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QMS: Its Application and Innovation at a Small Inspection and Appraisal Company

Abstract This paper analyzes the experience of a small inspection and appraisal company, discusses the establishment of the criteria and principles of a quality management system (QMS), explores how to appropriately use the articles of the relevant regulations and laws and how to foster innovation in quality management, and finally, makes an evaluation of QMS improvement and its contribution to the development of quality management companies.

Keywords: quality management system (QMS), buildings, inspection-appraisal

1 Introduction

Using a company's operational experience as an example, this article discusses the application of quality management system (QMS) at a small inspection and appraisal company. This company "A" was formally created in December 2008 and initially had 20 people. After 6 months of preparation (from January to June 2009), including QMS establishment and compiling various documents, the company began operations. After 6 months of operation, the company began to apply for official accreditations concerning quality management. In November 2009, the company obtained a certificate of "China Metrology Accreditation" issued by the Guangdong Provincial Administration of Quality and Technology Supervision. In December 2009, the company obtained a qualification certificate for "Construction Quality Inspection Project"

from the Guangdong Provincial Housing and Construction Department. In May 2010, the company obtained a "Laboratory Accreditation Certificate" from the China National Accreditation Service for Conformity Assessment (CNAS). In October 2011, the company obtained an "Inspection Agency Accreditation Certificate" from CNAS. These certificates have been renewed to the date of this article. By the second half of 2013, there were 1,740 companies, or institutes, holding a certificate of "China Metrology Accreditation" in Guangdong. As of December 31, 2013, there were 4,890 companies, or institutes, holding a "Laboratory Accreditation Certificate" and 370 companies, or institutes, with an "Inspection Agency Accreditation Certificate" (Statistical Information, 2013).

2 Three criteria of QMS

The company A established a QMS with three major parts: QMS standards; the actual operation of the small inspection and appraisal company; and the preparation of relevant laws and regulations, standards, rules, application notes, guide and other documents. The preparation of various documents followed three criteria: *Assessment Criteria for Laboratory Accreditation* (Letter of Certification and Accreditation Administration of the People's Republic of China, 2006, No. 141); *General Requirements for Competence of Testing and Calibration Laboratories* (GB/T 27025-2008), which is equivalent to an *Accreditation Criteria for the Competence of Testing and Calibration Laboratories* (ISO/IEC 17025:2005); and an *Accreditation Criteria for the Competence of Inspection Bodies* (ISO/IEC 17020:1998, and ISO/IEC 17020:2012 version).

2.1 Common of the three criteria

All three criteria required, among other things, the following: justice, confidentiality, document control, sub-contract management, complaints, corrective action, preventive action, control of records, internal audits, management reviews, personnel, equipment, methods,

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sampling, and reporting the results. The roles of the three criteria are to make company management more standardized. As the Chinese saying goes “Nothing can be accomplished without norms or standards”, the common goals of the three criteria include improving laboratory management and technical abilities.

2.2 Differences of the three criteria

The *Assessment Criteria for Laboratory Accreditation* (Letter of Certification and Accreditation Administration of the People's Republic of China, 2006, No. 141) has a total of 19 elements. In China, which issues the certification of data and results to the society (China Metrology Accreditation/Accreditation Review) must comply with all standards. All requirements are consistent with the *Accreditation Criteria for the Competence of Testing and Calibration Laboratories* (ISO/IEC 17025:2005). However, a significant difference is that it has 19 specific terms. For example, a subcontracting proportion must be controlled (limited to equipment for the use of low frequency, high price and special construction project). This code is the basic file to apply the “China Metrology Accreditation and Qualification”. Accreditation and Qualification is a mandatory requirement of the law and management in China at both national-level and provincial-level.

The *General Requirements for Competence of Testing and Calibration Laboratories* (GB/T 27025–2008), equivalent to the *Accreditation Criteria for the Competence of Testing and Calibration Laboratories* (ISO/IEC 17025:2005), defines 25 elements. With the wide application of QMS, as part of larger organization laboratories or the laboratories providing other services, the company should also comply with this standard management system operation. The requirement is also based on GB/T 19001. This standard includes all requirements related to the laboratory testing and calibration services as defined in GB/T 19001. Therefore, following this testing standard and calibration laboratories is based on GB/T 19001. This standard is equivalent to the *Accreditation Criteria for the Competence of Testing and Calibration Laboratories* (ISO/IEC 17025:2005) and it is the basis of the international standard of testing and calibration laboratory. Laboratories are accredited according to these standards and obtain an authorization so that their testing and calibration results will be more widely recognized in China with the help of accreditation companies or institutes in China. These are also recognized worldwide if a mutual recognition agreement is entered into by companies or institutes with other countries. This standard has active significance, especially for the cooperation between laboratories, exchanging information and experiences, as well as the coordination of standard and program.

Accreditation Criteria for the Competence of Inspection Bodies (ISO/IEC 17020:2012) is a revision of an earlier

version (ISO/IEC 17020:1998). It has a total of 21 elements. The intent of this standard is to increase the trust of the inspection agencies. Inspection agency is on behalf of private clients—its head office or official agency to implement the inspection work. The purpose of inspection agency is to provide the conformity information of the project of regulations, standards, specifications, inspection plans, or contracts. Parameters checked include quantity, quality, safety, applicability, and the operation of device or system and continuous security compliance. To make the inspection service acceptable to customers and supervisory organization, the inspection companies, or institutes, should comply with this standard. The standard covers inspection activities, including material review, product, installation, plant, process, procedures, or services, determining conformance to requirements, and reporting to the customer. If it is necessary, it can be required to report to the official agency. All stages of the project are involved in the inspection and design phase. Engaging in inspection activities, especially for the evaluation of the conformity, usually requires professional judgment. Accreditations of Testing and Calibration Laboratories and Inspection Bodies are voluntary, but at the national level.

3 The innovation of application of QMS

3.1 Activating the article

After learning all the terms, the authors combined the specific circumstances of company A to write their QMS files and publicized to the staff. Every year, they would revise the files according to the actual situation, and the terms become alive. At the beginning of each year, they would draw proficiency testing programs, staff training programs, equipment traceability, and period verification plans. Internal audits and management reviews are relatively fixed happening once a year. An internal audit should cover all key elements of the standards. It is an internal check, so it is better to check as carefully as possible. The main purpose of management review is to draw out some improvement projects so that the company can make progress every year.

There is a clause in the *Accreditation Criteria for the Competence of Testing and Calibration Laboratories*: “The laboratory should keep the records of the evaluation of the suppliers of important consumables, supplies and services, which might affect the quality of testing and calibration, and establish the suppliers list.” About this clause, in the first two years, the authors' company implemented the evaluation work, and kept the records, but found later that there could be a change of the suppliers who could not satisfy with the requirements of the standard. How could they know? So the evaluation work should be dynamic in terms of the situation, to make a

survey and evaluation to the same supplier generally once a year.

3.2 Applying Innovation

Taking the staff training as an example, in Shenzhen, the professional title review needs a table—*Professional and Technical Personnel (appointment expires) Registration Form*. The content covers three years. Many people put the content of three years when they apply for a professional title. It may be incomplete. The authors found this table could use for the company's internal appraisal, and it was easy to fill it once a year. So they used it every year. When they apply for the professional title, they just take it out. They just need to combine the repeated work as early as possible.

The company has established a dedicated internal QQ group internet platform. The authors shared notification and learning materials through it. The company invited researchers from Tsinghua University Shenzhen Graduate School to help us establish a "tailor-made" QMS for editing control. It is named "document approval management system (DAMS)". The system's main work was: basic information input—draw up the contract—contract review—personnel arrangement—data input—report writing—report audit—report approval—report authorize—report output—data archiving—charge, and so on.

The authors' company made a "Training Passport" to every colleague. When participating in training, whether internal or external, a record is kept in it, including time, place, theme, organizational unit, speaker, and the training experience. It is a "passport" because it is carried everywhere the training is held and just like a passport should be taken wherever you go. The "Training Passport" should be signed and evaluated by the headmaster. If the evaluation is excellent or just OK, the page could get the "training dedicated seal" at the year's end. The authors would make statistics. Prizes would be given to those who are calculated as "excellent". To record the harvest is the intention of experience writing; it can deepen the impression and accumulate knowledge. In the future, if they read the "Training Passport" again, it will be easy to recall the content. At the same time, if they find some experiences are valuable to share, they will post on their internal QQ group. The training subjects include some large or complex projects, and the technical staffs are responsible for the preparation of the project, and the introduction to how to carry out the safety appraisal to the building. The authors suppose that it is a way to transform the tacit knowledge into explicit knowledge.

Experts have pointed out that tacit knowledge is highly individualized and specialized. It is very difficult to standardize and communicate. It is in individual mind and is hard to be seen, to be shared, to be copied, or to be managed. Explicit knowledge could be coded by, among other things, languages and digit. It is easy to share and

communicate. It can be stored in written documents and procedures, such as specification, notebook and design code. Tacit knowledge is experimental knowledge. It is accumulated gradually by the long-term practice, and tacit knowledge must be transformed by its characteristics. Experts believe that new knowledge is created through the interaction of tacit knowledge and explicit knowledge. Scholars generally believe that the proportion of explicit knowledge in an organization is just around 10%, and the other 90% is tacit knowledge (Jia & Cao, 2008).

Therefore, if there is a way that makes tacit knowledge transformable into explicit knowledge in the organization can be found, it is valuable for promoting knowledge to the members.

4 Improvements of the QMS

4.1 Early problems

Companies will often have following problems.

- (1) Appointment documents are not complete.
- (2) Quality forms are insufficient.
- (3) Job duties and qualification descriptions are incomplete.
- (4) The evaluation of equipment verification or calibration service cannot be provided.
- (5) Forms contain incomplete information.
- (6) The parameters of verification/calibration are deficient.
- (7) The analysis of training needs is lacking.
- (8) Guidance records from the senior inspector to the inspector are missing, lacking of some work instructions, measuring cylinder without verification; the professional ability of quality supervisors are failed to cover the company's business scope; several equipments are not labeled; they are lack of environmental protection program; the range of instrument is not enough; the calibration results of instruments do not confirm with the detection standard; the introduction of new standards has not been timely implemented, failed to choose a representative witness inspection plan, and not configured for the lifting gravity block of magnetic particle testing instrument of the period verification, and so on.

4.2 Solutions

QMS experts believe that for most systems or business situations, 94% of all problems come from the system itself with only 6% from personnel. Low efficiency and bad quality are caused mainly by the company management system but not staff. Good quality originates from an improved system. QMS should focus on continuous improvement, through the error correction and error proofing to prevent quality problems from occurring, rather than attribute it to employees.

In pursuit of perfect overall performance for a laboratory, QMS is a way to obtain higher efficiency and quality. By using continuous optimization and a combination of the various quality processes of QMS, companies should continuously improve the QMS.

The authors should first analyze and discover the flaws and vulnerabilities of QMS when they meet problems and accidents, such as flaws and vulnerabilities in system documents, rules and regulations. It should be determined whether the organizational structure and the process have strong operability and rationality, whether the quality system has error correction and error proofing design, and whether the quality problems and accident management should focus on the removal of the flaws and vulnerabilities of the QMS in order to prevent quality problems and accidents from happening again (Wang & Shao, 2014).

4.3 Methods improved

These problems were found by the external review group. The authors treated each problem seriously and tried to find out the reasons. Some reasons may be not external. Therefore, they should think deeply, and then determine the corrective actions, and track the implementation. The company has formed a specific kind of atmosphere, which is that they will identify the reasons when they meet problems in the work of inspection and appraisal, but not deal with them at the individual level. Sometimes there is a situation in which they find out that the system operation process needs to be improved, such as process optimization. The QMS should be improved and the management documents revised constantly according to company development. The QMS should be strictly implemented.

5 Significant achieved effect

5.1 Winning trust and enhancing competitiveness

Establishing and effectively implementing the QMS is the basic condition to apply for certification and accreditation. To obtain certification or approval might indicate the company that has the technological capability to carry out testing and calibration services according to the corresponding standards, enhance the market competition ability, and win the trust of government and community. The accrediting body can also be recognized by the bodies that have signed mutual recognition agreements with other countries or areas. They have the opportunity to participate in the international accreditation communication of bilateral or multilateral, to enhance the visibility.

5.2 Improving the quality and efficiency of work

QMS gives the managers a good guide. Its instructions are very clear. They won't go astray. They keep all the plans

and records needed, which helps the staff to improve personal ability, enhance the team's fighting capacity. They could feel the advantage of it, and it plays an important role in improving the quality and efficiency of their work. Some intermediaries make a set of documents for a company to apply the accreditation. It's not a real QMS in fact, and it becomes a mere formality. People cannot realize the real use of the QMS.

5.3 Establishing a learning-type company

Each professional person like a single pearl; managers are trying to string them together through the QMS. A single pearl becomes a treasure, and a powerful company needs talents. The authors are trying to make their team friendly, warm and full of cohesion. Accordingly, they need justice, independence, security, strict boycott unhealthy tendencies, and advance toward the quality objectives. Fortunately, several people in the company are students of senior professor Qian Lu of Tsinghua University. Prof. Lu's learning is profound and immense, but he is still modest. They were infected with his fine qualities. I still remember that a few years ago, I sent an E-mail to him with attached a WORD document. I had set the password, so the document was not editable. Prof. Lu returned my e-mail immediately; he asked me how to set the password. I was moved by his urges for new knowledge. In the last six years in his life, he was writing books. In August, 2013, one of his books was published. Prof. Lu prepared to give the books to some of his friends and students. He wrote a sentence to everyone in the book just the day when he passed by. The sentence for me is: "To study hard, to make contributions to the motherland!" Prof. Lu was a model professional and an example to us. The authors must keep learning, try their best to establish a learning company, and make contribution to their society.

5.4 Sound check of buildings

QMS makes inspections and appraisals more rigorous. It provides a sound check of building's life cycle management. In general, a building's design service life is around 50 years, and important buildings are around 100 years or more. The failure state, which is corresponding to the design service life, only affects the applicability of the normal use of the structure, such as the mild cracking or excessive deformation emerging. However, it does not threaten the structure safety. The design service life contains security reserve, even comes to the end of the design service life. If so, the suitability of guaranteed rate must be greater than 90% (Lu & Lin, 2008). It needs a check to assure the quality during design, construction and supervision phases. With the elapse of the times, and in order to improve the utilization of land, city renovation and other reasons, many buildings' lifespan are less than 30 years. Now the promotion of sustainable development and

waste of resources' reduction becomes more important, inspection and appraisal industry is burdened with an important historical mission: A dilapidated building can shake the body into a new building through testing quality assurance and retrofitting, after identification. They are invigorated, and people can live in it again. It also creates an enormous wealth of society, which has become a trend.

6 Conclusions

Buildings record a city's progress and social development. Today, the whole society is reaching for a low carbon civilization. The authors are dedicated promoting sustainable development to making a livable environment for their future generations. Inspection and appraisal work is very meaningful, because a building's life just begins when it has been built. Its whole life needs to be managed during the later decades or even a hundred years. Thus, technical staffs play a very important role in the buildings. Inspectors and appraisers doctor the building. Some scholars have studied city residential life a few years ago according to the surveys. They found that building life in cities in China was much shorter than in European and American countries.

The short life of buildings does not accord with sustainable scientific development concept and is a loss of value and a waste of material resources, constituting a huge loss of building resource and social wealth (Ouyang & Ren, 2008). Therefore, inspection and appraisal, reinforcement and transformation work will be more and more important to building structures. Accordingly, the perfect QMS will provide quality security to this work.

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