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# ISO 9000: A Stepping Stone to Total Quality Management for Construction Companies?

**Rizwan U. Farooqui**
Florida International University, Miami, Florida, USA, rfaro001@fiu.edu

**Syed M. Ahmed**
Florida International University, Miami, Florida, USA, ahmeds@fiu.edu

## ABSTRACT

As construction projects get bigger and more complex, clients are increasingly demanding higher levels of quality, efficiency, and delivery. Total Quality Management (TQM) has long been recognized as a successful management philosophy in the manufacturing and service industries. TQM can also be embraced in the construction industry to help raise quality and productivity. This report attempts to introduce the basic elements of ISO 9000 and describes how each can be implemented in a wide array of construction-related companies, in order to achieve their goal of total quality. Numerous case studies were found which demonstrate the ability of ISO 9000 to improve a company's quality performance, avoid costly errors, and produce satisfied customers. For the purpose of this report, two case studies are discussed showing how construction companies can successfully implement TQM. The benefits experienced include reduction in quality costs, better employee job satisfaction because they do not need to attend to defects and client complaints, recognition by clients, work carried out correctly right from the start, subcontractors with proper quality management systems, and closer relationships with subcontractors and suppliers. TQM performance measures were also reflected through top management commitment, customer involvement and satisfaction, employee involvement and empowerment, customer–supplier relationships, and process improvement and management. Finally, a framework for implementing TQM in construction is recommended.

**Keywords:** Total Quality Management, ISO 9000.

## 1. INTRODUCTION

Companies are being persuaded to adopt quality management systems in order to meet the demands of customers in a global market. ISO 9000, a series of international quality management standards, has emerged during the last two decades as a system that can be applied to different types of companies in order to obtain improvements in quality procedures and products. ISO 9000 is being implemented all over the world as a system of standards related to quality assurance management and control for companies and institutions. ISO 9000 certification in the construction industry has been widely accepted in many countries, and the number of certifications for general, heavy and specialty contracting companies is growing considerably. Some investigators associate ISO 9000 with multiple advantages and with positive changes in internal procedures of construction firms. Yet others argue that these standards do not apply directly to the construction industry and cannot be associated with a substantial improvement in the delivery of a quality construction product.

The success of the ISO 9000 family of standards is still growing and the number of countries where ISO 9000 is being implemented has increased. Over 400,000 companies in 158 countries have identified the ISO 9000 standard as a strategic management tool essential to effective control and best business practice. The construction industry has embraced the ISO 9000 standard since its inception. The Quality Management standard has become the benchmark for successful construction companies. The discipline and systematic approach has helped many companies to structure their management and processes to consistently meet the client's requirements. The

revised ISO 9001: 2000 standard places greater emphasis on customer needs and expectations and improving business performance and is now easily applied to a construction companies operations.

## 2. BACKGROUND

The ISO 9000 series was originated from the military procurement standards in the Second World War, which ultimately led to the first civil quality management standard: BS 5750 of the British Standards Institution in 1979. In 1987, the British Standard BS 5750 was adapted with a few modifications and turned into the international standard of ISO 9000. Although the international standard was updated in 1994, there was not much change until the new version in 2000, which to certain extent is a complete rewrite.

The success of the ISO 9000 family of standards is still growing and the number of countries where ISO 9000 is being implemented has increased. Over 400,000 companies in 158 countries have identified the ISO 9000 standard as a strategic management tool essential to effective control and best business practice. The standard specifies six compulsory documents:

- Control of Documents
- Control of Records
- Internal Audits
- Control of Nonconforming Product / Service
- Corrective Action
- Preventive Action

In addition to these, ISO 9001:2000 requires a Quality Policy and Quality Manual (which may or may not include the above documents). The ISO 9000:1994 standards consist of three auditable certification standards as ISO 9001/2/3. These apply correspondingly to organizations which:

1. Design their own products and services (20 clauses),
2. Do everything with the exception of design (19 clauses), and
3. Provide products and services that can be verified only by inspection and test (16 clauses).

The ISO 9001:2000 standards integrate these three elements into ISO 9001, which places stronger emphasis on process management and resource management, and has commonality of architecture with ISO 9004, so that quality assurance requirements and quality management can be aligned holistically.

One of the biggest changes in ISO 9001:2000 is that the new concepts of process approach management are promoted. The process approach management is defined as "the application of a system of processes within an organization, together with the identification and interactions of these processes, and their management" (Biazzo and Bernardi, 2003). This approach is significantly different from ISO 9000:1994; under the new standard, organizations must identify processes within the quality system, including interactions, manage and control them to the compliance with the requirements. This change of the ISO 9001:2000 standard is significant for construction firms. In the construction industry, the final product is produced by activities in a process and the construction process does not follow a production line as the manufacturing industry does but is composed of concurrent activities in a construction site, such as concreting, bar fixing and formwork erecting. The documented procedures form the biggest bureaucrat in controlling the processes/activities.

The revised ISO 9001: 2000 standard places greater emphasis on customer needs and expectations and improving business performance and is now easily applied to a construction companies operations. The eight Quality Management Principles stated in ISO 9000:2000 and ISO 9004:2000 provide the basis for the performance improvement (see Table 1).

**Table 1: ISO 9001: 2000 Principles**

| EIGHT BASIC CONCEPTS | RESULTS |
|---|---|
| Focusing on the Customer | Increased revenue and market share. |
| Choose Effective Leaders | Motivation towards achieving organizational goals |
| Involving People | Fostering innovation, creativity and accountability |
| Understanding Processes | Systematically defining the activities necessary to obtain a desired result |
| Valuing a Systems Approach | Structuring a system to achieve the organization's objectives in the most effective and efficient way |
| Looking for Continual Improvement | Making continual improvement of products, processes and systems an objective for every individual in the organization |
| Exercising Good Judgment | Informed decisions |
| Recognizing Common Cause | Increased ability to create value for both parties |

### KEY CHANGES IN THE REVISED ISO 9001: 2000 STANDARDS

The key changes in the revised ISO 9001: 2000 document as compared to previous versions of ISO standards are summarized below. These changes highlight the move of ISO towards implementing TQM.

- Number of standards reduced and simplified.
- Restructured on a business process model in tune with the way organizations actually work.
- Now measures customer satisfaction.
- Expands and reinforces management responsibilities and communication skills.
- Helps companies make continual explicit improvement.
- Language less manufacturing oriented and more user-friendly.
- Reduces the need for documented procedures, with increased emphasis on training and competence.
- Requires involvement throughout the organization - managing quality and quality management.

A literature review of the standards' potential and contribution towards total quality management proved to be dichotomized, and the main conclusion that is drawn (Carlsson and Carlsson, 1996; Mayer, 1993; Stephens, 1997; Taylor, 1995; Tummala and Tang, 1996; Tsiotras and Gotzamani, 1996) is that the standards' long-term contribution to the certified companies may be positive, neutral or negative, depending on the way that companies choose to implement them. The success or failure of the standards does not depend on the adequacy of their requirements alone, but rather on the companies' ability and willingness to implement them correctly. Certification alone without the proper development and continuous improvement of a dynamic quality assurance system, continuously adapting to the variable external requirements, cannot bring the positive results expected to provide the basis for future adoption of TQM.

### ISO 9000: A WAY OF MANAGING FOR CONFORMANCE

Quality assurance, according to the Standard, is a way of managing that prevents non-conformance and thus "assures quality". This is what makes ISO 9000 different from other standards: it is a management standard, not a product standard. It goes beyond product standardization: it is standardizing not what is made but how it is made. To use standards to dictate and control how organizations work was to extend the role of standards to new territory. To take such a step we might have firstly established that any such requirements worked — that they resulted in ways of working which improved performance.

## 3. QUALITY CONTROL IN THE CONSTRUCTION INDUSTRY

Quality is probably one of the most important competitive weapons in today's unpredictable and competitive markets. In the general context of management, quality is defined as:

*"The totality of features and characteristics of a product that bears on its ability to satisfy stated or implied needs." (ISO 1994A, Chung, 1999)*

Quality is an elusive and indistinct tool, yet despite plenty of writing on the subject; quality can still be defined differently to fit a particular business situation, organization, or customer. However, construction quality in particular, can be seen as very difficult to define due to the uniqueness of its construction methods, product and work force that can be involved in a single project. Unlike a normal product, which can be taken back to the production line if it does not meet the requirements, the construction product is usually in the form of a project, which, once built, is irreversible. It is a one of the unique undertakings that is constrained by the ever-present goal of meeting time, cost and performance. These three are inextricably linked, such that altering one, will undoubtedly have an effect on the others. In the construction industry, required performance can be said to represent quality, which means quality can be simply described as: "conformance to requirements."

Despite different interpretations of quality by quality experts, one cannot avoid seeing how quality has developed into the most important competitive weapon these days. In construction, the nature of a project implies that there will be several different professionals and tradesmen responsible for the finished building product. As a result, if an error was to appear years later, it would be difficult to identify the source of the problem. Therefore, the different professionals working on a project need to have separate quality management systems that will assure adherence to the contractual requirements.

In an industry that has for a long time been 'viewed as resistant to change and benchmarked internationally as simply uncompetitive,' quality initiatives must be embraced in order to shake off such an image, which prevents construction companies from gaining a competitive advantage internationally. Quality needs to become the new business philosophy of any organization.

## 4. ISO 9000 AND THE CONSTRUCTION INDUSTRY

A formal quality management system has the potential to change attitudes, cultures, and work procedures at any construction firm in a way the organization has never experienced before. In most cases, in order to set up a formal quality management system at a construction firm, there has to be direct demands from their customers, whose requirement for quality is essential for doing business. Most of the construction organizations will not enter into the cost and allocation of resources to implement a quality management system unless they will be compensated. There is a general movement towards making implementation of a quality management system a contractual requirement. Small to medium sized organizations can always argue that they 'operate to a quality system' although this is not formalized. However, since the existence of such 'informal' quality systems are difficult to justify, the International Standards Organization, (ISO) has come up with ISO 9001 series of standards that are applicable to all organizations irrespective of size or nature of business.

ISO 9000 refers to a set of quality management standards. Standards present an opportunity for an organization to develop a quality management system that meets the requirements specified by ISO 9001:2000, which are recognized internationally, making the organization competitive. ISO 9001 family of standards is undeniably the most prolific of all formal standards. This could be due to the worldwide applicability standardization and flexibility with which the standards are associated, even though there are some experts that still question the standards' applicability in the construction industry. It is important to note that ISO 9001:2000 has replaced ISO 9001:1994, ISO 9002:1994 and ISO 9003:1994, while the old ISO 9002 and ISO 9003 standards have been discontinued.

## 5. BENEFITS OF ISO 9000 FOR CONSTRUCTION COMPANIES

ISO 9000 certification will drive continual improvement and contribute to:

- Improvement in "bottom line" profit through:
    - Better efficiency

    - Continual improvement
    - Waste Reduction
- Consistent and effective control of key processes and project management
- Promotion and standardization of good working practices
- Provision of a vehicle for training new employees
- Effective management of risk and reducing crisis management
- More effective data analysis, generation of key performance metrics and continual improvement objectives
- Greater emphasis on communication, leadership, change management and adequacy of training
- A planning and review process which will ensure that the system in place remains suitable, effective and capable of identifying new opportunities
- Effective remote site management, accountability and contractual control
- Promoting control of suppliers and subcontractors and the development of effective supply chain management
- World-wide recognition

## 6. IMPLEMENTING ISO 9000 IN A CONSTRUCTION COMPANY

Deming has provided a seven point action plan as follows: Much research has been done with regard to the implementation of TQM and it is belief that the benefits of higher customer satisfaction, better quality products, and higher market share are often obtained following the adoption of TQM by construction companies. It requires a complete turnaround in corporate culture and management approach As compared to the traditional way of top management giving orders and employees merely obeying them. It is believed that the single most important determinant of the success an organization in implementing TQM is its ability to translate, integrate, and ultimately institutionalize TQM behaviors into everyday practice on the job. TQM is a way of thinking about goals, organizations, processes, and people to ensure that the right things are done right the first time. It is a major organizational change that requires a transformation in the culture, process, strategic priorities, beliefs, etc. of an organization. The first question that a construction company must ask itself prior to implementing a formal quality management system is 'where should we start?'

The main challenge facing most construction companies understands what their first step is for implementing a quality process. In developing a total quality culture in construction, one important step is to develop a construction team of a main contractor and subcontractors who would commit to the quality process and develop a true quality attitude. Thus, the main contractor should only select subcontractors who have demonstrated quality attitude and work performance on previous jobs. The problem is that most quality management systems are not meant for small to medium businesses, which comprise the majority of the construction firms in the U.S., who neither have the structure nor the management time to support the recommended 'top-down approach' which suits large companies, for which the quality manuals are written. In small to medium construction companies, this kind of 'top-down approach' is criticized by Asher, (1998) who believes that like every quality management systems before, applies only to large organizations. In his argument, small to medium construction companies neither have the structure or the management time to support such implementation.

In short, small to medium construction companies are at a huge disadvantage in trying to implement quality systems, due to their size, and the problems associated with being small. These do not have the management time to support implementation; there is also, the issue of the cost of implementing the system itself, fear and inertia that result from being owner-managed. At the same time, a study by Nwanko, (2000) found that implementing quality management systems in most construction companies revolve around the ISO 9001-type implementation. As mentioned before, the process of obtaining an ISO 9001:2000 certificate is not too complex. It involves putting together the necessary documents to prove to the external auditor that the system exists.

On the other hand, critics of ISO 9001:2000 standard in small to medium construction companies agree that the nature of the ISO 9001-type standard allows organizations to focus on short-term goals of obtaining a certificate, failing to appreciate the organisational benefits, which could be obtained if the process of certification was not seen as: 'an end in itself.' Given that the small to medium construction companies play such a critical role in supporting the U.S. economy it has been implied that they could benefit from any performance enhancing strategies such as the introduction of quality management systems. The reputation of small to medium construction company's procurement creates an environment that diverts effort from pursuing quality to the defence of inefficiency, error and waste. Therefore, formal quality systems like the ISO 9001:2000 series are a way of increasing customer confidence that the material, product or service will conform to specified requirements.

## 7. CASE STUDIES

Two construction companies in Singapore who have implemented TQM in their organizations were studied. The case studies aim to examine how each organization practices TQM and the tools used to assist them in doing so. In addition, the methods of measuring the performance of TQM within each organization are presented. The studies made use of interviews and reviews of relevant company publications in Singapore.

### ORGANIZATION A

Organization A is a G8 Japanese contractor who has involved in local construction projects for more than 22 years. Construction companies in Singapore are registered with the Building and Construction Authority's Central Registry of Public Sector Contractors in one of eight financial categories. These range from G1, the smallest, to G8, the largest financial category. The Management Representative, who has worked for the firm for 19 years, was interviewed for this case study. Organization A has won several quality awards before, including one from a Japanese client for quality workmanship for a chemical plant project. This is not surprising because the quality mission of the company has incorporated certain aspects of TQM that is to: ''Provide quality construction that meets customer requirements and continual improvement to enhance customer satisfaction.'' At the time of this study, Organization A was audited and awaiting certification to the ISO 9001:2000 standard. The Management Representative highlighted that the ISO 9001:2000 standard emphasizes continual improvement and is more systematic than the old ISO 9001:1994 standard which concentrated on documentation. Nevertheless, the Management Representative admitted that the reason behind ISO 9001:2000 certification was largely motivated by regulatory requirements in Singapore and not because it will help in TQM implementation in the first instance. He added that the benefits of ISO 9001:2000 certification would be enjoyed most by organizations that were not already certified to the ISO 9001:1994 standard.

### ORGANIZATION B

A local G8 construction firm, Organization B is known for its high-quality standards in design-and-build projects. The personnel interviewed were the Quality Systems Manager who has worked for Organization B for three years. The firm seeks to adopt the ''do it right the first time'' approach and to strive for zero wastage and zero defects. Like Organization A, Organization B is also committed to understanding the needs of its customers to deliver quality products through a continual improvement process. At the time of this study, Organization B was expected to obtain their certification to the ISO 9001:2000 standard in the third quarter of 2002. It was then preparing for the ISO 9001:2000 audits. The Quality System Manager agreed that certification to the ISO 9001:2000 standard will help in facilitating continual improvement to allow Organization B to respond more positively toward client needs and expectations. The Quality System Manager opined that organizations will only carry out TQM principles that are required in the ISO 9001:2000 standards and that unless an organization is aware of these principles, TQM will not be implemented in totality. The quality system manager noted that the new ISO 9001:2000 standard focuses on process flow that can help to identify what needs to be controlled. This is unlike the old ISO 9001:1994 standard which focused on individual quality elements, thus failing to highlight the relationship between them.

### ANALYSIS

Construction organizations should realize that results cannot be gained overnight and that an organization needs time to adapt, change, and learn. The biggest hurdle for the organization is to change its status quo and develop a culture that will support TQM. Commitment of top management is crucial in decision making and for successful TQM implementation. Organization B appears to lack this commitment, which was why TQM was not fully carried out. Both Organizations A and B have not used a statistical approach to TQM because they were not familiar with statistical tools and felt that the time and resources needed to train their employees would be long and tedious. When the decision to set up a company in Singapore was made, the headquarters of Organization A in Japan sent their employees to Singapore to help with TQM education. Hence, Organization A started the process of TQM implementation right from day one. It appears easier for a new organization to train its employees in TQM practices than one whose employees already have fixed ways of doing things. In the latter, TQM may be seen as an additional burden rather than to help them to improve quality. Hence, linking the two case studies, it is clear that implementing TQM requires a major organizational change that would transform the culture, processes, strategic priorities, and beliefs of an organization. Apart from commitment, top management must educate its employees on the need for TQM and communicate clearly to them that TQM is not an additional burden to the organization. Instead, TQM will help to reduce the amount of work for employees if they no longer need to attend to customer complaints and defect problems. In summary, the two case studies confirmed that the following factors are important considerations for TQM implementation: An understanding of TQM requirements including customer/supplier involvement, continuous improvement, top management commitment, strategic review of education and implementation plans, provision of ample budgets and resources, teamwork, training, and timely feedback. Nevertheless, the limitation of the two case studies is that the two organizations were reluctant to divulge information relating to their strategy used to implement TQM and details of their training programs. In addition, the authors were also unable to interview the general managers of both organizations. Consequently, the Management Representative of Organization A and Quality Systems Manager of Organization B were interviewed instead. Although they may be able to provide appropriate information because of their in-depth knowledge of quality systems, they may not be able to articulate other information such as those relating to top management commitment.

## 8. CONCLUSIONS

Clearly, ISO 9000 can prove to be a great method of building a quality track record that will stand up under the closest scrutiny, even in the most competitive construction environments. It enables all types of construction professionals--from architects and engineers to contractors and suppliers--to develop quality standards and procedures precisely suited to their particular needs and responsibilities. It offers step-by-step instructions on the implementation and management of an ISO 9000 quality assurance system and demonstrates how the system puts the quality-management process into effect before work begins and detects and corrects problems before they reach disastrous proportions.

Companies with ISO 9000 certification are already given contract preference in Europe and Australia. It is likely that within a few years the same will be true in North America. ISO 9000 compliance is rapidly becoming a prerequisite for companies seeking international construction contracts, and the same may soon be true for firms operating solely within North America. For architects, engineers, contractors, specifications workers, hardware managers, and other professionals in construction-related industries, ISO 9000 in Construction is the key to achieving more consistent performance levels, improved efficiency and productivity, a solid reputation for quality, and a sharper competitive edge.

The list below shows how ISO 9000 certification will drive continual improvement and contribute to improvements in "bottom line" profit:

- ✓ Better efficiency
- ✓ Continual improvement

- ✓ Waste Reduction
- ✓ Consistent and effective control of key processes and project management
- ✓ Promotion and standardization of good working practices
- ✓ Provision of a vehicle for training new employees
- ✓ Effective management of risk and reducing crisis management
- ✓ More effective data analysis, generation of key performance metrics and continual improvement objectives
- ✓ Greater emphasis on communication, leadership, change management and adequacy of training
- ✓ A planning and review process which will ensure that the system in place remains suitable , effective and capable of identifying new opportunities
- ✓ Effective remote site management, accountability and contractual control
- ✓ Promoting control of suppliers and subcontractors and the development of effective supply chain management
- ✓ World-wide recognition

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