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strngly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutrl (4)</th>
<th>Disagrd (3)</th>
<th>Strngly disagrd (2)</th>
<th>M (1)</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean(20)</td>
<td>12(60%)</td>
<td>5(25%)</td>
<td>3(15%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.45</td>
<td>0.76</td>
<td>0.17</td>
</tr>
<tr>
<td>Chair(48)</td>
<td>22(46%)</td>
<td>19(40%)</td>
<td>6(12%)</td>
<td>1(2%)</td>
<td>0(0%)</td>
<td>4.29</td>
<td>0.77</td>
<td>0.11</td>
</tr>
<tr>
<td>Fac(23)</td>
<td>13(57%)</td>
<td>9(39%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>1(4%)</td>
<td>4.44</td>
<td>0.90</td>
<td>0.19</td>
</tr>
<tr>
<td>Total(91)</td>
<td>47(52%)</td>
<td>33(36%)</td>
<td>9(10%)</td>
<td>1(1%)</td>
<td>1(1%)</td>
<td>4.39</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results have been shown in Table 31. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.
Table 31

Analysis of Variance of Survey Statement 13

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>0.51</td>
<td>0.26</td>
<td>0.40</td>
</tr>
<tr>
<td>Within groups</td>
<td>88</td>
<td>56.52</td>
<td>0.64</td>
<td>p = 0.67</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>57.03</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Fourteen

This portion stated that it was imperative to have a system for continued training and education for respondents. The responses are shown in Table 32.

Table 32

Responses to Survey Statement 14--"It is imperative to provide a system for continued training, and education for administrators and faculty."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strongly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutral (3)</th>
<th>Disagreed (2)</th>
<th>Strongly disagreed (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean(19)</td>
<td>10(53%)</td>
<td>5(26%)</td>
<td>4(21%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.32</td>
<td>0.82</td>
<td>0.19</td>
</tr>
<tr>
<td>Chair(48)</td>
<td>29(61%)</td>
<td>14(29%)</td>
<td>5(10%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.50</td>
<td>0.68</td>
<td>0.10</td>
</tr>
<tr>
<td>Fac(25)</td>
<td>20(80%)</td>
<td>4(16%)</td>
<td>1(4%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.76</td>
<td>0.52</td>
<td>0.11</td>
</tr>
<tr>
<td>Total(92)</td>
<td>59(64%)</td>
<td>23(25%)</td>
<td>10(11%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4.53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This factor showed over 90% agreement from the respondents, while over 70% of the respondents felt that this system needed to be developed or was currently being developed within their departments (Table 67). To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results are shown in Table 33. The results were significant, indicating that faculty were higher than chairs, who were higher than deans. This was not unexpected because of the difficulty faculty often have when trying to arrange attendance at training seminars.

Table 33

Analysis of Variance of Survey Statement 14

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>2.24</td>
<td>1.12</td>
<td>2.45*</td>
</tr>
<tr>
<td>Within groups</td>
<td>89</td>
<td>40.67</td>
<td>0.46</td>
<td>p = 0.09</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>42.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10

The Scheffe test was used and the results are displayed in Table 34. The Scheffe test was conducted because of the F value in the ANOVA test. It was found that deans' responses were significantly lower and faculty were highest if we are willing to accept a relatively large Type I error. This was not expected due to the relatively larger amount of paperwork typically performed by administrators.
Table 34

Survey Statement 14—Comparison Between Ranks Regarding Responses

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>-0.18</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>-0.44</td>
<td>2.33</td>
<td>(0.1 &lt; p &lt; 0.25)</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>-0.26</td>
<td>1.22</td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Fifteen

This statement of the survey suggested a statistical measurement for predicting student success should have been a component of the management of the department. When relating this factor to the industrial portion of the ISO 9000 guidelines, this was an important measuring device to determine when quality was improving. The responses have been shown in Table 35. This question had the lowest agreement rate (44%), the highest neutral rate (42%), and the highest disagreement rate (11%) of any other factor in the survey.

According to the responses for this statement, it appeared that this was not considered necessary at the post-secondary level. Other portions of the survey illustrated that few of the respondents understood this factor nor saw relevance when managing the affairs of their Industrial Technology Department. No respondent was able to illustrate that their institution was utilizing this factor in any way. A review
of the ISO 9000 guidelines strongly suggested the importance of the factor in the industrial setting. In industry, this factor was used to accurately predict product of less than acceptable quality so that corrections were made in time to assure a minimum of scrap or to reduce the possibility of extensive rework.

Table 35

Responses to Survey Statement 15—"A statistical measurement for predicting student success should be a component of the management of the Industrial Technology Department (i.e., similar to high school where placement rates, future success, etc. is predicted)."

<table>
<thead>
<tr>
<th>Position (# replied)</th>
<th>Strngly agreed (5)</th>
<th>Agreed (4)</th>
<th>Neutrl (3)</th>
<th>Disagrd (2)</th>
<th>Strngly disagrd (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dean(17)</td>
<td>4(24%)</td>
<td>4(24%)</td>
<td>6(34%)</td>
<td>2(12%)</td>
<td>1(6%)</td>
<td>3.47</td>
<td>1.18</td>
<td>0.29</td>
</tr>
<tr>
<td>Chair(49)</td>
<td>9(18%)</td>
<td>13(27%)</td>
<td>17(35%)</td>
<td>7(14%)</td>
<td>3(6%)</td>
<td>3.37</td>
<td>1.13</td>
<td>0.16</td>
</tr>
<tr>
<td>Fac(23)</td>
<td>4(17%)</td>
<td>5(22%)</td>
<td>13(57%)</td>
<td>1(4%)</td>
<td>0(0%)</td>
<td>3.52</td>
<td>0.85</td>
<td>0.18</td>
</tr>
<tr>
<td>Total(89)</td>
<td>17(19%)</td>
<td>22(25%)</td>
<td>36(40%)</td>
<td>10(11%)</td>
<td>4(5%)</td>
<td>3.45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of this test are shown in Table 36. The results were not significant, indicating that there were no significant differences between the 3 groups.
Table 36

Analysis of Variance of Survey Statement 15

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>0.41</td>
<td>0.21</td>
<td>0.18</td>
</tr>
<tr>
<td>Within groups</td>
<td>86</td>
<td>99.36</td>
<td>1.16</td>
<td>p = 0.84</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>99.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Research Question Two and Three

Research Question 2 asked to what extent ISO 9004-2 guidelines had been implemented as perceived and reported by the respondents. Research Question 3 asked what the differences were in perceptions of level of implementation of ISO 9004-2 guidelines between the respondents. This portion of the survey examined critical differences among the responses of the three levels of respondents. It was to discern whether ISO 9004-2 guidelines would have been an appropriate model for implementation within an Industrial Technology Department to improve the quality of management and by inference, the quality of operation.

Survey Question One

This statement of the survey related to the necessity for administrators to have developed a leadership role and taken responsibility for a quality program within their department. Deans, chairs, and faculty agreed with this statement.
Despite the overall agreement with this factor, less than half of the respondents reported this factor as being established at their institution.

Table 37

Status of Department in Development of Factor 1—"It is necessary that administrators develop a leadership role and take responsibility for the development of a quality program within the Industrial Technology Department."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop (4)</th>
<th>Being develop (3)</th>
<th>Needs to be develop (2)</th>
<th>Not needed (1)</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(23)</td>
<td>14(61%)</td>
<td>5(22%)</td>
<td>3(13%)</td>
<td>1(4%)</td>
<td>3.39</td>
<td>0.89</td>
<td>0.19</td>
</tr>
<tr>
<td>Chairs(50)</td>
<td>22(44%)</td>
<td>12(24%)</td>
<td>15(30%)</td>
<td>1(2%)</td>
<td>3.10</td>
<td>0.91</td>
<td>0.13</td>
</tr>
<tr>
<td>Faculty(23)</td>
<td>8(35%)</td>
<td>4(17%)</td>
<td>10(44%)</td>
<td>1(4%)</td>
<td>2.83</td>
<td>0.98</td>
<td>0.21</td>
</tr>
<tr>
<td>Total(96)</td>
<td>44(46%)</td>
<td>21(22%)</td>
<td>28(29%)</td>
<td>3(3%)</td>
<td>3.12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Despite the strong support shown for this factor in Table 1, less than half of the departments already had a system to accomplish this factor in place, while about 29% of the departments still needed to begin the process of developing this factor, and another 22% were currently in the development stage. To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of this test are shown in Table 38. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.
Table 38

Analysis of Variance of Survey Statement 1

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3.68</td>
<td>1.84</td>
<td>2.156</td>
</tr>
<tr>
<td>Within groups</td>
<td>93</td>
<td>79.28</td>
<td>0.85</td>
<td>p = 0.12</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>82.96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Two

This statement referred to the component of the ISO 9004-2 guidelines which specified that a firm commitment to the quality program must have been made by those involved. Of the total respondent population, about 33% felt that it was already present on their campus, while about 33% felt it was currently being developed, and another 33% felt that it needed to be developed. Those that responded that it was being developed were not specific about the method which was being used. A small minority responded that it was not needed in their Industrial Technology Department, but the frequency of this response was not alarming.

It appears from the data in Table 39 that deans believed more firmly in the accomplishment of this factor than chairs, who in turn believed more firmly in the this factor than faculty. This was in spite of the fact that 90% of the respondents agreed with the need for this factor in the management of their departments (see Table 3).
Table 39

Status of Department in Development of Factor 2---"All administrators and faculty need to make a firm commitment to the quality program."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(25)</td>
<td>13(52%)</td>
<td>10(40%)</td>
<td>1(4%)</td>
<td>1(4%)</td>
<td>3.40</td>
<td>0.76</td>
<td>0.15</td>
</tr>
<tr>
<td>Chairs(50)</td>
<td>15(30%)</td>
<td>16(32%)</td>
<td>18(36%)</td>
<td>1(2%)</td>
<td>2.90</td>
<td>0.86</td>
<td>0.12</td>
</tr>
<tr>
<td>Faculty(24)</td>
<td>4(17%)</td>
<td>5(21%)</td>
<td>14(58%)</td>
<td>1(4%)</td>
<td>2.50</td>
<td>0.83</td>
<td>0.17</td>
</tr>
<tr>
<td>Total(99)</td>
<td>32(32%)</td>
<td>31(32%)</td>
<td>33(34%)</td>
<td>3(2%)</td>
<td>2.93</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Faculty believed that this factor was not present in their department and either needed to be developed or was being developed. Deans felt that it was currently developed or was being developed, but few deans felt that it was needed.

The mean score of this factor demonstrated that most respondents felt this was in place or was in the process of being developed in the management of their Industrial Technology department. Faculty demonstrated disagreement, but their frequency of responses was low.

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of the ANOVA test are shown in Table 40. The results were significant, indicating there was significant difference between the 3 groups surveyed.
Table 40

Analysis of Variance of Survey Statement 2

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>10.01</td>
<td>5.00</td>
<td>7.22*</td>
</tr>
<tr>
<td>Within groups</td>
<td>96</td>
<td>66.50</td>
<td>0.69</td>
<td>p = 0.01</td>
</tr>
<tr>
<td>Total</td>
<td>98</td>
<td>76.51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10

The Scheffe results are displayed in Table 41. Deans responses were significantly higher than responses of chairs and faculty, but this was expected due to the leadership duties of administrators.

Table 41

Survey Statement 2--Comparison Between Ranks Regarding Responses

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>0.50</td>
<td>3.01</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>0.90</td>
<td>7.16</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>0.40</td>
<td>1.87</td>
<td></td>
</tr>
</tbody>
</table>
Survey Question Three

This factor of the ISO 9004-2 guidelines related to the need for an Industrial Technology Department to have monitored itself and corrected its own problems. From the initial understanding of ISO 9000 guidelines, this was important so that industrial organizations did not need to wait for outside accreditors to define quality deficiencies. Of the respondents, over 36% felt this was already occurring, while another 30% felt it was being developed, but most replied that it was being developed too slowly or was not effective in the department when put in use. Another 32% responded that it needed to be developed. Again, a small minority (one dean and one chair) felt it was not needed, but the frequency of this response was not alarming.

The results are shown in Table 42.

Table 42

Status of Department in Development of Factor 3—"Internal scrutiny and feedback functions should be established within the Industrial Technology Department."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(24)</td>
<td>9(38%)</td>
<td>10(42%)</td>
<td>4(16%)</td>
<td>1(4%)</td>
<td>3.13</td>
<td>0.85</td>
<td>0.17</td>
</tr>
<tr>
<td>Chairs(49)</td>
<td>20(41%)</td>
<td>16(32%)</td>
<td>12(25%)</td>
<td>1(2%)</td>
<td>3.12</td>
<td>0.86</td>
<td>0.12</td>
</tr>
<tr>
<td>Faculty(24)</td>
<td>6(28%)</td>
<td>3(13%)</td>
<td>15(69%)</td>
<td>0(0%)</td>
<td>2.63</td>
<td>0.88</td>
<td>0.18</td>
</tr>
<tr>
<td>Total(97)</td>
<td>35(36%)</td>
<td>29(30%)</td>
<td>31(32%)</td>
<td>2(2%)</td>
<td>2.96</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Although 90% of the respondents agreed with the importance of this factor, the upper ranking respondents (deans and chairs) felt more strongly that this factor was currently in place in their Industrial Technology Departments. The faculty, who were represented well by the frequency of their responses, felt much more strongly that it needed to be developed, but was not currently in place nor being developed. Only a small percentage felt that it was not needed.

A relatively high percentage of respondents answered this factor (see Table 5 and Table 42). To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of this test are shown in Table 43. Since the results were significantly different in the ANOVA test based on the F value, the Scheffe post-hoc test was used to determine significant differences between pairs of groups.

Table 43

Analysis of Variance of Survey Statement 3

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>4.49</td>
<td>2.24</td>
<td>3.03*</td>
</tr>
<tr>
<td>Within groups</td>
<td>94</td>
<td>69.52</td>
<td>0.74</td>
<td>p = 0.05</td>
</tr>
<tr>
<td>Total</td>
<td>96</td>
<td>74.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10
The results of the Scheffe test are shown in Table 44. It appears that faculty are significantly lower at \( p < .10 \) level. This was expected due to the administrative duties of deans and chairs.

Table 44

Survey Statement 3—Comparison Between Ranks Regarding Responses

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>0.00</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>0.50</td>
<td>2.03</td>
<td></td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>0.50</td>
<td>2.70</td>
<td>( p &lt; .10 )</td>
</tr>
</tbody>
</table>

Survey Question Four

This identified the need for administrators and faculty to have been cognizant of the costs of the quality system. Approximately 20% of the respondents already had this developed on their campus, while 28% felt that it was currently being developed and 46% felt that it needed to be developed.

Although 85% of the respondents agreed with the importance of this factor (Table 7), only 21% stated that it was already developed in their Industrial Technology Department (Table 45). Almost half (47%) of the respondents felt that it needed to be developed for their department. The results are shown in Table 45.
Table 45

Status of Department in Development of Factor 4—"Administrators and faculty should be familiar with the costs of the quality system (i.e., as related to budget restraints)."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(20)</td>
<td>4(20%)</td>
<td>10(50%)</td>
<td>5(25%)</td>
<td>1(5%)</td>
<td>2.85</td>
<td>0.81</td>
<td>0.18</td>
</tr>
<tr>
<td>Chairs(47)</td>
<td>11(23%)</td>
<td>12(25%)</td>
<td>20(43%)</td>
<td>4(9%)</td>
<td>2.64</td>
<td>0.94</td>
<td>0.14</td>
</tr>
<tr>
<td>Faculty(25)</td>
<td>4(17%)</td>
<td>4(17%)</td>
<td>17(76%)</td>
<td>0(0%)</td>
<td>2.48</td>
<td>0.77</td>
<td>0.15</td>
</tr>
<tr>
<td>Total(92)</td>
<td>19(21%)</td>
<td>26(28%)</td>
<td>42(46%)</td>
<td>5(5%)</td>
<td>2.66</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These results (see Table 45) indicated that should a department have decided to utilize ISO 9004-2 guidelines as a quality model for the management of their Industrial Technology Department, much work would have needed to be accomplished to place this factor in operation in their department. Since few departments currently had such a system in place, there were few models for departments to follow if they desired to put this factor in place. This appeared important considering the number of department who were developing such a system or wished to develop such a system.

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of the ANOVA test are shown in Table 46. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.
**Table 46**

**Analysis of Variance of Survey Statement 4**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.52</td>
<td>0.76</td>
<td>1.00</td>
</tr>
<tr>
<td>Within groups</td>
<td>89</td>
<td>67.64</td>
<td>0.76</td>
<td>p = 0.37</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>69.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Survey Question Five**

This question related to the need for an overall marketing strategy within the Industrial Technology Department. Of the respondents to this question, almost half stated that this was already developed on their campus, while about 30% felt it was currently being developed, and about 20% felt that it needed to be developed.

This factor was not supported by the literature relative to the management of an academic department, but was supported strongly by ISO 9000 guidelines. From other portions of the survey it was obvious that although many Industrial Technology Departments had marketing efforts, these were primarily at the university or college level and few were the responsibility of the Industrial Technology Department. This was in spite of a 71% of the respondents that felt such activities needed to occur within the department (as shown in Table 10). About 52% of the respondents felt that this factor was being developed or needed to be developed in their department. The results of the survey for this factor have been shown in Table 47.
Table 47

Status of Department in Development of Factor 5—"It is important that marketing strategies (i.e., student recruitment, public relations) be established within the Industrial Technology Department."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(23)</td>
<td>11(47%)</td>
<td>9(40%)</td>
<td>2(8%)</td>
<td>1(5%)</td>
<td>3.30</td>
<td>0.82</td>
<td>0.17</td>
</tr>
<tr>
<td>Chairs(50)</td>
<td>26(52%)</td>
<td>14(28%)</td>
<td>9(18%)</td>
<td>1(2%)</td>
<td>3.30</td>
<td>0.84</td>
<td>0.12</td>
</tr>
<tr>
<td>Faculty(26)</td>
<td>9(35%)</td>
<td>6(23%)</td>
<td>10(38%)</td>
<td>1(4%)</td>
<td>2.89</td>
<td>0.95</td>
<td>0.19</td>
</tr>
<tr>
<td>Total(99)</td>
<td>46(47%)</td>
<td>29(30%)</td>
<td>21(22%)</td>
<td>3(1%)</td>
<td>3.16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Many respondents stated in other portions of the survey that their department contacted past graduates or visited industry and that this was adequate for a marketing strategy. Should a department have pursued ISO 9000 accreditation, a thorough review of the guidelines should have been accomplished to determine an overall marketing strategy that would have been comprehensive in nature and assigned specific responsibilities for duties to individuals.

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of the ANOVA test are shown in Table 48. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.
Table 48

Analysis of Variance of Survey Statement 5

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3.33</td>
<td>1.67</td>
<td>2.22</td>
</tr>
<tr>
<td>Within groups</td>
<td>96</td>
<td>72.02</td>
<td>0.75</td>
<td>p = 0.11</td>
</tr>
<tr>
<td>Total</td>
<td>98</td>
<td>75.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Six

This question related to the need identified by ISO 9004-2 guidelines to have had quality considered when designing a product, which was interpreted by the researcher to mean the designing of a major or a curriculum. Of the 98 respondents, 32% felt that this was already in place on their campus, while 36% felt that it was being developed, and 29% felt that it needed to be developed.

Since ISO accreditation allowed a department to interpret the application of any factor, the application of this factor would have involved interpretation by the personnel of a department, followed by the application of the standard to meet the needs of the department. A majority (90%) of respondents agreed with the importance of this factor (Table 12), yet few departments (an average of 32%) currently had this factor in place (Table 49). However, an average of 65% of the respondents either felt this was being accomplished or needed to be accomplished. Refer to Table 49 for the results of this factor of the survey.
Table 49

Status of Department in Development of Factor 6—"It is imperative that the aspects of a quality program be considered when specifying and/or designing a major or curriculum."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(23)</td>
<td>11(48%)</td>
<td>7(30%)</td>
<td>2(9%)</td>
<td>3(13%)</td>
<td>3.13</td>
<td>1.06</td>
<td>0.22</td>
</tr>
<tr>
<td>Chairs(49)</td>
<td>17(35%)</td>
<td>17(35%)</td>
<td>14(28%)</td>
<td>1(2%)</td>
<td>3.02</td>
<td>0.85</td>
<td>0.12</td>
</tr>
<tr>
<td>Faculty(26)</td>
<td>3(12%)</td>
<td>11(42%)</td>
<td>12(46%)</td>
<td>0(0%)</td>
<td>2.65</td>
<td>0.69</td>
<td>0.14</td>
</tr>
<tr>
<td>Total(98)</td>
<td>31(32%)</td>
<td>35(36%)</td>
<td>28(29%)</td>
<td>4(3%)</td>
<td>2.93</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ANOVA test was conducted and the results are shown in Table 50. The results were not significant, indicating there were no significant differences.

Table 50

Analysis of Variance of Survey Statement 6

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3.27</td>
<td>1.64</td>
<td>2.18</td>
</tr>
<tr>
<td>Within groups</td>
<td>95</td>
<td>71.47</td>
<td>0.75</td>
<td>p = 0.12</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>74.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Survey Question Seven

ISO 9004-2 guidelines stated that new employees should have been hired only after a determination had been made that they could have worked within the quality parameters identified by the company or organization. Refer to Table 51 for the results of this factor of the survey. About 84% of the respondents agreed with the importance of this factor in the management of their department. Of the 92 respondents to this question, only 37% felt that this was already in place, while 24% felt that it was currently being developed, and 33% felt that it needed to be developed. Interestingly, several respondents felt that this screening process was not needed for new administrative or faculty personnel.

Table 51

Status of Department in Development of Factor 7- "When hiring a new administrator or faculty person, it is important to consider whether that person can operate within the bounds of the established quality system."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(22)</td>
<td>12(55%)</td>
<td>4(18%)</td>
<td>4(18%)</td>
<td>2(9%)</td>
<td>3.18</td>
<td>1.05</td>
<td>0.22</td>
</tr>
<tr>
<td>Chairs(47)</td>
<td>17(36%)</td>
<td>14(30%)</td>
<td>13(28%)</td>
<td>3(6%)</td>
<td>2.96</td>
<td>0.96</td>
<td>0.14</td>
</tr>
<tr>
<td>Faculty(23)</td>
<td>5(22%)</td>
<td>4(17%)</td>
<td>13(57%)</td>
<td>1(4%)</td>
<td>2.57</td>
<td>0.90</td>
<td>0.19</td>
</tr>
<tr>
<td>Total(92)</td>
<td>34(37%)</td>
<td>22(24%)</td>
<td>30(33%)</td>
<td>6(6%)</td>
<td>2.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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In the industrial setting, this factor was typically accomplished through a testing and verification process before or shortly after an employee was hired, and was often mandatory for all employees regardless of position. No instance of this testing was documented for higher education and verification typically seemed to consist of validation of the appropriate degrees and/or training, or based on the outcome of verbal or written recommendations for the person being hired.

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of this ANOVA test are shown in Table 52. The results were significant, indicating there were significant differences between the 3 groups.

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>4.47</td>
<td>2.23</td>
<td>2.40*</td>
</tr>
<tr>
<td>Within groups</td>
<td>89</td>
<td>82.84</td>
<td>0.93</td>
<td>p = 0.10</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>87.30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Scheffe post-hoc test was used to discover differences between pairs of groups. The results are displayed in Table 53. The Scheffe test was conducted

*\( p < .10 \)
because of the $F$ value (2.40 with 2; 89 degrees of freedom) in the ANOVA test. It was found that deans responses were higher than the responses of faculty if we are willing to accept a relatively large Type I error. These values were not significant at the 0.10 level, but were found to be significant when $0.10 < p < 0.25$. This was expected due to the role in hiring of administrators.

Table 53

Survey Statement 7--Comparison Between Ranks Regarding Responses

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>0.22</td>
<td>0.41</td>
<td></td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>0.62</td>
<td>2.30</td>
<td>$0.1 &lt; p &lt; 0.25$</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>0.39</td>
<td>1.28</td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Eight

ISO 9004-2 guidelines identified the need for quality to be incorporated into the manufacturing process, which the researcher interpreted as the teaching process for purposes of the survey. In the manufacturing environment, the concepts of quality control have become more clearly understood. The researcher chose not to interpret what as meant by quality in teaching, as this contradicted the premise of the ISO 9000 guidelines that an organization interpreted a factor based on their individual needs.
Although 86% of the respondents agreed with the importance of this factor in the management of their department (see Table 18), about 95% of the respondents demonstrated the importance of this factor by having it in place, having it in development, or stating that it needed to be developed. One dean, 3 chairs, and one faculty responded that this was not needed in the Industrial Technology Department (refer to Table 54).

Table 54

<table>
<thead>
<tr>
<th>Status of Department in Development of Factor 8— &quot;The concepts of a quality system need to be incorporated into the teaching process.&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank(freq)</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Deans(24)</td>
</tr>
<tr>
<td>Chairs(46)</td>
</tr>
<tr>
<td>Faculty(24)</td>
</tr>
<tr>
<td>Total(94)</td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of this ANOVA test have been shown in Table 55. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.
To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of this ANOVA test are shown in Table 55. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.

Table 55
Analysis of Variance of Survey Statement 8

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.00</td>
<td>0.50</td>
<td>0.60</td>
</tr>
<tr>
<td>Within groups</td>
<td>91</td>
<td>76.20</td>
<td>0.84</td>
<td>p = 0.55</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>77.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Nine

ISO 9004-2 guidelines identified a need to track the entire process to have ensured that quality concepts were incorporated throughout all aspects of the management and operation of an entity. About 89% of the respondents agreed with the importance of this factor in the management of their department (see Table 21). Less than 25% of the 93 respondents already had this in place, while 41% felt that it was currently being developed, and 31% stated that it needed to be developed. The results of this factor of the survey are shown in Table 56.
Table 56

Status of Department in Development of Factor 9—"The process of student learning must be designed and tracked to ensure that quality concepts are incorporated."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(22)</td>
<td>4 (18%)</td>
<td>14 (63%)</td>
<td>3 (14%)</td>
<td>1 (5%)</td>
<td>2.96</td>
<td>0.72</td>
<td>0.15</td>
</tr>
<tr>
<td>Chairs(46)</td>
<td>11 (24%)</td>
<td>18 (39%)</td>
<td>14 (30%)</td>
<td>3 (7%)</td>
<td>2.80</td>
<td>0.89</td>
<td>0.13</td>
</tr>
<tr>
<td>Faculty(25)</td>
<td>7 (28%)</td>
<td>6 (24%)</td>
<td>12 (48%)</td>
<td>0 (0%)</td>
<td>2.80</td>
<td>0.87</td>
<td>0.17</td>
</tr>
<tr>
<td>Total(93)</td>
<td>22 (24%)</td>
<td>38 (41%)</td>
<td>29 (32%)</td>
<td>4 (3%)</td>
<td>2.85</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results of this test are shown in Table 57. The results were not significant, indicating there were no significant differences between the 3 groups.

Table 57

Analysis of Variance of Survey Statement 9

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>0.39</td>
<td>0.19</td>
<td>0.27</td>
</tr>
<tr>
<td>Within groups</td>
<td>90</td>
<td>64.19</td>
<td>0.71</td>
<td>p = 0.76</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>64.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Survey Question Ten

ISO 9004-2 guidelines identified a need for a consistent measuring and testing process to assure uniformity (see Table 58). Of the 94 persons who responded to this question, approximately 25% felt that this was already in place within their Industrial Technology Departments, while 32% felt that it was currently being developed, and 37% felt that it needed to be developed.

From the results of the survey, it appeared this concept was not implemented in the departments of the respondents. Despite the high percentage of agreement (75%) with this factor in Table 23, only about 23% of the respondents felt that this factor was in place and another 70% felt that it was being developed or needed to be developed (see Table 58).

Table 58

Status of Department in Development of Factor 10--"A measuring and testing process must be established and adhered to in order to guarantee the incorporation of quality."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(22)</td>
<td>4(18%)</td>
<td>8(36%)</td>
<td>7(32%)</td>
<td>3(14%)</td>
<td>2.59</td>
<td>0.96</td>
<td>0.20</td>
</tr>
<tr>
<td>Chairs(47)</td>
<td>12(26%)</td>
<td>17(36%)</td>
<td>17(36%)</td>
<td>1(2%)</td>
<td>2.85</td>
<td>0.83</td>
<td>0.12</td>
</tr>
<tr>
<td>Faculty(25)</td>
<td>6(24%)</td>
<td>5(20%)</td>
<td>11(44%)</td>
<td>3(12%)</td>
<td>2.56</td>
<td>1.00</td>
<td>0.20</td>
</tr>
<tr>
<td>Total(94)</td>
<td>22(23%)</td>
<td>30(32%)</td>
<td>35(38%)</td>
<td>7(7%)</td>
<td>2.67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
To test the difference between the 3 groups of respondents, the ANOVA test was conducted. The results are shown in Table 59. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.

Table 59

Analysis of Variance of Survey Statement 10

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.81</td>
<td>0.91</td>
<td>1.09</td>
</tr>
<tr>
<td>Within groups</td>
<td>91</td>
<td>75.44</td>
<td>0.83</td>
<td>p = 0.34</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>77.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Eleven

ISO identified the need to have earmarked product which did not meet the quality standards required for delivery. This was interpreted by the researcher as having identified students who had not met the requirements for graduation. Of the 95 respondents, over half (57%) felt that this was already in place on their campus. Twenty-two percent felt that this factor was currently being developed and 15% felt that it needed to be developed. This was in spite the high agreement (86%) with this factor illustrated in Table 31. Refer to Table 60 for the results of this portion of the survey.
Table 60

Status of Department in Development of Factor 11--"A system must be established to identify students not meeting the requirements for graduation."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(22)</td>
<td>10(45%)</td>
<td>5(23%)</td>
<td>3(14%)</td>
<td>4(18%)</td>
<td>2.96</td>
<td>1.17</td>
<td>0.25</td>
</tr>
<tr>
<td>Chairs(48)</td>
<td>34(71%)</td>
<td>9(19%)</td>
<td>4(8%)</td>
<td>1(2%)</td>
<td>3.58</td>
<td>0.74</td>
<td>0.11</td>
</tr>
<tr>
<td>Faculty(25)</td>
<td>10(40%)</td>
<td>7(28%)</td>
<td>7(28%)</td>
<td>1(4%)</td>
<td>3.04</td>
<td>0.94</td>
<td>0.19</td>
</tr>
<tr>
<td>Total(95)</td>
<td>54(57%)</td>
<td>21(22%)</td>
<td>14(15%)</td>
<td>6(6%)</td>
<td>3.19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ANOVA test was conducted and the results are shown in Table 61. The results were significant, indicating significant differences between the 3 groups.

Table 61

Analysis of Variance of Survey Statement 11

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>8.17</td>
<td>4.08</td>
<td>4.97*</td>
</tr>
<tr>
<td>Within groups</td>
<td>92</td>
<td>75.58</td>
<td>0.82</td>
<td>p = 0.01</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td>83.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10
The Scheffe post-hoc test was used to discover differences between pairs of groups. The results are displayed in Table 62. The Scheffe test was conducted because of the $F$ value (4.97 with 2; 92 degrees of freedom) in the ANOVA test. It was found that the chairs' responses differed significantly from deans, and chairs' responses differed significantly from faculty, but deans and faculty did not have a significant difference.

**Table 62**

**Survey Statement 11--Comparison between Ranks Regarding Responses**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe $F$-ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>-0.63</td>
<td>3.63</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>-0.09</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>0.54</td>
<td>2.95</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
</tbody>
</table>

**Survey Question Twelve**

When interpreted, this question stated that a system must have been established to provide post-graduation, placement, and educational updating services to students. Of the 93 respondents, about 40% felt that this was already in place. Another 22% felt that it was being developed and 27% felt that it needed to be developed (see Table 63 for the results).
In the industrial section of the ISO 9000 guidelines, this factor related to the need for an industrial organization to have provided after-sales servicing and repair to the customer that was of high quality. When the researcher developed this factor for purposes of the survey, this was interpreted as the need for a type of servicing after graduation. From the validation that was conducted before the mailing of the survey, this was interpreted to mean such instances as placement and educational updating following graduation.

Table 63

<table>
<thead>
<tr>
<th>Status of Department in Development of Factor 12—&quot;A system must be established to provide post-graduation, placement and education updating services to students.&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank(freq)</td>
</tr>
<tr>
<td>Deans(22)</td>
</tr>
<tr>
<td>Chairs(46)</td>
</tr>
<tr>
<td>Faculty(25)</td>
</tr>
<tr>
<td>Total(93)</td>
</tr>
</tbody>
</table>

To test the difference between respondents, the ANOVA test was conducted. The results are shown in Table 64. The results were not significant, indicating there were no significant differences between the 3 groups surveyed.
Table 64

Analysis of Variance of Survey Statement 12

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>1.71</td>
<td>0.86</td>
<td>0.72</td>
</tr>
<tr>
<td>Within groups</td>
<td>90</td>
<td>107.54</td>
<td>1.20</td>
<td>( p = 0.49 )</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>109.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Thirteen

ISO identified the need for a system that ensured paperwork was consistently filled out in a thorough manner and subsequently followed the same path through the administrative maze to assure timely, quality results. From the initial industrial version of the ISO 9000 guidelines, this was intended to assure timely and accurate information so that reliable decisions were made, assuring a minimum of downtime and scrap (poor quality) at every point in the manufacturing environment. This was not a factor of the ISO 9000 guidelines that an industrial organization was allowed to make as "Not applicable."

About 88% of the respondents agreed with the importance of this factor in the management of their Industrial Technology Department (see Table 30). Of the 94 respondents to this question, 44% felt that this was already in place on their campus, while 27% felt that it was being developed, and 24% felt that it needed to be developed (see Table 65).
Table 65

Status of Department in Development of Factor 13—"It is important to assure that paperwork and documents are handled and progress through the system in a consistent manner each and every time."

| Rank(freq) | Already develop | Being develop | Needs to be develop | Not needed | M  | SD  | SE 
|------------|-----------------|---------------|---------------------|-----------|----|-----|-----
| Deans(23)  | 12(52%)         | 7(30%)        | 3(13%)              | 1(5%)     | 3.30| 0.88| 0.18
| Chairs(46) | 20(44%)         | 14(30%)       | 10(22%)             | 2(4%)     | 3.13| 0.91| 0.13
| Faculty(25)| 9(36%)          | 4(16%)        | 10(40%)             | 2(8%)     | 2.80| 1.04| 0.21
| Total(94)  | 41(44%)         | 25(27%)       | 23(25%)             | 5(4%)     | 3.08|     |     

The ANOVA test was conducted and results are shown in Table 66. The results were not significant, indicating there were no significant differences.

Table 66

Analysis of Variance of Survey Statement 13

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3.23</td>
<td>1.62</td>
<td>1.84</td>
</tr>
<tr>
<td>Within groups</td>
<td>91</td>
<td>80.09</td>
<td>0.88</td>
<td>p = 0.17</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
<td>83.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Survey Question Fourteen

ISO identified a need for personnel to have continually received updated training and education. Of the 96 respondents to this factor, about 29% felt that a program of continued training and education was already in place. That resulted in almost 75% of the respondents who felt that this system was being developed or needed to be developed (see Table 67).

Table 67

Status of Department in Development of Factor 14—"It is imperative to provide a system for continued training and education for administrators and faculty."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(23)</td>
<td>8(35%)</td>
<td>11(48%)</td>
<td>4(17%)</td>
<td>0(0%)</td>
<td>3.17</td>
<td>0.72</td>
<td>0.15</td>
</tr>
<tr>
<td>Chairs(47)</td>
<td>13(27%)</td>
<td>15(33%)</td>
<td>17(36%)</td>
<td>2(4%)</td>
<td>2.83</td>
<td>0.89</td>
<td>0.13</td>
</tr>
<tr>
<td>Faculty(26)</td>
<td>6(23%)</td>
<td>6(23%)</td>
<td>14(54%)</td>
<td>0(0%)</td>
<td>2.65</td>
<td>0.84</td>
<td>0.16</td>
</tr>
<tr>
<td>Total(96)</td>
<td>27(29%)</td>
<td>32(34%)</td>
<td>35(36%)</td>
<td>2(1%)</td>
<td>2.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test the difference between respondents, the ANOVA test was conducted (see Table 68). The results were not significant, indicating there were no significant difference for the 3 groups surveyed.
Table 68

Analysis of Variance of Survey Statement 14

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3.02</td>
<td>1.51</td>
<td>2.144</td>
</tr>
<tr>
<td>Within groups</td>
<td>93</td>
<td>65.48</td>
<td>0.70</td>
<td>p = 0.123</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>68.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Survey Question Fifteen

ISO identified the need for a statistical process that would have predicted the number of rejects, which the researcher translated as meaning student success. Of the 88 people who responded to this question, only 14% felt that this was already in place, while another 13% felt that it was being developed. Forty-two percent felt that it needed to be developed, while 32% felt that it was not needed (see Table 69). This represented the largest proportion of any respondents of the survey who stated that a factor was not needed.

This factor appeared to gather the least support of any factor in the survey, in both those that agreed with its importance (Table 35) as well as those who felt that it was not present or was not needed in their department (Table 69). A majority of respondents (56%) remained neutral or disagreed with the importance of this factor (Table 35), and consecutively 31% felt that this was not needed in the management of their department (Table 69).
According to the responses to this statement, the opinion appeared strong that this factor was not needed in the management of an Industrial Technology Department. This was reinforced from other portions of the survey. ISO 9000 guidelines strongly emphasized the importance of this factor in the industrial setting.

Table 69

Status of Department in Development of Factor 15—"A statistical measurement for predicting student success should be a component of the management of the Industrial Technology Department (i.e., similar to high school where placement rates, future success, etc is predicted)."

<table>
<thead>
<tr>
<th>Rank(freq)</th>
<th>Already develop</th>
<th>Being develop</th>
<th>Needs to be develop</th>
<th>Not needed</th>
<th>M</th>
<th>SD</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deans(18)</td>
<td>4(22%)</td>
<td>5(27%)</td>
<td>6(33%)</td>
<td>3(18%)</td>
<td>2.56</td>
<td>1.04</td>
<td>0.25</td>
</tr>
<tr>
<td>Chairs(49)</td>
<td>5(10%)</td>
<td>5(10%)</td>
<td>21(43%)</td>
<td>18(37%)</td>
<td>1.94</td>
<td>0.94</td>
<td>0.14</td>
</tr>
<tr>
<td>Faculty(21)</td>
<td>3(14%)</td>
<td>1(5%)</td>
<td>10(48%)</td>
<td>7(33%)</td>
<td>2.00</td>
<td>1.00</td>
<td>0.22</td>
</tr>
<tr>
<td>Total(88)</td>
<td>12(14%)</td>
<td>11(13%)</td>
<td>37(42%)</td>
<td>28(31%)</td>
<td>2.17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ANOVA test was conducted and the results of this test are shown in Table 70. The results indicate chairs were significantly higher than both deans and faculty, but this was expected because of the role that chairs have in assuring that students have met the requirements for graduation.
Table 70

**Analysis of Variance of Survey Statement 15**

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>2</td>
<td>5.18</td>
<td>2.59</td>
<td>2.71*</td>
</tr>
<tr>
<td>Within groups</td>
<td>85</td>
<td>81.26</td>
<td>0.96</td>
<td>p = 0.07</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>86.44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .10

The Scheffe test was conducted. Deans were significantly higher than chairs and faculty if we are willing to accept a relatively large Type I error. This was expected because of the role of administrators in the Industrial Technology department and the benefits that an improved prediction system would have for them.

Table 71

**Survey Statement 15--Comparison Between Ranks Regarding Responses**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Mean differ</th>
<th>Scheffe F-ratio</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dean vs. chair</td>
<td>0.62</td>
<td>2.62</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>dean vs. faculty</td>
<td>0.56</td>
<td>1.57</td>
<td>.1 &lt; p &lt; .25</td>
</tr>
<tr>
<td>chair vs. faculty</td>
<td>- 0.06</td>
<td>0.03</td>
<td></td>
</tr>
</tbody>
</table>

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Research Question Four

How can the factors identified by ISO 9004-2 guidelines be used to indicate quality management within Industrial Technology related programs at 4-year post-secondary institutions? This data was to be gathered from the open portion of the survey. Respondents were asked to give examples of how these factors were currently being met or could have been used to improve the quality of management of their Industrial Technology Departments.

Survey Question 1

This statement of the survey related to the necessity for administrators to have developed a leadership role and taken responsibility for the development and installation of a quality program within the Industrial Technology Department. Several deans responded that (a) their department used the Malcolm Baldrige criteria from industry to have administrators develop a leadership role at their institution, (b) their Industrial Technology Department had been "working" quality for years, but did not indicate how it was being done or how successful it was, and (c) their department used ABET (Accreditation Board for Engineering and Technology) criteria to make faculty responsible for quality issues. Another dean responded that the Vice President for Academic Affairs as well as Deans and Department Heads at their institution were involved in an articulation agreement that made it necessary for administrators to develop a leadership role, but no indication was given regarding the success of this leadership role.
A chair responded that this was being accomplished on their campus by following W. Edwards Deming's principles as closely as possible in the context of the university environment. Other chairs felt that this was being accomplished at their institutions by (a) using student feedback and assessment testing, (b) having secretaries develop a quality program and record its development and progress, (c) having their department's newly developed strategic plan designed to include benchmarks and identify persons responsible for specific quality issues, and (d) having administrators lead the quality pursuit, but all faculty participate in the program.

One chair reported that their campus had been working on such a model for over a year and a half, but did not indicate when the model was expected to be implemented. Another felt that the primary responsibility for this needed to be with faculty and department chairs, with the other administrators understanding and supporting the effort but not directly involved. A chair stressed that since needs have constantly changed in their department, the leadership demonstrated by administrators should have also changed.

It was noted by chairs that this was being accomplished at their universities by having a faculty mentorship program, another had in-class observation of teaching, chair observation of teaching, student evaluations of teaching and senior faculty evaluations of class materials. One chair felt that if administrators did their tasks effectively and efficiently quality automatically existed within the Industrial Technology Department.
A faculty noted that Total Quality Management concepts had been initiated at their institution and were filtering down to the Industrial Technology Department. Another faculty felt this was not needed at their institution because none of the administrators on campus identified with the Industrial Technology Department, while another considered their ongoing continuous quality improvement effort successful because of the support of their dean and several noted that a leadership role was established by the department chair but not by any other administrator. Clearly the responses varied widely.

In summary, on the open portion of the survey it was commonly stated that the leadership role had been taken by administrators and faculty in quality issues. However, not all respondents replied positively to this leadership role or its effect. Several instances of isolationism between administrators and faculty were mentioned, as well as communication problems and lack of understanding and respect for other groups.

**Survey Question 2**

This factor stated that all administrators and faculty needed to have made a firm commitment to the quality program. A dean reported that quality was always a priority at their institution, while another responded that commitments and improvements to the quality process were continually being developed. One dean was not sure whether the quality commitment should start from the president or should start at another level of administration. A dean felt that when the administrators
developed an articulation agreement, they were in essence making a firm commitment to quality at their institution, while another felt that the new Faculty Development Center would establish and demonstrate a commitment to quality by administrators and faculty. One dean responded that their university was developing a system of university-wide, school-wide, and department-wide quality teams which when put into effect would demonstrate the quality commitment for the entire institution.

A chair stated that this was being accomplished on their campus by having everyone from administrators to faculty striving to continuously improve in order to meet pre-established benchmarks which demonstrated quality improvement. Another chair felt that this needed to be developed at their institution because only "lip service" was given to quality, as demonstrated by the dollars that were being spent to make things look aesthetically good when there was no commitment to quality in the areas of teaching and student service. In responding to this factor, a chair stated that personal agendas often "got in the way" of departmental goals to improve quality in their department.

One chair noted that the commitment to quality had changed with the resources that were made available at their university, while it was noted by a different chair that by offering coursework in Total Quality Management their department was meeting this criteria for ISO 9000 guidelines. One chair stated that this was done by having all faculty complete a formative and summative review of professional objectives each year.
A faculty noted that on their campus the commitment to quality was present from faculty but not from administrators, while another faculty noted that the quality commitment seemed to be working although only isolated faculty members were concentrating on quality improvement. A faculty noted that in their Industrial Technology Department the commitment was recent, just since the appointment of a new program coordinator.

In summation, in this open portion of the survey there seemed to be a lot of dissatisfaction among respondents about the commitment that others had made to a quality program. Few instances were noted where administrators and faculty appeared to have open communication about quality and the improvement of quality in their Industrial Technology Department. It appeared that the leadership to develop a quality program was often lacking, or the respondent did not know where the leadership should come from.

**Survey Question 3**

This statement of the survey referred to internal scrutiny and feedback functions having been developed within the Industrial Technology Department. One dean mentioned that although their campus had a peer review system and supervisory review system, both were malfunctioning and not effective in improving the quality of their department. Two deans felt that this was being accomplished in their Industrial Technology Departments through a system of course and program evaluations, graduate surveys, advisory groups, and focus groups.
A chair stated that this was accomplished in their department by having the students do faculty evaluations every semester for the purpose of improving instruction quality, while several chairs reported that this was being done at their institution by a yearly evaluation of all faculty and administrators by peers and students. One chair felt that this was being accomplished in their department by having a 5-year program review performed by faculty and submitted to administrators.

A chair stated that a system was in place for internal scrutiny, but accountability was not present in their department. Another strongly agreed with this factor, but felt it would be difficult at their university because of their department's limited ability to assess outcomes. A chair felt internal scrutiny was accomplished up to his level, but not much was done at any level above the chair and another felt that accomplishing this factor of the ISO 9000 guidelines would have unnecessarily burdened faculty with paperwork for no purpose.

A faculty member indicated that this was already being accomplished in their Industrial Technology Department by a student assessment of instruction survey and by having students complete a perception of academic advisement survey. Another indicated that there was no internal scrutiny in their department and it was not wanted by faculty. A faculty indicated that this was important and was being accomplished by seeking student evaluations of teaching during courses, at the end of courses, at graduation and following graduation. Another felt that this was being done within
their department by having all personnel do annual evaluations, state certifications, annual resume updating, and goal setting.

In summation, many solutions presented by respondents to this factor appeared established and of value to the ISO 9000 process as defined in the literature. It appeared that several Industrial Technology Departments had established a system that included many facets, many of which would have more met the guidelines of ISO 9004-2.

Survey Question 4

This statement of the survey referred to the need for administrators and faculty to have been familiar with the costs of quality. A number of deans stated that at their institutions (a) quality was simply good economics, (b) the Industrial Technology chair had full control of budgets and allocation of funds with no input from faculty whatsoever, and (c) this was being accomplished on their campus by having faculty fully involved in budget development.

A chair felt that since "quality is free," it was only the things that the Industrial Technology Department did poorly that cost in terms of time and productivity. Another chair felt that since he directed a small department with a small budget, this was not needed because of good communications between administrators and faculty. It was stressed by a chair that although this factor was important to quality improvement, adequate means to determine the cost of quality were not available to academic programs. One chair from a major university felt that this had
been implemented at the college and department level, but not at the university level. Another chair noted that it was very difficult to educate faculty about budgets in their department.

One faculty felt that this was not feasible because of the diversity of disciplines within the Industrial Technology Department. Another noted that at their institution the administrators were familiar with costs, but faculty were not given the opportunity to become familiar with these costs. In summation, the concept of having all administrators and faculty cognizant of the costs of quality did not appear as if it were being accomplished effectively,

Survey Question 5

This statement referred to the importance of a marketing strategy within the Industrial Technology Department. One dean said their marketing strategy was in place, but very weak, while two others said that although their campuses had had a marketing strategy for several years, they had recently decided to review and upgrade their strategy and redirect their efforts with new directions and emphases.

A dean doubted whether it was important to have a marketing strategy within the Industrial Technology Department and another felt that the marketing their campus was doing to local community college students would satisfy this requirement. One dean noted that a marketing effort required strong leadership from the chair and this was not forthcoming. Another noted that this was being accomplished through a formal and established strategy that included marketing, recruiting and retention.
A chair felt that this was being done through displays and brochures, but both needed updating. Other chairs stated that (a) since most of their majors were transfer students they didn't need other sources, (b) this was already accomplished with an active Public Relations committee and by the chair visiting industry, (c) this was being accomplished by having everyone aware that students were the customers, and (d) their recruitment effort satisfied this since it included a monthly review and follow-up duties. One chair felt their efforts were not consistent because sometimes marketing was a high priority and other times was moved to a "back burner."

A chair noted that this was an ongoing activity where faculty were given release time while another pointed out that satisfied graduates had established an effective marketing effort on the behalf of the Industrial Technology Department, but their marketing efforts needed to focus more on internal efforts within the university. One chair said his department purchased the names of prospective students ranked by SAT score and area of interest, while another felt that this was important if handled by the Admissions Office and the Public Relations department, but that faculty were to be protected from doing any duties other than teaching.

One faculty felt that sending out posters with reply cards to local industries and schools and following the returned replies with a standard letter, program materials, and brochures was adequate. Another stated that although his department had marketing in place, it was "push" oriented and would have been more effective if it were "pull" oriented. One faculty felt that this was not needed because their
department relied on transfer students. There appeared to be a wide diversity of involvement in marketing efforts among respondents, and several respondents appeared dissatisfied, but were not sure of how to change the present marketing program.

Survey Question 6

This referred to considering the quality program when specifying and/or designing a major or curriculum. A dean felt that this was being accomplished by an ongoing continuous improvement process and another dean felt this was not necessary because NAIT and ABET standards fulfilled this need.

A chair noted that this was being done in his department by major changes that were underway in curriculum development to reflect the needs of those who employed their students. Another pointed out that although this was a high priority within the department, at the university, and in the board of regents, new curricula were seldom approved and old curricula were defended at intervals that were too frequent.

One chair stated that their Industrial Technology Department had made this an objective and was refining it. A faculty noted that this needed to be developed but their department was operating on autopilot, which he defined as "shuffle in, shuffle through, shuffle out."

In summation, few seemed satisfied with the quality of their method for developing and specifying new majors and/or curriculum. A system that was comprehensive in accomplishing this factor did not appear evident from any
responses. The respondents who replied that their department relied on accreditation criteria or state criteria appeared to have the most comprehensive system for the accomplishment of this factor.

**Survey Question 7**

This statement referred to the importance of considering whether a new person hired in the capacity of administrator or faculty could operate within the bounds of the quality system. One dean questioned whether it was important to have administrators and faculty operate within the bounds of the quality system.

Chairs stated that (a) this was being done by inquiring into the applicant's abilities, (b) was part of their interview process, (c) was being accomplished by requiring written documentation, and (d) it was becoming more important to screen job applicants on their ability to operate within the quality system. One chair felt that this could not be done because too much was based on resumes and "vibes" to have been able to predict this fairly and accurately before hiring. Another pointed out that this was required of all positions, not only administrators and faculty.

One chair stated that the recent hirings in their department were in line with this concept. It was also noted that this was critical and tough interviews which examined technical abilities were essential. Another noted that this was not needed in their department because diversity was just as important as conformity and without this diversity educational efforts were hampered. In summation, few respondents demonstrated a system (especially a documentable system) for this screening. No
respondent had an established testing system in place, although several mentioned a teaching "test" for new faculty.

Survey Question 8

This statement of the survey referred to the need for the concepts of the quality system to be incorporated into the teaching process. A chair felt that this was already being accomplished at their institution by having student surveys at midterm and student evaluations at the end of the semester. Another felt this needed to be developed in their department because Total Quality Management was taught in some courses. A chair responded that maybe ISO 9000 was an acceptable model for higher education, but "Deming-style Total Quality Management" was not.

Chairs noted that at their institutions (a) their accountability and evaluation system helped, but more needed to be developed to compliment what was in place, (b) this was driven by accreditation, and (c) when students saw high quality teaching and were offered the opportunity to evaluate of this teaching, then students were convinced that high quality teaching was important at that institution. One chair stated that this was being piloted in three degree programs and the graduate studies department although no results were available for review to determine the success of the experiment.

A faculty stated this was being accomplished in their department by doing teacher inservices, and another pointed out that aspects of Total Quality Management were filtering down to the Industrial Technology Department from the college level.
A faculty member stressed that some faculty in their department were using new syllabi and a testing procedure that was designed to gain feedback weekly from students about the learning environment and the lesson for the week.

In summation, several instances of monitoring the quality of the teaching process(es) surfaced when reading the open portion of the survey. Much of the instances centered on a quality evaluation by students, although alternative ideas were evident.

Survey Question 9

This statement referred to the need for student learning to be designed and tracked to ensure that quality concepts were incorporated. One dean felt that this was being accomplished at his campus through a milestone testing of student knowledge at regular intervals during the students educational career. A chair stated this was being done in their department by having faculty give regular feedback to students regarding their progress.

One chair reported that this was being developed by having faculty in their department who were willing to adapt to the student’s needs. Another noted that this could only be done after deciding which teaching methodologies were optimum and then improving on these methodologies. Several chairs stated that this could not be measured during the learning process, but rather should be accomplished two to four years after graduation from the program. One chair felt that this was the responsibility of the student.
A faculty pointed out that this assessment was required by the regents of their state and that by accomplishing this, their department was accomplishing quality management. One faculty indicated that student learning was not tracked at their campus in any manner, while another indicated that as good teachers they had been doing this in their department for a long time. One faculty stated that their department was using mastery learning techniques to accomplish and document this.

In summation, although several respondents gave examples concerning how their department was accomplishing this, the methodology tended to be dated. No respondents gave examples of distance-based testing, computer testing, or self-paced learning techniques. When reviewing the industrial techniques for accomplishment of this factor, several examples of new methodology were mentioned, while in education the respondents tended to utilize methods of tracking that have long been established and utilized.

**Survey Question 10**

This statement referred to the need for a measuring and testing process to have been established and adhered to in order to guarantee the incorporation of quality. Chairs stated that this needed to be accomplished in their departments by developing an exit exam or using either an SME (Society of Manufacturing Engineers) exam or a NAIT (National Association of Industrial Technology) certification exam. One chair reported that this was being accomplished on their campus by using an evaluation developed by faculty and approved by administration through the Vice President for
Another chair reported that a standardized grading procedure was being developed in their department to solve this need and unsatisfactory performance by the student had been defined. One chair felt that the outcomes assessment process currently under development in their department met this requirement.

A faculty indicated that they did an annual assessment within their department to track their progress concerning this factor. Another pointed out that there was no consistency of testing or evaluation between faculty members teaching the same course and so this consistency needed to be established. One faculty pointed out that since their Industrial Technology program was not ABET accredited, criteria was based on what the originators of the program had thought was important over 20 years ago. Another faculty stated that course grades were an adequate measure of this factor.

In summation, the measuring and testing process appeared to be as antiquated as the tracking process of Factor 9. However, most of the respondents appeared satisfied with their established methods and few mentioned a desire to change.

**Survey Question 11**

This statement referred to the need for a department to identify students not meeting the requirements for graduation. Two deans felt that this was not a quality issue at all. A dean and a chair asserted that this was being developed through a degree audit process. Another dean stated that this was being done by the Registrar's Office.
Chairs responded that this was being accomplished at their institutions by (a) having a fulltime departmental advisor track the student's progress, (b) having a system developed so students not performing satisfactorily were not allowed to continue, (c) a new computer system that linked advisors with the registrars and records office, and (d) an accurate grading system. A chair reported that minimum standards of performance were currently being developed for their Industrial Technology program and that this would meet the requirement.

Another chair pointed out that their department had added an internship as a criterion for graduation, as well as a more accurate measurement of writing skills throughout the educational process. A faculty member felt that a graduation review was adequate to accomplish this objective and no continuous form of evaluation was necessary.

In summation, many of the respondents reported that a system was in place rather than only a single component. Several specifically related to documented systems that could have been verified for consistency and accuracy of the process. It appeared that many of the respondents had systems in place that could have met ISO 9004-2 guidelines.

Survey Question 12

This statement referred to the need for a system to provide post-graduation, placement, and educational updating services to students. A dean felt that since their campus had a high placement of the limited number of graduates from their program,
this was all that was necessary to fill this requirement. Another dean felt that this factor was being accomplished through the university placement center as well as by "word of mouth."

Chairs stated that this was being accomplished at their institutions by (a) having two career days each year, (b) having a data bank of job opportunities in the department office, (c) having added a follow-up check for the third year after graduation, and (d) transferring students into the master's program.

A chair reported that their department was currently developing such a system to periodically check graduates to learn of their progression at several different periods following graduation. Several chairs felt that the Industrial Technology Department did not need to do all things since this was already being done by the Placement Office and Office of Alumni Affairs.

One chair pointed out that tracking graduates was too difficult. Another felt that this was being accomplished with the faculty advisor and that placing their graduates in good jobs was sufficient to meet this criteria. Another chair stated that this factor was the reason for employment agencies, who were doing an adequate job to meet the needs of the students. One faculty member strongly agreed with this statement because he/she felt that this was simply a matter of serving the customer. Another faculty felt that this factor was very important and needed to be done.

In summation, many of the respondents commented on placement plans currently in effect in their department or at their institution. But few departments had
established systems for post-graduation placement, continuation of education, or follow-up. It appeared that there were few new systems established recently that were unique in meeting the needs of students in this area.

Survey Question 13

This statement referred to the importance of assuring that paperwork and documents were handled and progressed through the system in a consistent manner each and every time. One dean felt that since the paperwork system on their campus took "forever" to accomplish, this factor desperately needed to be developed. Another felt that this was being developed through the establishment of a university handbook for administrators and faculty.

A chair stated that the system in their department was exceptional because it had been identified by the university as one of the "quality" departments on campus based not only on quality of the data but the quality of their documents. A chair felt that this was not needed because there were only 3.25 fulltime-equivalent faculty in the department, and the department was too small to worry about this factor. Another stated that this had already been developed on their campus because of the need for each student's experiences to be recorded at critical times during every grading period.

One chair felt that this factor had been handled well within the Industrial Technology Department, but other areas of the university had problems. Another stated that paperwork "fell through the cracks" no matter how attentive faculty were
and one chair felt that having a clear policy allowed their department to meet this objective.

A faculty stated that the routing slip process was working adequately to accomplish this factor and stressed the importance of having degree plans come to his/her office before being routed through channels. Another faculty member felt that too much trivial paperwork was required by administrators, the state bureaucracy had clogged the system, and an electronic forms system was required to perform the task. A faculty felt that in their department it was adequate to have the system worked by the department chair.

In summation, although several respondents mentioned systems that appeared to work well, those respondents that were not satisfied with their system tended to blame someone else at their campus. Several respondents had components of a system, but lacked the completeness of a thorough and consistent system that was comprehensive.

**Survey Question 14**

This statement referred to a system for continued training and education of administrators and faculty. A dean mentioned that their institution had a system in place, but it was not consistent. A chair felt that this was being accomplished by paying all faculty for one to three weeks of work every summer for work on curriculum, multimedia, portfolios and/or technical skills. Another felt that the $1000 provided to faculty each year for workshops and conferences had been productive.
A chair noted that it was being developed in their department because of the need to have each faculty member be an expert in his/her area of expertise. Conversely, another chair stated that there were not enough funds available for continuous updating of knowledge. One chair pointed out that this factor had been accomplished in their department by considering travel money as an investment and focusing on external sources to obtain travel money.

A faculty said that the travel budget for 12 fulltime faculty members in their department was only $6000/year and that most travel money was reserved for the dean, thus making accomplishment of this factor impossible. Several faculty stressed that there was no system in place and it was being accomplished on a "hit or miss" basis at best. Another stressed that the only development money available at their institution was for instructional development and it was hard to get into this program.

In summation, few respondents seemed satisfied with their current system of continued training and education for administrators and faculty. Many pointed out the inadequacies of their current system, although several excellent systems or components did surface.

Survey Question 15

This statement referred to the need to utilize statistical measurements for predicting student success. One dean felt that this was accomplished in his department by having an institutional program for all entering students. Another stated that the results would not have been worth the effort. A dean felt that it might
be important if the instrument was right. One chair felt that this was being accomplished in their department by surveying all graduates one year after graduation and then using the data to predict the success of current students.

A chair felt that this was not needed because it could not have been done with enough reliability to be of any real value. Another noted that this would have been helpful for the department and each student by assuring them of their possible success or failure based on certain factors. One chair pointed out that since students mature at different rates, the grade point average was sufficient to gauge success for every student.

A chair noted that although their department used ACT scores, high school records, and testing for placement, an improved system would have been beneficial for students. One respondent felt that the test given to students to test basic skills (SAT) accomplished this factor by dictating remedial courses where needed. One chair felt that descriptive rather than inferential statistics needed to be developed for their department.

A faculty stated that college placement tests were accomplishing this objective on their campus and this tended to cause students to bias their expectations. Another pointed out that data was being collected as part of the college’s Total Quality Management system, but that only about two years worth of data had been collected, and this was not sufficient for accurate predictions. One faculty stressed that this needed to be developed as a testing method for seniors preparing to graduate.
faculty member stated that their department had reduced the use of these measures after reviewing their validity. Although several respondents doubted the reliability and effectiveness of a predicting system, several noted that indeed they did have some form of this in place.

**General Comments on the Appropriateness of ISO 9000 to Higher Education**

General comments on the appropriateness of utilizing ISO 9000 guidelines in education included a comment by a dean that ISO 9000 guidelines were only a small portion of an overall total quality control program and that this program was required for quality improvement at the university and departmental level. Another dean commented that he/she not only agreed with the ISO 9000 guidelines outlined in the survey instrument, but had been doing these activities for over 20 years at an upper level institution.

A dean from a university in the west stated that he believed that ISO 9000 guidelines were not appropriate due to the fact that they focused on the process. He felt that Malcolm Baldrige criteria would have been more relevant for higher educational institutions and they were already utilizing continuous improvement teams.

One dean mentioned that ISO 9000 guidelines paralleled what they have been doing in the area of quality management for years. A chair noted that in his opinion ISO 9000 could have contributed to the improvement of Industrial Technology
Departments. One respondent felt that since different people had different needs and styles and that conformity destroyed creativity, ISO 9000 guidelines should not be used. A chair noted that although people have been managed in ways that increased their effectiveness, each person responded to management in ways that were often unpredictable.

A chair from Missouri sent a copy of the Missouri Quality Award criteria and application forms developed specifically for education institutions in that state. This criteria had been developed based on the Malcolm Baldrige Award criteria used in the industrial setting. There was an extensive focus on the customer and managerial responsibility and it provided a measure for the school to use in measuring quality maturity.

Although this chair felt that the MQA (Missouri Quality Award) presented a better model for education than ISO 9000, he noted that any quality model was a step forward for education. This was the only state-wide quality model for education that was returned by any participant, although a model developed by East Tennessee State University was mentioned.

A chair noted that faculty who were semi-competent in quality concepts were few and the one faculty who understood ISO 9000 "protects his turf as though he alone can deal in such classified minutiae." This chair recommended that faculty
should have been certified in those fields that they were assigned to teach and that work experience would have been one method available to satisfactorily complete this certification.

A chair noted that ISO 9000 had no relevance to higher education. This chair felt that although quality was important, trying to force education into an industrial mold was not appropriate. One chair felt that in his/her opinion quality standards were not intended for application to human interaction and were not appropriate for academia. This chair was stated that since humans have come to college from varying backgrounds with varying skills and potential, quality implied narrowing the tolerance on graduates.

One faculty noted that at their institution neither the dean nor the chair understood technology or quality. Another faculty felt that no quality program existed in their department, but to remain competitive a program needed to be developed. One faculty pointed out that a study to determine the appropriateness of a quality model to an academic department was overdue and was needed in higher education. A faculty stressed that a quality system could be accomplished only if administrators and faculty agreed to cooperate.

A faculty felt strongly that quality and quality assurance concepts were not important to his college, and that since the department chair was not from a technology related area it was unlikely that any form of quality would ever be considered in the Industrial Technology area. Another faculty stated that the survey
was an attempt to justify more administrators, administration expense, and an administrative empire. A faculty felt that other faculty in the general studies and liberal arts areas either didn't believe or didn't know that education was a business and because of this quality management would not be applied to education.

One faculty stated that the quality management approach was needed, but that ISO 9000 guidelines appeared superficial and political. A faculty stated that many of the factors required for ISO 900 were already in place, but needed to be documented.

In summation, several examples of components or in some cases, entire quality systems were mentioned, critiqued and discussed by respondents. In the opinion of the researcher, if these components were combined together into a comprehensive system and then documented for consistency and accuracy, the ISO 9004-2 guidelines would probably have been met. This would have allowed an Industrial Technology Department the opportunity to have met the guidelines and improved the quality of management of their department.

The interest in quality appeared to demonstrate an interest in the development of a quality system. The weak differences that were noted between the 3 groups appeared to demonstrate that administrators and faculty were currently involved in the pursuit of quality and often demonstrated a willingness and the ability to critique their quality system and consider improvements.
CHAPTER 6

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

After reviewing the results of the survey, it appeared a majority of the respondents agreed with the applicability of ISO 9004-2 guidelines to the needs of managing an Industrial Technology Department at a 4-year regional university (see Appendix H and Tables 1, 3, 5, 7, 10, 12, 15, 18, 21, 23, 25, 28, 30, 32, and 35). A relatively smaller proportion of the respondents already had many of the factors identified by ISO 9004-2 guidelines in place (see Appendix I and Tables 37, 39, 42, 45, 47, 49, 51, 54, 56, 58, 60, 63, 65, 67, and 69).

When considering the 15 factors identified in the survey, well over half of the respondents either felt that these factors were currently being developed or needed to be developed (see Appendix H and Tables 1, 3, 5, 7, 10, 12, 15, 18, 21, 23, 25, 28, 30, 32, and 35). A number of factors were deemed as not important or differed in importance between the respondents.

Conclusions

It appears to this researcher that ISO 9004-2 guidelines could have been a management tool for the incorporation of quality in the management of Industrial Technology Departments at 4-year state regional universities. Although many universities had several of the factors in place, there was general agreement about the needs between deans, chairs, and faculty. No consistent differences between the 3
groups were found. Significant differences between the 3 groups regarding the
importance of ISO 9004-2 guidelines were found for survey statements 4, 6, 7, 8, 11,
and 14. Significant differences between the 3 groups regarding the status of a
department in the development of a factor were found for survey statements 2, 3, 7,
11, and 15.

It appeared that some states such as Wisconsin, Missouri, Pennsylvania,
Michigan, Indiana, and New York had concentrated on quality in their educational
endeavors and appeared more advanced than other states surveyed. This was
reinforced from the literature review in Chapter 2, where the quality efforts of
management of these state's educational institutions were specifically mentioned.

Research Question One

Respondents indicated to what degree the ISO 9004-2 guidelines were needed
in their department by rating each factor on a 5-point scale including the following
categories (a) strongly agree (5), (b) agree (4), (c) neutral (3), (d) disagree (2), and
(e) strongly disagree (1). The mean score for agreement with the criteria for ISO
9004-2 guidelines was 4.32, indicating that ISO 9004-2 guidelines were generally
considered by the respondents to have been appropriate as a management tool.

Significant differences between the 3 groups regarding the importance of ISO
9004-2 guidelines were found for survey statements 4, 6, 7, 8, 11, and 14.
Differences tended to be weak and not severe in nature. An essential element of ISO
9000 guidelines was the strategic direction, communication, basic agreement, and
understanding of the guidelines by deans, chairs, and faculty. In this respect, Research Question 1 supported this premise by seeking information that benchmarked the opinions of the respondents, highlighting where differences occurred, and the weakness of these differences.

**Research Question Two and Three**

Respondents indicated to what degree the ISO 9004-2 guidelines were present in their Industrial Technology Department by rating their respective department on a four point scale including the following categories (a) already developed (4), (b) being developed (3), (c) needs to be developed (2), and (d) not needed (1). The research also involved noting the differences apparent between the 3 groups of respondents (deans, chairs, and faculty). Significant differences between the 3 groups regarding the status of a department in the development of a factor were found for survey statements 2, 3, 7, 11, and 15. Differences tended to be weak and not severe in nature.

The study was intended to determine to what extent systems similar to ISO 9004-2 guidelines had been implemented in Industrial Technology Departments at 4-year higher education institutions. It was also intended to examine how respondents differed in their opinions regarding the degree of this implementation.

It appeared that respondents felt that their Industrial Technology Departments were either developing a system similar to ISO 9004-2 guidelines or needed to develop such a system (see Appendix H and Tables 1, 3, 5, 7, 10, 12, 15, 18, 21,
23, 25, 28, 30, 32, and 35). This complemented the results of Research Question 1, where respondents tended to agree with the factors of the ISO 9004-2 guidelines (see Appendix H and Tables 1, 3, 5, 7, 10, 12, 15, 18, 21, 23, 25, 28, 30, 32, and 35).

Research Question Four

The evidence reinforced agreement with ISO 9004-2 guidelines in the management of Industrial Technology Departments and the respondents tended to emphasize that the factors either were being developed or needed to be developed within their departments. Few differences were noted between the 3 groups, and these differences tended to be weak.

Few Industrial Technology Departments actually had a comprehensive plan that included a majority of the factors and would have served for ISO 9000 accreditation purposes. The departments that were accomplishing a factor of the guidelines demonstrated a diversity of methods, which according to the literature on ISO 9000 was expected and encouraged, since every institution has different needs or different methods of solving those needs. Many of the methods seemed to be at odds with each other but would have tied together for consistency and quality in the management of an Industrial Technology Department. Several states appeared advanced in the implementation of quality in higher education, many with models in place.

Several respondents highlighted frustrations with methods that were not working as well as expected or were not being emphasized nor directed in such a
manner that they were successful. It was obvious in the open portion of the survey that chairs had extensive feedback they wished to share regarding the existing systems and success of these systems.

The responses to Research Question 4 appeared to illustrate that Industrial Technology Departments were performing many of their management duties according to what industry termed "good quality practices." Several examples where a quality of management process had been initiated, was in operation, or was being developed demonstrated that Industrial Technology Departments had factors in place that could have been pulled together into a comprehensive system.

Summary of Conclusions

Based on the results of this research, it appeared ISO 9004-2 guidelines would have served as an acceptable model to have improved the quality of management of Industrial Technology Departments at 4-year, post-secondary institutions. Based on the results, the respondents demonstrated reasonably good agreement on the importance of the factors in the survey, and an eyeball glance showed that every factor had a positive response. The few significant differences that were noted between the 3 groups were weak and it appeared this would not have seriously affected the implementation of a quality of management system based on ISO 9004-2 guidelines.

Since the research did not involve the comparison of ISO 9004-2 guidelines with other quality models, the ISO 9004-2 guidelines are not considered the only
quality model nor necessarily the best quality model for Industrial Technology Departments at 4-year, post-secondary institutions, but are considered by the researcher as an acceptable quality model. Based on the feedback received during the research, many Industrial Technology Departments have already been accomplishing many of the factors of the ISO 9004-2 guidelines and would simply have needed a comprehensive plan for full implementation.

Recommendations

As a result of this research, the following recommendations are made:

1. Other academic areas within the post-secondary educational setting in addition to the area of Industrial Technology need to be explored.

2. Other management quality models mentioned in this study should be examined across an academic discipline in studies similar to the format used for this study.

3. To test the application of ISO 9004-2 guidelines to an academic discipline such as Industrial Technology, the criteria needs to be utilized in the management of a department, with the methodology and results carefully recorded and scrutinized.

4. It is recommended that Industrial Technology Departments that have begun the implementation of a quality management model within their department continue the pursuit of management quality by changing to the ISO model and benchmarking the effectiveness of ISO 9004-2 guidelines to the effectiveness of the previous quality model.
5. Several measurements for determining the effectiveness of ISO 9004-2 guidelines were mentioned in this study. To apply a single criterion to the management of a department would be beneficial in determining the usefulness of ISO 9004-2 guidelines.

6. The application of a quality model such as that developed by the State of Missouri could serve as a customized and appropriate quality model for an Industrial Technology Department.

7. A study that examines the responses by different groups in the organizational dynamic tension between an administrative authority structure versus a faculty authority structure, factoring in the incentive and reward systems for both and the institutional context (research university, comprehensive university) would be useful if performed by a qualified researcher in the field. A sophisticated discussion of organizational and individual behavioral theory that transcended a question by question analysis would be useful.

8. A focused group of a dean, chair, and faculty that could form a working group to implement ISO 9004-2 guidelines would serve as a working model for Industrial Technology.

9. A pre-screening of the sample to encourage responses from deans, chairs, and faculty involved in a quality management process would serve to increase the response rate.
further the research regarding the actual implementation of the guidelines by allowing for more precise statistical measures.
References


Van, J. (1992, January 23). Educators to bone up on global competition. Chicago Tribune, p. 3-3.


APPENDIXES
### APPENDIX A

**Research Budget**

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APPENDIX B

Human Subjects Review Approval

January 18, 1994

Mr. Floyd L. Olson
120 Fox-Shannon Place
St. Clairsville, OH 43950

Dear Mr. Olson:

Your project, "Perceived Importance of ISO 9000 Factors as Indicators of Quality in Industrial Technology Programs at Four-year State Regional Universities", which you submitted for human subjects review on January 4, 1994 has been determined to be exempt from further review under the guidelines stated in the UNI Human Subjects Handbook. You may commence participation of human research subjects in your project.

Your project need not be submitted for continuing review unless you alter it in a way that increases the risk to the participants. If you make any such changes in your project, you should notify the Graduate College Office.

If you decide to seek federal funds for this project, it would be wise not to claim exemption from human subjects review on your application. Should the agency to which you submit the application decide that your project is not exempt from review, you might not be able to submit the project for review by the UNI Institutional Review Board within the federal agency's time limit (30 days after application). As a precaution against applicants' being caught in such a time bind, the Board will review any projects for which federal funds are sought. If you do seek federal funds for this project, please submit the project for human subjects review no later than the time you submit your funding application.

If you have any further questions about the Human Subjects Review System, please contact me. Best wishes for your project.

Sincerely,

Norris M. Durham, Ph.D.
Chair, Institutional Review Board

cc: Dr. David A. Walker, Associate Dean
Graduate College 1 Storer
Luther College, Iowa
50614-0702 (319) 273-2748

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APPENDIX C

Introductory Letter and Survey

April 18, 1994

Dear

An obvious question might be "What is an Engineering Dean at a two-year college doing inquiring about industrial quality criteria such as ISO 9000 practices at four-year institutions?" Let me assure you that this is exactly where, in my opinion, such an inquiry must begin for two-year colleges to have any hope of developing meaningful ISO 9000 administrative and academic approaches. Let me also thank you for reading this letter this far and ask that you take the next approximately 15 minutes to help both of our institutions with reference to quality standards.

By way of introduction, I am, in addition to my position as Dean at Belmont Technical College, a doctoral candidate in Industrial Technology at the University of Northern Iowa. I am researching the appropriateness of applying an industrial quality standard, ISO 9000, to the quality of management within an Industrial Technology or related department. The quality of your department is not being questioned, but rather whether ISO 9000 criteria is appropriate for auditing, measuring and improving the quality of your department.

ISO 9000 is a quality management standard developed by the International Organization of Standardization. It asks questions regarding specific areas of your management system. The questions in the attached survey are based on ISO 9000 and have been interpreted for educational institutions.

Please assist me by completing the enclosed survey, which will only take about 15 minutes of your time. All information which you provide on this survey will be kept confidential. If you wish to receive a copy of the survey results, please indicate this on the last page of the survey. If you have any comments or questions, call (614) 695-9500 or (614) 695-8347.

I would appreciate your response within the next week to facilitate a timely compilation of the results. I have enclosed a self-addressed, stamped envelope for your convenience. Thank you for your time and effort in this matter.

Sincerely,

Floyd Olson
Dean of Engineering, Math and Technology
Survey Based on ISO 9000 Criteria Relating These Criteria to Industrial Technology Related Departments at Four-Year Post-Secondary Institutions

Directions: Please circle the response you most agree with on the Likert scale for each question and place an X in the appropriate column at the end of the question. If a factor is present within your department, please briefly describe how your department is accomplishing this or why it would not be used.

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</table>

1. It is necessary that administrators develop a leadership role and take responsibility for the development of a quality program within the Industrial Technology department.

Is this present within your Industrial Technology department?

[ ] [ ] [ ] [ ] [ ]

2. All administrators and faculty need to make a firm commitment to the quality program.

Is this present within your Industrial Technology department?

[ ] [ ] [ ] [ ] [ ]

3. Internal scrutiny and feedback functions should be established within the Industrial Technology department.

Is this present within your Industrial Technology department?

[ ] [ ] [ ] [ ] [ ]

4. Administrators and faculty should be familiar with the costs of the quality system (ie., as related to budget restraints).

Is this present within your Industrial Technology department?

[ ] [ ] [ ] [ ] [ ]
5. It is important that marketing strategies (ie., student recruitment, public relations) be established within the Industrial Technology department. Is this present within your Industrial Technology department? 

6. It is imperative that the aspects of a quality program be considered when specifying and/or designing a major or curriculum. Is this present within your Industrial Technology department? 

7. When hiring a new administrator or faculty person, it is important to consider whether that person can operate within the bounds of the established quality system. Is this present within your Industrial Technology department? 

8. The concepts of a quality system need to be incorporated into the teaching process. Is this present within your Industrial Technology department? 

9. The process of student learning must be designed and tracked to ensure that quality concepts are incorporated. Is this present within your Industrial Technology department?
10. A measuring and testing process must be established and adhered to in order to guarantee the incorporation of quality. Is this present within your Industrial Technology department?

11. A system must be established to identify students not meeting the requirements for graduation. Is this present within your Industrial Technology department?

12. A system must be established to provide post-graduation, placement and educational updating services to students. Is this present within your Industrial Technology department?

13. It is important to assure that paperwork and documents are handled and progress through the system in a consistent manner each and every time. Is this present within your Industrial Technology department?

14. It is imperative to provide a system for continued training and education for administrators and faculty. Is this present within your Industrial Technology department?
15. A statistical measurement for predicting student success should be a component of the management of the Industrial Technology department (i.e., similar to high school where placement rates, future success, etc. is predicted. Is this present within your Industrial Technology department?

COMMENTS ON THE APPROPRIATENESS OF ISO 9000 CRITERIA TO AUDIT AND/OR IMPROVE THE QUALITY OF YOUR DEPARTMENT:
APPENDIX D

ISO 9000

INTERNATIONAL STANDARD

ISO 9004-2

First edition

1991-08-01

Quality management and quality system elements —

Part 2: Guidelines for services

Gestion de la qualité et éléments de système qualité —

Partie 2 Lignes directrices pour les services

Reference number

ISO 9004-2 1991(E)

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ISO 9004-2:1991(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International Standard ISO 9004-2 was prepared by Technical Committee ISO/TC 176, Quality Management and Quality Assurance.

ISO 9004 consists of the following parts, under the general title Quality management and quality system elements:

- Part 2: Guidelines for services
- Part 3: Guidelines for service material
- Part 4: Guidelines for managing quality improvement
- Part 5: Guidelines for quality plans
- Part 6: Guidelines for configuration management

Part 1 will be a revision of ISO 9004:1987. Parts 3 to 6 are in preparation.

Annexes A, B and C of this part of ISO 9004 are for information only.
Introduction

Quality and customer satisfaction are important subjects receiving increasing attention worldwide. This part of ISO 9004 provides a response to this awareness and seeks to encourage organizations and companies to manage the quality aspects of their service activities in a more effective manner.

This part of ISO 9004 builds on the quality management principles given in the ISO 9000 to ISO 9004 series. It recognizes that a failure to meet quality objectives can have consequences that may adversely affect the customer, the organization, and society. It further recognizes that it is a management responsibility to ensure that such failures are prevented.

The creation and maintenance of quality in an organization is dependent upon a systematic approach to quality management aimed at ensuring that customer needs are understood and met. The achievement of quality necessitates a commitment to quality principles at all levels in the organization and a continual review and improvement of the established system of quality management based on feedback of the customer's perception of the service provided.

The successful application of quality management to a service provides significant opportunities for

- improved service performance and customer satisfaction,
- improved productivity, efficiency and cost reduction, and
- improved market share.

To achieve these benefits, a quality system for services should also respond to the human aspects involved in the provision of a service by

- managing the social processes involved in a service,
- regarding human interactions as a crucial part of service quality,
- recognizing the importance of a customer's perception of the organization's image, culture, and performance,
- developing the skills and capability of personnel, and
- motivating personnel to improve quality and to meet customer expectations.
Quality management and quality system elements —

Part 2:
Guidelines for services

1 Scope

This part of ISO 9004 gives guidance for establishing and implementing a quality system within an organization. It is based on the generic principles of internal quality management described in ISO 9004 1987 and provides a comprehensive overview of a quality system specifically for services. This part of ISO 9004 can be applied in the context of developing a quality system for a 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.

The concepts and principles in this part of ISO 9004 are appropriate to large and small organizations. Although the small service organization will not have, nor need, the complex structure necessary in the larger enterprise, the same principles apply. The difference is simply one of scale.

Primarily, the customer will be the ultimate recipient of the service external to the organization. Frequently though, the customer can be internal within the organization. This is especially so in larger organizations where the customer can be at a subsequent stage in the provisioning process. While this part of ISO 9004 is written principally with respect to external customers, it can also apply to internal customers for overall achievement of the required quality.

The selection of operational elements and the extent to which they are applied depends on such factors as the market being served, the nature of the organization, the nature of the service, the service processes and the customer needs.

Annex A is for information only, and gives examples of services to which this part of ISO 9004 may be applied. The examples include service activities inherently performed in product manufacturing industries.

2 Normative references

The following standards contain provisions which, through reference in this text constitute provisions of this part of ISO 9004. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9004 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.
ISO 9004-2:1991(E)

ISO 8402 1986, Quality — Vocabulary


ISO 9004 1987, Quality management and quality system elements — Guidelines

3 Definitions

For the purposes of this International Standard the definitions given in ISO 8402, together with the following definitions, apply

NOTES

2 The term "service organization" is also used to denote "supplier", as appropriate

3 To provide clearer guidance, some existing definitions (without notes) are repeated with the source given in brackets

3.1 organization: A company, corporation, firm, enterprise or association, or part thereof, whether incorporated or not, public or private, that has its own function(s) and administration

3.2 supplier: An organization that provides a product or a service to a customer

NOTE 4 The supplier is sometimes referred to as a "business first party"

3.3 sub-contractor: A supplier to the service organization in a contractual situation

3.4 customer: The recipient of a product or a service

NOTES

5 A customer may be, for example, the ultimate consumer, user, beneficiary or purchaser

6 A customer is sometimes referred to as a "business second party"

7 A customer may be a unit within the service organization

3.5 service: The results generated, by activities at the interface between the supplier and the customer and by supplier internal activities, to meet customer needs

NOTES

8 The supplier or the customer may be represented at the interface by personnel or equipment

9 Customer activities at the interface with the supplier may be essential to the service delivery

10 Delivery or use of tangible product may form part of the service delivery

11 A service may be linked with the manufacture and supply of tangible products

3.6 service delivery: Those supplier activities necessary to provide the service

3.7 quality: The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs [ISO 8402]

3.8 quality policy: The overall quality intentions and direction of an organization as regards quality, as formally expressed by top management [ISO 8402]

3.9 quality management: That aspect of the overall management function that determines and implements the quality policy [ISO 8402]

3.10 quality system: The organizational structure, responsibilities, procedures, processes and resources for implementing quality management [ISO 8402]

4 Characteristics of services

4.1 Service and service delivery characteristics

The requirements of a service need to be clearly defined in terms of characteristics that are observable and subject to customer evaluation

The processes that deliver a service also need to be defined in terms of characteristics that may not always be observable by the customer, but directly affect service performance

Both types of characteristic need to be capable of evaluation by the service organization against defined standards of acceptability

A service or service delivery characteristic may be quantitative (measurable) or qualitative (comparable), depending on how it is evaluated and whether the evaluation is done by the service organization or the customer

NOTE 12 Many qualitative characteristics subjectively evaluated by customers are candidates for quantitative measurement by the service organization

Examples of characteristics that might be specified in requirement documents include:

— facilities, capacity, number of personnel and quantity of materials.
— waiting time, delivery time and process times.
— hygiene, safety, reliability and security.
— responsiveness, accessibility, courtesy, comfort, aesthetics of environment, competence, dependability, accuracy, completeness, state of the art, credibility and effective communication.

4.2 Control of service and service delivery characteristics

In most cases the control of service and service delivery characteristics can only be achieved by controlling the process that delivers the service. Process performance measurement and control are therefore essential to achieve and maintain the required service quality. While remedial action is sometimes possible during service delivery, it is usually not possible to rely on final inspection to influence service quality at the customer interface where customer assessment of any nonconformity is often immediate.

The service delivery process may range from being highly mechanized (as in a direct dialled telephone call) to one that is highly personalized (as in services such as legal, medical or consultancy). The more definable the process, whether by mechanization or by detailed procedures, the greater the opportunity to apply structured and disciplined quality system principles.

5 Quality system principles

5.1 Key aspects of a quality system

Figure 2 illustrates that the customer is the focal point of the three key aspects of a quality system. It also illustrates that customer satisfaction can only be assured when there is harmony of interaction between the management responsibility, the personnel and material resources and the quality system structure.

5.2 Management responsibility

5.2.1 General

Management is responsible for establishing a policy for service quality and customer satisfaction. Successful implementation of this policy is dependent upon management commitment to the development and effective operation of a quality system.

5.2.2 Quality policy

The responsibility for and commitment to a quality policy for the service organization belongs to the highest level of management. Management should develop and document a quality policy relating to the following:
— grade of service to be provided.
— service organization’s image and reputation.
— objectives for service quality.
— approach to be adopted in pursuit of quality objectives.
— role of company personnel responsible for implementing the quality policy.

Management should ensure that the quality policy is promulgated, understood, implemented and maintained.

5.2.3 Quality objectives

The realization of a quality policy requires the identification of primary goals for establishing quality objectives. Primary goals should include:
— customer satisfaction consistent with professional standards and ethics.
— continuous improvement of the service.
— giving consideration to the requirements of society and the environment.
— efficiency in providing the service.

Management should translate the primary goals into a set of quality objectives and activities. Examples of these are
clear definition of customer needs with appropriate quality measures,
- preventive action and controls to avoid customer dissatisfaction,
- optimizing quality-related costs for the required performance and grade of service,
- creation of a collective commitment to quality within the service organization,
- continuous review of service requirements and achievements to identify opportunities for service quality improvement,
- prevention of adverse effects by the service organization on society and the environment.

5.2.4 Quality responsibility and authority
To achieve the quality objectives, management should establish a quality system structure for the effective control, evaluation, and improvement of service quality throughout all stages of the provision of a service.

General and specific responsibility and authority should be explicitly defined for all personnel whose activities influence service quality. This should include ensuring effective customer/supplier relationships at all interfaces within and external to the service organization. The responsibility and authority defined should be consistent with the means and methods necessary for achieving service quality.

Senior management should be responsible for ensuring that the requirements for a quality system are developed. They should retain responsibility or designate a management representative responsible for ensuring that the quality system is established, audited, continually measured and reviewed for improvement.

While personnel with specific designated responsibilities can be instrumental in the attainment of quality, it should be stressed that it is not these personnel who create quality. They are only part of the quality system. The scope of the quality system encompasses all of the functions, and requires the involvement, commitment, and effective interworking of all personnel in the service organization to achieve continuous improvement.

5.2.5 Management review
Management should provide for formal periodic and independent reviews of the quality system in order to determine its continuing suitability and effectiveness in implementing the quality policy and achieving the quality objectives. Particular emphasis should be placed on the need or opportunity for improvement. The reviews should be carried out by appropriate members of management or by competent, independent personnel reporting directly to senior management.

Management reviews should consist of well-structured and comprehensive evaluations encompassing all relevant sources of information, including:
- findings of service performance analysis, i.e., information on the overall effectiveness and efficiency of the service delivery process in achieving service requirements and customer satisfaction (see 5.4),
- findings of internal audits on the implementation and effectiveness of all elements of the quality system in meeting stated objectives for service quality (see 6.4),
- changes brought about by new technologies, quality concepts, market strategies, and social or environmental conditions.

Observations, conclusions, and recommendations reached as a result of a review and evaluation should be submitted in documentary form to management for necessary action in establishing a programme for service quality improvements.

5.3 Personnel and material resources

5.3.1 General
Management should provide sufficient and appropriate resources to implement the quality system and achieve the quality objectives.

5.3.2 Personnel

5.3.2.1 Motivation
A most important resource in any organization is that of the individual members of personnel involved. This is especially important in a service organization where the behavior and performance of individuals directly impact the quality of service.

As a spur to the motivation, development, communication, and performance of personnel, management should
- select personnel on the basis of capability to satisfy defined job specifications,
- provide a work environment that fosters excellence and a secure work relationship.
— realize the potential of every member of the organization by consistent, creative work methods and opportunities for greater involvement,
— ensure that the tasks to be performed and the objectives to be achieved are understood, including how they affect quality,
— see that all personnel feel that they have an involvement and influence on the quality of service provided to customers,
— encourage contributions which enhance quality by giving due recognition and reward for achievement,
— periodically assess the factors which motivate personnel to provide quality of service,
— establish planned actions for updating the skills of personnel.

5.3.2.2 Training and development

Education brings awareness of the need for change and provides the means whereby change and development can be accomplished.

Important elements in the development of personnel include:
— training executives in quality management, including quality-related costs and evaluation of the effectiveness of the quality system,
— training of personnel (this should not be restricted to those solely concerned with quality responsibilities),
— education of personnel on the service organization's quality policy, objectives and concepts of customer satisfaction,
— a quality-awareness programme which may include instruction and training courses for new entrants, and periodic refresher programmes for longer-serving personnel,
— procedures for specifying and verifying that personnel have received suitable training,
— training in process control, data collection and analysis, problem identification and analysis, corrective action and improvement team working and communication methods,
— the need to assess carefully the personnel requirements for formal qualifications and give appropriate assistance and encouragement where necessary.

5.3.2.3 Communication

Service personnel, especially those directly involved with the customer, should have adequate knowledge and the necessary skills in communication. They should be capable of forming a natural work team able to interact appropriately with external organizations and representatives to provide a timely and smooth running service.

Team activities, such as quality improvement forums, can be effective for improving communication between personnel and can provide an opportunity for supportive participation and cooperation in solving problems.

Regular communication within the service organization should be a feature at all levels of management. The existence of an appropriate information system is an essential tool for communication and for service operations. The methods of communication may include:
— management briefings,
— information exchange meetings,
— documented information,
— information technology facilities.

5.3.3 Material resources

The material resources required for service operations may include:
— service provisioning equipment and stores,
— operational needs such as accommodation provisions, transport and information systems,
— quality-assessment facilities, instrumentation and computer software,
— operational and technical documentation.

5.4 Quality system structure

5.4.1 General

The service organization should develop, establish, document, implement and maintain a quality system as a means by which stated policies and objectives for service quality may be accomplished. The operational elements of a quality system are described in clause 6.
The quality system elements should be structured to establish adequate control and assurance over all operational processes affecting service quality.

The quality system should emphasize preventive actions that avoid the occurrence of problems while not sacrificing the ability to respond to and correct failures, should they occur.

5.4.2 Service quality loop

Quality system procedures should be established to specify the performance requirements for all service processes including the three main provisioning processes (marketing, design and service delivery) which can be shown to be operating in a service quality loop, as illustrated in Figure 3.

The quality of service as seen by the customer is directly influenced by these processes as well as by actions arising from these service quality feedback measures which contribute to service quality improvements namely:

- supplier's assessment of the service provided
- customer's assessment of the service received
- quality audits of the implementation and effectiveness of all elements of the quality system

Quality feedback should also be established between interacting elements in the quality loop.
ISO 9004-2:1991(E)

5.4.3 Quality documentation and records

5.4.3.1 Documentation system

All service elements, requirements, and provisions incorporated in the quality system should be defined and documented as part of the service organization's overall documentation. Appropriate quality system documentation includes the following:

a) Quality manual. This should provide a description of the quality system as a permanent reference. It should contain:
   - the quality policy;
   - the quality objectives;
   - the structure of the organization, including responsibilities;
   - a description of the quality system including all elements and provisions that form part of it;
   - the quality practices of the organization;
   - the structure and distribution of the quality system documentation.

b) Quality plan. This should describe the specific quality practices, resources, and the sequence of activities relevant to a particular service.

d) Procedures. These are written statements which specify the purpose and scope of activities in the service organization to meet customer needs. They define how the activities are to be conducted, controlled, and recorded.

Procedures should be agreed, be accessible to personnel and understood by all those who interface with their operation.

e) Quality records. These provide information:
   - on the degree of achievement of the quality objectives;
   - on the level of customer satisfaction and dissatisfaction with the service;
   - about the results of the quality system for review and improvement of the service;
   - for analysis to identify quality trends;
   - for corrective action and its effectiveness;  
   - on appropriate sub-contractors' performance;
   - on the skills and training of personnel;
   - on competitive comparisons.

The quality records should be:
   - verified as valid;
   - readily retrievable;
   - retained for a designated period;
   - protected from damage, loss, and deterioration while in storage.

Management should establish the policy for access to quality records.

5.4.3.2 Documentation control

All documentation should be legible, dated (including revision dates), clear, readily identifiable, and carry authorization status.

Methods should be established to control the issuance, distribution, and revision of documents. The methods should ensure that documents are:
   - approved by authorized personnel;
   - released and made available in the areas where the information is needed;
   - understood and acceptable to users;
   - reviewed for any necessary revision;
   - removed when obsolete.

5.4.4 Internal quality audits

Internal quality audits should be performed periodically to verify the implementation and effectiveness of the quality system and adherence to the service specification (see 6.2.1), the service delivery specification (see 6.2.4) and the quality control specification (see 6.2.5).

Internal quality audits should be planned, performed, and recorded in accordance with documented procedures by competent personnel who are independent of the specific activities or areas being audited.

Audit findings should be documented and submitted to senior management. Management responsible for the activity being audited should ensure that necessary and appropriate corrective actions are taken in respect of the audit findings.
Implementation and effectiveness of corrective actions resulting from previous audits should be assessed.

NOTE 13 ISO 10011-1 is recommended for further information and guidance on quality audits.

5.5 Interface with customers

5.5.1 General

Management should establish effective interaction between customers and the service organization's personnel. This is crucial to the quality of service perceived by the customer.

Management can influence this perception by creating an appropriate image based on the reality of actions taken to meet customer needs. This image, presented by personnel at all levels, has a primary effect on the service organization's relationship with the customer.

Personnel with direct customer contact are an important source of information for the ongoing quality improvement process. Management should regularly review the methods used for promoting contacts with customers.

5.5.2 Communication with customers

Communication with customers involves listening to them and keeping them informed. Difficulties in communication or interactions with customers, including internal customers, should be given prompt attention. These difficulties provide important information on areas for improvements in the service delivery process. Effective communication with customers involves:

- describing the service, its scope, its availability and timeliness of delivery;
- stating how much the service will cost;
- explaining the interrelationships between service delivery and cost;
- explaining to customers the effect of any problems, and how they will be resolved, should they arise;
- ensuring that customers are aware of the contribution they can make to service quality;
- providing adequate and readily accessible facilities for effective communication;
- determining the relationship between the service offered and the real needs of the customer.

The customers' perception of service quality is acquired often through communication with the service organization's personnel and facilities.

NOTE 14 Communication with the customers will be adversely affected by inadequate resources.

6 Quality system operational elements

6.1 Marketing process

6.1.1 Quality in market research and analysis

A responsibility of marketing is to determine and promote the need and demand for a service. Useful approaches include surveys and interviews for the collection of market information. Management should establish procedures for planning and implementing market activities. Elements associated with quality in marketing should include:

- the establishment of customer needs and expectations relevant to the service offered (e.g., consumer tastes, grade of service and reliability expected, availability, unstated expectations or biases held by customers);
- complementary services;
- competitor activities and performances;
- review of legislation (e.g., health, safety and environmental) and relevant national and international standards and codes;
- analysis and review of customer requirements, service data and contract information that has been collected (relevant summaries of the analyzed data should be communicated to the design and service delivery personnel);
- consultation with all affected service organization functions to confirm their commitment and ability to meet service quality requirements;
- ongoing research to examine changing market needs, new technology and the impact of competition;
- the application of quality control.

6.1.2 Supplier obligations

Supplier obligations to customers may be expressed in an explicit or implicit manner between the service organization and its customers. Explicit supplier obligations such as warranties should be adequately documented. Prior to publication, the documented obligations should be reviewed for consistency with...
— related quality documentation;
— supplier capability;
— relevant regulatory and legal requirements.

These obligations should be referenced in the service brief (see 6.1.3). Effective liaison with customers is especially important when supplier obligations are formally defined.

### 8.1.3 Service brief

Once a decision has been made to offer a service, the results of the market research, analysis and the agreed supplier obligations should be incorporated into a service brief. This brief defines the customers' needs and the related service organization's capabilities as a set of requirements and instructions that form the basis for the design of a service.

### 8.1.4 Service management

Prior to the development of a service, management should establish procedures for planning, organizing and implementing the launch of the service and, where applicable, its eventual withdrawal.

Management responsibilities should include ensuring that all necessary resources, facilities and technical supports are available against the planned timescales for each process contributing to the service launch.

Included in this planning should be a responsibility for ensuring that service requirements and service delivery requirements each contain explicit provision for safety aspects, potential liabilities and appropriate means to minimize risks to personnel, customers and the environment.

### 6.1.5 Quality in advertising

Any advertisement of a service should reflect the service specification and take account of the customers' perception of the quality of service provided. The marketing function should recognize the liability risks and financial implications of offering exaggerated or unsubstantiated claims for a service.

### 6.2 Design process

#### 6.2.1 General

The process of designing a service involves converting the service brief (see 6.1.3) into specifications for both the service and its delivery and control, while reflecting the organization's options (i.e., aims, policies and costs).

The service specification defines the service to be provided, whereas the service delivery specification defines the means and methods used to deliver the service. The quality control specification defines the procedures for evaluating and controlling the service and service delivery characteristics.

Design of the service specification, the service delivery specification and quality control specification are interdependent and interact throughout the design process. Flow charts are a useful method to depict all activities, relationships and interdependencies.

The principles of quality control should be applied to the design process itself.

#### 6.2.2 Design responsibilities

Management should assign responsibilities for service design and ensure that all those who contribute to the design are aware of their responsibilities for achieving service quality. The prevention of service defects at this stage is less costly than correction during service delivery.

Design responsibilities should include:

- planning, preparation, validation, maintenance and control of the service specification (see 6.2.3), the service delivery specification (see 6.2.4) and the quality control specification (see 6.2.5);

- specifying products and services to be procured for the service delivery process (see 6.2.4);

- implementing design reviews for each phase of the service design (see 6.2.6);

- validating that the service delivery process, as implemented, meets the service brief requirements (see 6.2.7);

- updating the service specification, the service delivery specification and the quality control specification in response to feedback or other external stimuli when necessary (see 6.2.8).

During design of the service specification, the service delivery specification and the quality control specification, it is important to:

- plan for variations in the service demand;

- carry out an analysis to anticipate the effects of possible systematic and random failures and also service failure aspects beyond the supplier's control;

- develop contingency plans for the service.
6.2.3 Service specification

The service specification should contain a complete and precise statement of the service to be provided, including:

- a clear description of the service characteristics subject to customer evaluation (see 3.4);
- a standard of acceptability for each service characteristic.

6.2.4 Service delivery specification

6.2.4.1 General

The service delivery specification should contain service delivery procedures describing the methods to be used in the service delivery process, including:

- a clear description of the service delivery characteristics that directly affect service performance (see 4.1);
- a standard of acceptability for each service delivery characteristic;
- resource requirements detailing the type and quantity of equipment and facilities necessary to fulfil the service specification;
- number and skills of personnel required;
- reliance on sub-contractors for purchased products and services.

The service delivery specification should take account of the aims, policies and capabilities of the service organization, as well as any health, safety, environmental or other legal requirements.

6.2.4.2 Service delivery procedures

Design of the service delivery process may usefully be achieved by sub-dividing the process into separate work phases supported by procedures describing the activities involved at each phase. Particular attention should be given to the interfaces between separate work phases. Examples of work phases involved in services are:

- providing information about services offered to customers;
- taking the order;
- establishing provisions for the service and delivering the service;
- billing and collecting charges for the service.

Detailed flow charts of the service delivery process can assist in this sub-division.

NOTE 15 The content, appropriate order and completeness of work phases may vary according to the type of service involved.

6.2.4.3 Quality in procurement

Purchased products and services may be critical to the quality, cost, efficiency and safety of the services supplied by a service organization. Procurement of products and services should be given the same level of planning, control and verification as the other internal activities. The service organization should establish a working relationship with sub-contractors, including feedback in this way a programme of continuous quality improvements can be supported and quality disputes avoided or settled quickly.

Procurement requirements should include as a minimum:

- purchase orders, whether set out as descriptions or specifications;
- selection of qualified sub-contractors;
- agreement on quality requirements and quality assurance requirements;
- agreement on quality assurance and verification methods;
- provision for settlement of quality disputes;
- incoming product and service controls;
- incoming product and service quality records.

In selecting a sub-contractor, the service organization should consider:

- on-site assessment and evaluation of the sub-contractor's capability and quality system elements needed for quality assurance;
- evaluation of sub-contractor's samples;
- past history with the selected sub-contractor and similar sub-contractors;
- test results of similar sub-contractors;
- experience of other users.

NOTE 16 It is recommended that ISO 9001, ISO 9002 or ISO 9003, as appropriate, be used when purchasing products or services.
6.2.4.4 Supplier-provided equipment to customers for service and service delivery

The service organization should ensure that when equipment is provided for use by a customer, this equipment is suitable for its purpose, and that written instructions are given, as required, for its use.

6.2.4.5 Service identification and traceability

Where appropriate, the service organization should identify and record the source of any product or service that forms part of the service provided, including personal responsibility for verification and for other service actions throughout the service delivery process to ensure traceability in cases of nonconformity, customer complaint and liability.

6.2.4.6 Handling, storage, packaging, delivery and protection of customers' possessions

The service organization should establish effective controls for the handling, storage, packaging, delivery and protection of customers' possessions which the service organization is responsible for, or comes into contact with, during the delivery of the service.

6.2.5 Quality control specification

Quality control should be designed as an integral part of the service processes, marketing design and service delivery. The specification developed for quality control should enable the effective control of each service process to ensure that the service consistently satisfies the service specification and the customer.

The design of quality control involves:

- identifying the key activities in each process which have a significant influence on the specified service;
- analysing the key activities to select those characteristics whose measurement and control will ensure service quality;
- defining methods for evaluating the selected characteristics;
- establishing the means to influence or control the characteristics within specified limits.

The application of quality control principles to the service delivery process is illustrated in the restaurant service example shown below.

a) A key activity to be identified in a restaurant service would be the preparation of a meal and its effect on the timeliness of the meal being served to a customer.

b) A characteristic of the activity requiring measurement would be the time taken to prepare the ingredients for a meal.

c) A method for evaluating the characteristic would be sample checks of the time taken to prepare and serve a meal.

d) The effective deployment of staff and materials would ensure that the service characteristic of timeliness was maintained within its specified limits.

6.2.6 Design review

At the conclusion of each phase of the design of a service, a formal documented review of the design results should be carried out against the service brief.

The design work at the end of each phase should be reviewed so that it is consistent with and can satisfy the requirements of:

- items in the service specification pertaining to customer needs and satisfaction,
- items in the service delivery specification pertaining to service requirements,
- items in the quality control specification pertaining to the control of service processes.

Participants at each design review should include representatives of all the functions affecting service quality appropriate to the phase being reviewed. The design review should identify and anticipate problem areas and inadequacies and initiate actions to ensure that:

- the complete service specification and service delivery specification meet customer requirements;
- the quality control specification is adequate to provide accurate information about the quality of service delivered.

6.2.7 Validation of the service, service delivery and quality control specifications

New and modified services and their service delivery processes should undergo validation to ensure that they are fully developed and that the service meets the needs of customers under anticipated and adverse conditions. Validation should be defined, planned and completed prior to service implementation. The results should be documented.

Prior to the initial delivery of a service, the following should be reviewed to confirm:

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the service is consistent with customer requirements;
the service delivery process is complete;
resources are available to meet the service obligations, particularly materials and personnel;
that applicable codes of practice, standards, drawings and specifications are satisfied;
information to customers in the use of the service is available.

Periodic revalidation should be performed to ensure that the service continues to meet the needs of the customer and conforms to the service specification, and to identify potential improvements in the provision and control of the service.

Revalidation should be a planned and documented activity and should include considerations of actual field experience, impact of modifications in the service and processes, impact of personnel changes, adequacy of procedures, instructions, guides and proposed modifications.

6.2.8 Design change control

The service delivery specification, service delivery specification and quality control specification are the basic reference documents for the service and should not be changed without due cause and consideration.

The objective of design change control is to document and manage changes in requirements and procedures, after the initial specifications have been authorized and implemented. This control should ensure that:

- the need for change is identified, verified and submitted for analysis and redesign of the portion of the service affected;

- changes to the specifications are properly planned, documented, approved, implemented and recorded;

- representatives of all functions affected by a change participate in its determination and approve the change;

- the impacts of changes are evaluated to ensure they produce the expected result and do not degrade the quality of service;

- customers are informed when design changes will affect service characteristics and performance.

6.3 Service delivery process

6.3.1 General

Management should assign specific responsibilities to all personnel implementing the service delivery process, including supplier assessment and customer assessment.

The provision of a service to customers entails:

- adherence to the prescribed service delivery specification;

- monitoring that the service specification is met;

- adjusting the process when deviations occur.

6.3.2 Supplier's assessment of service quality

Quality control should form an integral part of the operation of the service delivery process. This includes:

- measurement and verification of the key process activities to avoid undesirable trends and customer dissatisfaction;

- self inspection by service delivery personnel as an integral part of the process measurements.

- a final supplier assessment at the interface with the customer to provide a supplier perspective of the quality of service delivered.

6.3.3 Customer's assessment of service quality

Customer assessment is the ultimate measure of the quality of a service. Customer reaction may be immediate, or it may be delayed and retrospective. Often subjective evaluation will be the sole factor in a customer's assessment of the service provided. Customers seldom volunteer their assessment of service quality to the service organization. Dissatisfied customers often cease to use or purchase services without giving notice that would permit corrective action to be taken. Reliance on customer complaints as a measure of customer satisfaction can lead to misleading conclusions.

NOTE 17 Customer satisfaction should be consistent with the professional standards and ethics of the service organization.

Service organizations should institute an ongoing assessment and measurement of customer satisfaction. These assessments should seek positive as well as negative reactions and their likely effect on future business.

The evaluation of customer satisfaction should focus on the extent to which the service brief, specifi-
cations and the service delivery process meet the customer needs. A service organization often thinks that it is supplying a good service but the customer may not agree, indicating inadequate specifications, processes or measures.

A comparison should be made of the customer's assessment with the supplier's own perception and assessment of the service provided to evaluate the compatibility of the two quality measures and any need for appropriate action for service quality improvement.

6.3.4 Service status

The status of the work done at each phase of the service delivery process should be recorded to identify the achievement of the service specification and customer satisfaction.

6.3.5 Corrective action for nonconforming services

6.3.5.1 Responsibilities

Identification and reporting of nonconforming services is the duty and responsibility of each individual in the service organization. Every effort should be made to identify potential service nonconformities before customers are affected. Responsibilities and authority for corrective action should be defined in the quality system.

6.3.5.2 Identification of nonconformity and corrective action

When a nonconformity is detected, action should be taken to record, analyse and correct it. Frequently, there will be two stages of corrective action: first, an immediate positive action to satisfy the needs of the customer; second, an evaluation of the root cause of the nonconformity to determine any necessary longer-term corrective action to prevent recurrence of the problem.

Longer-term corrective action should be appropriate to the magnitude and effect of the problem. When implemented, the corrective actions should be monitored to ensure they are effective.

6.3.6 Measurement system control

Procedures should be established to monitor and maintain the system used for service measurement. The controls include personnel skills, measurement procedures and any analytical models or software used for measuring and testing. All measuring and testing, including customer satisfaction surveys and questionnaires, need to be tested for validity and reliability. The use, calibration and maintenance of all measuring and test equipment used in providing or assessing services should be controlled to provide confidence in decisions or actions based on measurement data. Measurement error should be compared with requirements and appropriate action taken when precision and/or bias requirements are not achieved.

NOTE 18 See ISO 10012-1 for guidance on quality assurance requirements for measuring equipment.

6.4 Service performance analysis and improvement

6.4.1 General

A continual evaluation of the operation of the service processes should be practised to identify and actively pursue opportunities for service quality improvement. To implement such evaluations, management should establish and maintain an information system for the collection and dissemination of data from all relevant sources. Management should assign responsibilities for the information system and for service quality improvement.

6.4.2 Data collection and analysis

Data will be available from measures of the service operation by means of:

- supplier assessment (including quality control);
- customer assessment (including customer reaction, customer complaints, requested feedback information);
- quality audits.

Analysis of these data will measure achievement of service requirements and indicate opportunities for improving service quality and the effectiveness and efficiency of the service provided.

To be effective and efficient, data collection and analysis need to be purposeful, disciplined and planned operations, not left to chance or operated haphazardly.

The identification of systematic errors, their cause and prevention should be a fundamental aim of data analysis. The root cause of error is not always obvious but should be pursued. This includes the potential for human error, which is seldom prompted in a random manner, more often there is an underlying cause. Too often errors attributed to personnel in customers actually arise from flaws in the service operation related to complex operations or to inadequate procedures, environment, working conditions, training, instructions or resources.
6.4.3 Statistical methods

Modern statistical methods can assist in most aspects of data collection and application, whether it be to gain a better understanding of customer needs, in process control, capability study, forecasting, or measurement of quality to assist in making decisions.

6.4.4 Service quality improvement

There should be a programme for continuously improving the service quality and the effectiveness and efficiency of the complete service operation, including an effort to identify:

- the characteristic which if improved would most benefit the customer and the service organization;
- any changing market needs that are likely to affect the grade of service to be provided;
- any deviations from the specified service quality due to ineffective or insufficient quality system controls;
- opportunities for reducing cost while maintaining and improving the service quality provided. (This requires systematic methods for estimating the quantitative costs and benefits.)

The activities of service quality improvement should address the need for both short-term and longer-term improvement and include:

- identifying relevant data for collection;
- data analysis and giving priority to those activities having the greatest adverse impact on service quality;
- feedback of results of the analysis to operational management with recommendation for immediate service improvement;
- reporting periodically to senior management for a management review of long-term quality improvement recommendations (see 5.2.5).

Members from different parts of the service organization working together may be able to offer fruitful ideas that could be directed towards improving quality and reducing cost. Management should encourage personnel at all levels to contribute to programmes for quality improvement, with recognition for their effort and participation.
Annex A
(informative)

Examples to which this part of ISO 9004 may be applied

**Hospitality services**
- Catering, hotels, tourism, entertainment, radio, television, leisure

**Communications**
- Airports and airlines, road, rail and sea transport, telecommunications, postal, data.

**Health services**
- Medical staff/doctors, hospitals, ambulances, medical laboratories, dentists, opticians

**Maintenance**
- Electrical, mechanical, vehicles, heating systems, air conditioning, buildings, computers

**Utilities**
- Cleansing, waste management, water supply, grounds maintenance, electricity, gas and energy supply, tele, police, public services

**Trading**
- Wholesale, retail, stockist, distributor, marketing, packaging

**Financial**
- Banking, insurance, pensions, property services, accounting

**Professional**
- Building design (architects), surveying, legal, law enforcement, security, engineering, project management, quality management, consultancy, training and education

**Administration**
- Personnel, computing, office services

**Technical**
- Consultancy, photography, test laboratories

**Purchasing**
- Contracting, inventory management and distribution

**Scientific**
- Research, development, studies, decision aids

NOTE 19 Manufacturing companies also provide internal services in their marketing, delivery systems and after-sales activities.
Annex B
(informative)

Cross-reference of quality system elements and clauses

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Annex C
(informative)

Bibliography


1) To be published
APPENDIX E

Twenty Factors of ISO 9000

The primary scope of ISO 9001, the most comprehensive of the standards, was the prevention of nonconformities across all stages of an industry from design to servicing. The ISO 9001 standard was designed for situations where a company needed to demonstrate the capability to design, develop, produce, install, and service a product or service.

An examination of the twenty factors assisted in understanding the impact of the system. The following paragraphs outlined the criteria (International Organization for Standardization, 1987; Lamprecht, 1992; Rothery, 1991):

1. Management was to have documented a written quality policy, which defined the responsibility, authority, and interrelation of all personnel whose work affected quality. Management was to have defined which function(s) (a) initiated action to prevent the occurrence of nonconformity, (b) kept records of quality problems, (c) ensured that solutions/corrective actions were implemented, and (d) monitored the processing, delivery, or installation of nonconforming product(s) until corrective actions were taken. Management determined timely audits to insure the suitability and effectiveness of the quality system and assured that records were maintained of this activity.

2. This clause required the organization to have implemented a system which warranted that the product and/or service conformed to specified requirements. The
system was to be composed of procedures, instructions and a plan which consisted of a quality manual.

3. This paragraph assured that contractual requirements had been defined and documented. It specified that differences between customer and product requirements had been resolved, that the organization had the capability to meet contractual requirements, and that records were kept of the above transactions.

4. This paragraph certified that the organization had procedures to control and verify the design of the product so that customer requirements had been met. It addressed the assignment of competent personnel to the control of all design components.

5. This paragraph was often in noncompliance during an accreditation inspection. It addressed control procedures, the review and approval of documents, as well as the removal of obsolete documents.

6. This paragraph assessed sub-contractors and the compliance of purchased products and/or services. Acceptable sub-contractors and the effectiveness of their quality system were identified.

7. This paragraph addressed the quality of purchased parts and/or services into the final product. The supplier was to have controlled procedures, including record keeping and verification of processes, and storage and maintenance procedures.

8. This factor addressed product identification and traceability during production, delivery, and installation. It was a "where appropriate" paragraph that
depended on the type of industry being evaluated. The medical, food, and pharmaceutical industries paid more attention to this paragraph than most other industries.

9. The organization was to have production and installation processes which ensured that these were under controlled conditions. When it was determined what affected quality, these activities were under controlled conditions. This was another of those "where applicable paragraphs."

10. Incoming product was inspected or verified to requirements as specified in the organization's quality plan. In this paragraph the organization was expected to (a) inspect, test, and identify product, (b) ensure that the product conformed to requirements, and (c) guarantee that a product had not been released until inspection and tests were completed. This paragraph was intended to focus specifically on the finished product.

11. This factor was to assure calibration, measurement accuracy and precision for inspection, measuring, and test equipment. It was expected that records were kept of these activities.

12. The inspection and test status of the product was to be identified. Whenever nonconforming product was released, records were kept to identify the inspection authority responsible for the release.

13. This paragraph identified who was responsible for nonconforming product and the requisite rework, re-grade, rejection, and/or acceptance. It identified who
had the responsibility and authority to report, adjust and record concessions to the customer.

14. The organization was to have had procedures for investigating nonconformity and implementing corrective actions which prevented reoccurrence. The organization was expected to have analyzed all records to detect and eliminate potential causes of nonconforming product. It was expected to initiate preventive actions commensurate with the risk, and to verify that the actions were implemented.

15. This paragraph specified requirements and delivery procedures which maintained the integrity of the product after final inspection and test. This required the organization to develop procedures to prevent damage or deterioration of the product.

16. This paragraph was cited in twelve of the twenty paragraphs. Its focus was on the quality of recordkeeping, maintenance, retention, storage, and availability of data.

17. Once the quality system was in place, it was to be audited for effectiveness and compliance with requirements. This paragraph specified internal audits.

18. Training, as the object of this paragraph, was often the most costly activity carried on by an organization. All personnel of the organization who affected quality were to have their training needs identified. Records of all training were needed.
19. This paragraph applied to companies that provided servicing activities, which made this not applicable for many. This stated that servicing procedures met specified customer requirements.

20. This section specified that statistical techniques for verifying the acceptability of process capability and product characteristics had been established.
APPENDIX F

Response Rate by Population Segment to Survey

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APPENDIX G

Response Rate Regarding A Factor’s Presence

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ISO 9004-2 Factor Ratings from Instrument

Mean Responses to Survey Questions

Mean score
APPENDIX I

ISO 9004-2 Implementation Ratings from Instrument

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