Implementing Quality Management Systems in Small and Medium Construction Companies: A Contribution to a Road Map for Success

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ABSTRACT: *This article focuses on the lessons learned while implementing ISO 9001:2000-compliant Quality Management Systems in small- and medium-sized construction companies in Portugal. It identifies the major difficulties to swift and successful implementation and proposes solutions. We make a comparison with equivalent issues in another unique industry and with cases described in the literature, and discuss how the solutions proposed in this article can be generalized to other industries and company sizes.*

Implementing a Quality Management System has been an endeavor for many construction companies in the last two decades. While the concept is receiving the utmost attention from large construction companies that seek a competitive edge (Bubshait and Al-Atiq 1999; Kuprenas et al. 1996; Love and Li 2004), small- and medium-sized construction companies have tended to hesi-

tate and postpone this step. Although they recognize the advantages of implementing an ISO 9001-compliant Quality Management System, the difficulty in fully perceiving what is involved has kept many companies from moving ahead. The comparison of literature with practice proves that there are recurrent issues that come up in implementations in different industries, company sizes, and geographic locations. Quality Management Systems can provide a solution

for several ancient issues in construction companies. It can also constitute a good opportunity for restructuring and modernization, as well as changes in traditional ways that have been accepted without in-depth analysis.

There are, however, difficulties and problems to overcome. The implementation of a thorough Quality Management System will permanently change the company's *modus operandi* in ways that can cause discomfort to its employees and/or management. The advantages are, nevertheless, undeniable.

BACKGROUND

The creation of Quality Management Systems (QMS) has gathered the attention in both the industry and the academy sectors during the 1980s and 1990s. Total Quality Management was favored and largely implemented in the United States. The International Standard Organization's (ISO) answer was the ISO 9000 set of norms, published in 1987 (ISO 2006). This set of norms was soon defining the industry standard in certification of QMS in Europe. Although the certification of QMS in several European countries, including Portugal, has been concluded, that period has mainly served to consolidate the accreditation networks and certification bodies. Critics of the 1994 version of the ISO 9000 set of norms noted excessive complexity of procedures and excessive bureaucracy (Bubshait and Al-Atiq 1999), without correspondence in terms of the quality of the final product and of customers' satisfaction.

ISO addressed these issues by publishing a revised and comprehensive version of the ISO 9001 norm in the year 2000. ISO 9001:2000 focuses on continual improvement and customer satisfaction, based on the cycle process "Plan-Do-Check-Act." This new version set forth an important paradigm shift. The new version of the norm replaced the traditional *a posteriori* quality control by a *during-the-process* quality assurance approach. The principle was "the right production process cannot yield wrong products."

The new version of the norm proved to be a success. The new, simplified document management system and the expediting of the norm led to a clear increase of the number of companies with certified QMS. The real coverage of industry sectors was also expanded to economy sectors, company types and sizes that had previously stayed out of this process. The certification of QMS generalized itself. At present, certified QMS can be found in companies of all sizes and economic sectors in Portugal. Chini and Valdez (2003) describe a similar landscape in the U.S. market, indicating a common trend in the American and Portuguese markets.

However, the major national companies in the construction business only recently concluded their certification processes. This economic sector is still today underrepresented in the companies with certified QMS. Just as Ganner and

Johnson (1997) state in their analysis of an implementation in a software organization, "First, it can be difficult to interpret how the requirements of the ISO 9001 standard apply to a software organization. The standard was originally developed for manufacturing organizations and understanding how the requirements apply in a software organization is not always straightforward" (p. 606). Construction companies, particularly small- and medium-sized enterprises (SME), face similar challenges in their implementations, and it is not an easy task to transfer these requirements to such a unique industry like construction.

CASE STUDY

This case study examines the implementation of a QMS in a SME operating in the construction sector in southern Portugal.

At the project kick-off time the company had been operating for 40 years. It is a family run business in its third generation with 60 employees on its payroll. The company is based in a town of 2,000 and the majority of its workers have been employed by the company during most of their career. Its core business is public works and real estate construction in a radius of roughly 200 km around its office. Fig. 1 shows how the company is structured. The company is characterized by a strong, centralized and very present leadership that concentrates the authority to make all relevant decisions. Formally, the company is a multilevel structure with mid-management. However, the dashed lines portray the informal, *de facto* structure, where only two levels and one single management level exist. The single exception is the construction projects where project managers and foremen retain some degree of management autonomy on field work within their own projects.

Hence formal and informal authority, procedures, and processes exist side by side.

Employees learn this peculiar system from other employees with more experience in the company and through daily routines. This creates a complex problem when trying to implement new procedures, since employees often don't know whether the formal or informal procedures are being changed and tend to assume that the old, informal ones will remain in place.

The company decided to venture into this project for three major reasons: (1) image; (2) keeping up with competition; and (3) maintaining the capability to bid major works, both public and private.

The latter reason rose due to a widespread opinion that major public works tended to be accessible only to companies with certified QMS. This trend proved to be slower than anticipated and is yet to be fulfilled.

Figure 1. Case study organization chart

Methodology

This study is based on the direct participation of the author as implementation manager in the company and through interviews and meetings with all key users, as well as consultants and the company's owner. Table 1 portrays the scope of the survey, identifying the stakeholders interviewed by their quantity and role within the company, as well as during the implementation. The QMS implementation process lasted more than 18 months.

Major Difficulties to Overcome

Unlike manufacturing industry, for which the ISO 9001:2000 standard was primarily designed, the construction industry carries out its production in ever-changing locations, and its work teams, equipment, fringe conditions and interfaces are always different (Bubshait and Al-Atiq 1999). The built object itself is unique, with a specific dimensioning and design. Never before has another identical object been built, and it is unlikely that it ever will, in the future. In the ideal situation where all the recourses, the concept, and design are identical, at least the soil upon which the object will be built will be different.

Systematization

This reality makes efforts towards systematization, standardization, and process automation particularly difficult. Although a significant amount of technology has been added to the equipment and materials utilized, the production process in the construction industry still maintains more similarities with crafts production than with industrial production. This is probably the industry sector where new

practices, techniques, and trends arrive latest. Certification of QMS is not an exception. However, the substantial increase in recent years of the number of companies that concluded their certification processes indicates that this is a stabilized reality that cannot be ignored.

Management

Besides the specific physical and technical characteristics of its sector, construction companies also have particular management practices. The greatest challenges that construction companies face while implementing a QMS can be organized into six areas:

1. Systematization and structuring;
2. Document control;
3. Defining and maintaining procedures;
4. Client satisfaction: evaluation, analysis, and action;
5. Interaction between quality and production departments; and
6. Costs and assignment of human resources.

The first point is not the most visible challenge, but it is probably the most important one. To implement a QMS it is necessary to clarify and often delegate authority and responsibility.

Systematization and Structuring

The systematic and comprehensive definition of the function records and of the respective function matrix is a structuring task that formalizes in a binding way the function record, its functional ties, the superior functions it reports to, and the minimum and preferred competences to be met in order to

Table 1. Scope of Data Collection

Function ^a	Hierarchy formal	Informal	Role in implementation	Data collection method
Owner	1	1	Follow up and approvals	Interviews and work interaction
IT administrator	2	2	IT support	Interviews and work interaction
Lawyer (juridical sector)	2	2	Legal consultancy	Work interaction
Procurement and invoicing officer	2	2	Process definition and implementation	Interviews and work interaction
Foremen (3)	3	2	Process implementation	Interviews
Project superintendents	2	2	Process definition and implementation	Interviews
Quarry foreman	2	2	Process definition and implementation	Interviews
Head mechanic	2	2	Process implementation	Interviews and work interaction
Maintenance mechanic	3	2	Process implementation	Interviews
Storehouse salesperson	2	2	Process implementation	Interviews and work interaction
Quarry workers (2)	3	2	Process implementation	On-the-job training
Head driver	2	2	Process definition and implementation	Interviews
Drivers (4)	3	2	Process implementation	Interviews and on-the-job training
QMS Consultants (3)	n/a	n/a	Consultancy, process definition and follow up	Interviews

^aFunction and number of people surveyed (when more than one).

execute the function. Formalizing an organization chart is essential for process systematization. However, this task often meets internal resistance, since it unambiguously formalizes a specific authority and responsibility structure. This is seldom consensual and can cause ego and labor/management conflicts (Kuprenas et al. 1996). In order to avoid this problem, consultants often suggest, as a first approach, an organization chart with functions instead of names.

Document Control

Certifying a QMS implies the introduction of a strict document control process. This is often a reason for resistance by members of the structure. The most important points to clarify are:

- Which documents will be subject to document control;
- Who will be responsible for updating and monitoring the system; and
- The platform where the management records will be based.

Introduction of a document control process and maintenance of QMS records, especially nonconformities, preventive and corrective actions, verification/calibration of measurement and monitoring devices (MMDs), as well as keeping management indicators updated, are the major reasons for the widespread opinion that QMSs are complex and that they increase bureaucracy and paperwork in an unnecessary way. In fact, an underachieved implementation of a QMS will most certainly lead to results that confirm this opinion. However, if the opportunity, rather than the difficulty angle is observed, the implementation process is a good occasion to rationalize and simplify the storage and flow of records in the company, while shifting at the same time from paper to computer platforms. A successful implementation can in fact pave way for the reduction of paper and physical archives for all records in the company, QMS related or not.

Besides, the commitment to create and maintain records in a systematic manner brings about a mental shift towards the whole of documentation management: systematic, voluntary, continuous, and reliable instead of sporadic, unreliable, and forced upon. Concerning this subject, it is particularly important that the new tasks are introduced with new methods and tools to accomplish them. This is a sensitive

and often decisive issue for the success and sustainability of the implementation.

Defining and Maintaining Procedures

This issue is tightly connected with the previous one. In fact, many new procedures are created with the implementation of the document control process and with the introduction of records of nonconformities, preventive and corrective actions, and verification/calibration of MMDs.

However, Measurement, Analysis, and Improvement as set forth in the ISO 9001:2000 standard also create a set of procedures and records that have to be considered. Organizations often perceive this set of changes as extra obligations and hindrances to their fundamental mission. This attitude can be avoided if its origins are taken into consideration: production staff is by nature contrary to paperwork. Interviews showed a generalized feeling among production personnel that these tasks are unnecessary and consume time which diverts them from their essential production tasks. They often don't receive any positive feedback from the records they create and develop the opinion that the documents are either useless or are solely used to limit their autonomy and to monitor their vigilance by others. It is important to create strategies to avoid this mentality, in order to guarantee the motivated collaboration of the production staff.

Identifying the process (or activities) needed for the Quality Management System is an essential part of the Quality Manual. A common mistake is focusing on the administrative and bureaucratic part, instead of focusing on the production process. The norm does in fact require bureaucratic and administrative formalism. This is often the part the certification consultants are more comfortable with, since the administrative process is similar in any implementation they have carried out in the past. However, the aim must be kept in mind: manage the quality of the product/service provided. Thus, special attention must be given to identifying the process needed for the QMS. It must be specific, concrete, technical, and well integrated as a whole. Much more than a document with adequate formalism for securing the certification of the company's QMS, the Quality Manual must be a useful document for technical reference of the company's production activity. It must become in its various parts, especially in the identification of processes and activities, a reference manual that provides concrete and quantified information on how to carry out the production in a correct manner, both from the formal perspective of the QMS and from a technical perspective. In particular, it must specify for the measurements that must be done:

- Which, where, when, how and by whom;
- Established measurement values;
- Tolerances for these values; and
- What to do in case of a nonconformance.

Client Satisfaction: Identification, Analysis, and Improvement

This is yet another issue that is generally new to construction companies. Unlike in the services sector, there is no tradition of systematic identification of the needs and satisfaction of clients, and little emphasis on processing, analysing and improving as a result of the information obtained.

Here also it is important to shape the gathering and processing of data in a way that it is perceived by the organization as a positive contribution to its performance, not as a act of censorship or negative exposure of its work.

The layout of the questionnaires, when applicable, and the feedback from the Quality Management received by the structure are particularly important; questionnaires must be objective and clear, and the feedback must be given in an objective, constructive, and, above all, motivating manner. Negative criticism, perceived as unfair by the organization can jeopardize the quality of participation by the staff in this process. Furthermore, inadequate questionnaires compromise the credibility of the data obtained. Thus, when preparing the questionnaires, special attention should be given to the right choice of questions and their weight in the overall evaluation. Since certification consultants work in all kinds of sectors, they are tempted to propose questionnaires that are well tested, but not adequate to the specific business of the company.

Interaction between Quality and Production Departments

Staff assigned to monitoring and management of the QMS has an uneasy, misunderstood job. They are perceived as unproductive, often even a hindrance by the production staff. This image has been created by the assignment of people with insufficient production background to jobs related to quality. In many implementations of QMS, employees recent to the business or to the company have been assigned to quality related jobs. Staff members who have an administrative profile have often been preferred, in order to cope with the increased volume of documentation. Organizations may find themselves being channeled into managing the documentation aspects of the certification process, rather than into achieving the objectives of the QMS itself (Kelada 1996). Some of this staff may tend to see certification as an end in itself, rather than a means of implementing an ongoing quality system which seeks the objective of sustainable continuous improvement (Love and Li 2000). This also happened in order to avoid excessive complicity between the quality and production departments, which could lead to an incomplete and inaccurate verification of the procedures to be implemented. The quality staff then became "internal inspectors," denouncing their production colleagues' mistakes and shortcomings, or causing unnecessary work that

leads to delays in the production progress. Therefore, the staff assigned to quality functions and who interact on a daily basis with the production department should originate from the "field," thus having earned respect by the production department's staff. This way, they can do their job in a positive vigilant manner, introducing practical corrections suited to on-the-job learning by the production staff. In this context, the top management representative, as foreseen in the ISO 9001:2000 norm, has an important role to play. As a representative of the top management's commitment to the QMS, he or she will take the role of the guardian of the system against possible deviations and will guarantee that the complicity and solidarity between the quality and production staff will not be taken more seriously than the duties within the QMS.

Costs and Assignment of Human Resources

The process of implementation always means an extra effort to all in the organization. A well-implemented QMS will impact all sectors in the company. For the head of the company there is often the belief that this process can be achieved without impacting its own functions, "shoulders down." In small- and medium-sized companies, this is an illusion. These companies are managed by their head with such intimate involvement in details that it becomes impossible to keep the *modus operandi* of the head of the company unchanged. The head of small- and medium-sized construction companies is typically conservative and intervenes in the company's structure at all levels. Thus, the head has an important decision to make:

- Change the management model to a pyramid structure, with real delegation of powers; or
- Achieve deep knowledge about the QMS, follow it and make sure it is followed, thus significantly updating its previous *modus operandi*.

Another belief, or hope, in the beginning of the implementation process consists of thinking that this process represents a single time-added effort. This soon proves to be an illusion. The implementation process is, in fact, an effort limited in time. However, the extra tasks it implies must be taken into account. Besides building up new functions and resources related to the quality department, it is necessary to reassess the existing functions that are more impacted by the QMS. In the specific case of the construction industry, those affected are:

- Field engineer/superintendent;
- Foreman;
- Head of procurement;
- Personnel responsible for the reception, distribution, filing and sending of correspondence and documentation;

- Personnel responsible for storing, maintaining, and distributing MMDs;
- Personnel responsible for information technology (IT) resources;
- Personnel responsible for internal production sectors such as carpentries, metal workshops, or aggregate extraction plants; and
- Personnel responsible for health, safety, and the environment.

ADVANTAGES AND PERSPECTIVES

Achieving an ISO9001:2000-certified QMS has undeniable advantages in various fields, as it opens new perspectives for the company.

Image and Client Relationship

A certified QMS is a prestige factor. The company proves vitality, commitment to modernization, awareness of the current concept of quality, and capacity to operate important and positive changes in its structure. This alone is a basis for increased confidence by the customers. Assessment of the customers' opinions and commitment to continuous improvement brings the costumers and the company closer together. The costumers' opinions are heard and taken into account.

Restructuring and Modernization

As portrayed above, the process of implementing a QMS is a significant opportunity to restructure and modernize an organization. It is an external, widely accepted motive to change functions, procedures, and old habitudes in the organization. This effort would otherwise be considered an unnecessary and unjustified extra effort.

It is also an excellent opportunity to introduce new tools and work techniques, thus restructuring the organization not only to achieve the certification but also to make it more effective and rational. Just like when implementing Total Quality Management, when an organization implements an ISO 9001-compliant QMS, it is often dealing with replacing, not merely modifying, its culture (Demski 1993).

Systematization, Equipment, and Process Control

The certification of an ISO 9001:2000-compliant QMS is demanding in that it involves:

- Creation, maintenance, and tracking of records concerning the measurement and monitoring of processes and products;
- Verification, calibration, and maintenance of MMDs; and
- Control and preventive maintenance of production equipment.

This level of demand has been criticized for increasing the process bureaucracy. However, it brings about the adjustment of the structure to a new, more structured *modus operandi*. In some companies this means being exposed for the first time to written procedures and to the creation of records on a continuous, everyday basis.

It also demands from production personnel at all levels, recorded intermediate verifications of their work, enhancing self-control and responsibility on a wider range of functions. This represents an opportunity to change mentalities and work procedures, focusing of self-control, responsibility, measurement, and monitoring.

It is particularly important to avoid seeing QMS as one more obligation that can be fulfilled in a compressed manner right before specific milestones, maintaining the *modus operandi* unchanged during most of the year. The most important of these milestones will surely be the yearly audit by the certification body. In such a context, this audit will be preceded by a strenuous, but time-limited effort. This is a tempting deviation from the spirit of the norm and should be fought against.

Clarification of Functions, Tasks, Responsibilities, and Hierarchy

The implementation process leads to clarifying and recording what is expected from each function in the organization and the specific skills required to carry out that function. It also requires a clear, unambiguous definition of each employee's responsibilities. This requires a reassessment process that enables conclusions about ambiguous border areas. Another important aspect is the clear statement of the hierarchical chain, which outlines each employee's responsibilities and scope of authority.

Quality Standard and Continuous Improvement

Rather than guaranteeing a high level of production/services quality in the immediate post-certification phase, implementing a QMS guarantees a quality standard with lower dispersion. It also commits the organization to continuous improvement, thus gradually raising this standard.

Change in Mentality

The implementation of a QMS implies planning, defining, verifying, and updating processes and procedures. This is defined in the ISO 9001:2000 norm as the "*plan-do-check-act cycle*." It encourages a change of mentalities from a reactive to a proactive attitude. Planning and prevention gain ground to replace the daily solving of unexpected urgent problems.

CONCLUSIONS

Experience proves that implementing ISO 9001-compliant Quality Management Systems in small- and medium-sized

construction companies is an endeavor worth pursuing in Portugal. The advantages clearly outweigh the inconveniences and the investment of resources involved. Comparison with the experiences portrayed for other industries and geographical locations (Ganner and Johnson 1997; Bubshait and Al-Atiq 1999) shows remarkable similarities, which could indicate that the solutions proposed in this article can be extended to other situations. There are difficulties inherent to this process that need to be taken into consideration. They have been portrayed above and should not be underestimated. It is crucial that the stakeholders, particularly top management, are fully aware of the ramifications and changes that a QMS involves. The organization will necessarily undergo permanent changes that, when previously unknown, may drift from the initial expectation. A well-informed, planned, and systematic approach to the implementation phase avoids severe situations and reduces its duration, thus faster achieving stable operation and the desired benefits. The certification of a QMS represents an important opportunity for modernization and a paradigm shift for construction companies. It is particularly important for the small- and medium-sized companies in the business, due to the restructuring and work habit changes it brings about.

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