THE EFFECTIVENESS OF INTERNAL QUALITY AUDITS ON ISO 9000 QUALITY MANAGEMENT SYSTEMS IN THE CONSTRUCTION SECTOR

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Abstract

This paper examines the effectiveness, within the construction sector, of the Internal Quality Audit (IQA) and its contribution to Quality Management System (QMS) based on the ISO 9000 Certification Scheme.

Once a company has obtained ISO Certification the IQA is amongst the requirements specified in the ISO Standards that must be maintained. However, the way the IQA is conducted has an effect on its contribution to the QMS. This specifically includes company risk management and compliance with contractual obligations.

A literature review establishes the relationship between the QMS, ISO implementation and the auditing system. The four indicators of an effective IQA are identified. These indicators are then be used as a basis to measure effectiveness of IQAs when applied to construction. This paper draws on the findings of recently conducted case studies conducted on the use of IQAs in the construction industry in Singapore.

The key finding is that IQAs are under utilized in terms of a measure of the effectiveness of the QMS and also as a measure of demonstrating compliance with contractual obligations.

The recommendations arising from this research fall into two categories. The first category relates to the need to increase the frequency of conducting IQAs in order that there is adequate evidence of implementation of the QMS for the purpose of risk minimization, third party audits and compliance with contractual obligations. The second area is the need to train and educate staff to understand the role and contribution of the IQA to the overall QMS process.

Key words
Quality Management Systems, Quality Assurance, Internal Quality Audits, ISO 9000 Certification.

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Introduction

The use of the International Standards Organization (ISO) 9000 series suite is now the most widely used "technique" to be adopted by construction from the manufacturing sector. Quality Management Systems (QMS) based on the ISO 9000 series are the recognized approach to meeting quality assurance certification requirements in both the design and contracting sectors of the industry. Auditing is central to this process as the currency of the certification is established through third party audits and maintained through first and third party audits. This paper questions the reliance on third part certification as a reliable key performance indicator in the Lean construction context. This paper examines the first party audit process and its role in demonstrating that company objectives, and by inference contractual obligations, are being met. Lean construction is essentially activity and value added based. Demonstration of adherence to these objectives is not transparent in third party certification and can only be demonstrated through first party or second party audits.

The findings from case studies and questionnaires on Internal Quality Audits (IQA) by contractors in Singapore have been used to support the findings of this paper.

ISO 9000

ISO 9000 is increasingly becoming a pre-requisite for participating in large projects, in particular public sector projects. ISO 9000 is basically a set of requirements describing 'WHAT' must be accomplished, the 'HOW' is up to the individual organization. However, the attaining of the ISO 9000 Certificate does not automatically link to effective implementation of a QMS.

ISO 9000 Quality Assurance Frameworks and Auditing Standards

The Standards provide guidelines for conducting audits of quality systems. The current Standard for auditing is *"ISO 10011.1990 Guidelines for auditing quality systems, Parts 1 – 3*" (ISO 10011). Part 1 of ISO 10011 covers Auditing, Part 2 deals with Qualification criteria for auditors and Part 3 deals with Management of audit programs.

Lim and Niew (1995) have stated that quality audits may be internal or external and take one of the three following categories:-

First Party Audit – This audit is conducted by an organization on itself and may be done on the entire company or part of it. This audit is a mandatory requirement under Clause 4.17, Internal Quality Audits, of the ISO 9000. It is usually called an internal audit.

Second Party Audit – This audit is conducted by one company on another. It is usually an audit on a supplier by a customer and it is considered an external audit.

Third Party Audit – This audit is conducted by an independent company (the third party) on a supplier to gain certification. It is always known an external audit.

The only way to determine whether a QMS works is through checking and monitoring its implementation. Only through actively seeking out deficiencies then can the problems be identified and solutions found. Therefore, even if internal auditing was not a formal requirement of ISO 9000, it is a necessary undertaking in order to check the effectiveness of a QMS.

Quality Management Systems and Lean construction

Ballard and Howell (1998), citing Womack and Jones (1996), considers the tenets of Lean construction to be Lean Thinking and Lean Production. A properly structured QMS is capable of delivering on the former while the IQA facilitates a pro-active approach to the latter. In particular Makulina's (1998) requirements to match "what manufacturers have learned" in relation to quality means that "inspection comes from the supplier".

The role of the IQA within the particular characteristic of construction industry contractual frameworks needs to be put in perspective. The third party external audit determines whether the QMS meets the standards and requirements of ISO 9000. A certificate of currency is issued on the basis of evidence of appropriate procedures and the correct implementation of those procedures. This certificate will continue to be the acceptable criterion for pre-selection criteria for contractors or partners in strategic alliances. This certificate does not ensure that these procedures will be or are being implemented on a project specific basis. Because the IQA seeks to continually examine and improve effectiveness of the implemented QMS to meet the organization's quality objectives, it provides the project specific evidence of compliance. The IQA also meets Ballard and Howell's criteria in relation to the transparency requirements of Lean Production. The use of the results from the IQA does not involve either party in the additional costs involved in second party audits and is contractually less intrusive than the use of second party audits.

Reasons For Maintaining ISO 9000 Certification

Hutchins (1997) has identified the following areas as reasons for obtaining and keeping ISO 9000 Certification: -

Customer-Marketing Benefits

a) Conveys commitment to Quality
b) Fulfils contract requirements
c) Conveys Operational and Systems assurance
d) Facilitates On-time delivery

Internal Benefits

a) Facilitates Business and Quality Planning through detailed records
b) Used to transform company
c) Provides insights on company inter-relationships
d) Encourages internal focus and makes operations more efficient and effective
e) Assists staff in understanding and improving operations

These areas are capable of meeting Howell's (1999) criteria for Lean construction. These

criteria consist of :-

- "clear objectives for the delivery process"
- " maximizing performance for the customer at the project level"
- "concurrent design of product and process"
- "the application of production control throughout the life of the project"

All these criteria are achievable under third party certification. The weaknesses of the current approach becomes more apparent when Howell and Ballard's (1996) requirements in relation to project controls are applied. The traditional approach involves "monitoring conformance of DID with SHOULD" In particular, Howell's requirements in relation to determining a "degree of match between SHOULD and CAN" in the context of dynamic, complex projects is not accommodated within the project controls framework typically encountered under third party certification. IQAs are capable of demonstrating the degree of match between SHOULD and CAN and providing the transparency required by Ballard and Howell (1998).

Internal Quality Audit

The Standard for vocabulary, "*ISO 8402:1994: Quality management and quality assurance - Vocabulary"* (ISO 8402), Clause 4.9, defines a quality audit as a "*systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives*."

ISO 9000, Clause 4.17, Internal Quality Audits, requires an organization to audit its own QMS procedures and activities. This is in order to establish whether they comply with planned arrangements and to determine that the effectiveness of the QMS is adequate and being followed by the staff.

Hoyle (1996) states that the main purpose of an IQA is to: -

- Determine whether the QMS is effective in maintaining control to meet the resultant products and services of the specified requirements and achieving the prescribed quality objectives.
- Establish through unbiased means, factual information on quality performance.

Principles of Developing An Effective Internal Quality Audit

Based on ISO 10011, there are four main guiding principles to be followed in developing an effective IQA. These are training, audit plans and procedures, management involvement and educating the auditees/employees. Thomas (1996) considers the IQA as the appropriate tool for maintaining ISO 9000 to the highest possible level and to receiving the maximum benefit from the Standard through the achievement of stated business objectives.

Principle One - Training of Auditors

ISO 9000, Clause 4.18 Training, requires personnel performing specific assigned task to be qualified on the basis of appropriate education, training and/or experienced.

ISO 9000 Clause 4.17, Internal Quality Audits, requires that an ISO company to maintain an IQA program. However, the Standards do not explicitly state the composition of the audit team. In the absence of the audit team composition specification companies can use either an external first party auditor or an internal team. Regardless of the approach adopted, all organizations must maintain an IQA program in order to keep ISO 9000 Certification.

It is the responsibility of the organization to ensure that the auditors are carefully selected and trained to make certain of their competence in audit skills. Training should include:

a) Knowledge and understanding of ISO 9000 Standards and regulations;
b) General structure of the company QMS as a whole and applicable elements;
c) Auditing techniques (questioning, evaluating and reporting)
d) Managing audits which require planning, organizing, communicating and directing; and
e) On the job training as observers or member of the audit team.

Training in IQA auditing procedures is an important and ongoing process. However, how much time and cost to be invested to maintain the standard of an audit is subjective and it will vary from company to company.

Principle Two – Audit Plans and Procedures

a) Audit Plans

The minimum frequency for conducting IQAs is not specified under ISO 9000, Clause 4.17 Internal Quality Audits or under ISO 10011, 5.1.2 Audit Frequency. The frequency of IQAs under ISO 10011 is determined "by the client, taking account of specified or regulatory requirements". The frequency of IQAs may be specified by the third party certifier or the national bodies regulating certification. Some direction may be obtained from "*ISO/IEC Guide 62:1996 General requirements for bodies operating assessment and certification/registration of quality systems*" (ISO/IEC Guide 62). Under Clause 3.6 this Guide addresses the issue of post-certification monitoring of implementation under "Surveillance and Reassessment Procedures", but does not state a minimum frequency for external auditing. It does state that "it is most unlikely that a period greater than one year for periodic surveillance would satisfy the requirements of this clause". In theory an IQA must be carried out at least once a year, in practice this frequency can be increased by the requirements of the third party certifier or the regulating body for certifiers.

The audit plan has to have a schedule of IQAs that demonstrate a comprehensive review of the QMS. The schedule has to include all the procedure references and a summary of the activities required by the procedure within the QMS (Jackson and Aston, 1995).

Auditing must be carried out by someone who is not involved in the day-to-day activities for reason that the person is more likely to focus on what should happen than on what actually happens. (Voehl et al, 1994)

b) Audit Process

Under ISO 10011 the audit process is divided into three main phases: 1) audit initiation, 2) system inspection or execution phase and 3) follow-up action.

1) Audit Initiation

The auditor is to be familiarised with the QMS procedures, the responsibility of each person involved and how the records are kept. On the basis of an Audit Schedule the internal auditor should prepare the list of people to be interviewed, the questions to be asked and the type of records to be inspected. Good preparation will ensure that the procedure is checked comprehensively and time saved.

2) Audit Execution

Opening Meeting - The purpose of an opening meeting is to introduce the members of the audit team, review the scope and objective, a short summary of the methods and procedures and to clarify any unclear details.

Collecting Evidence - This is done through interviewing on the procedure and looking for documentary evidence. The conformance or non-conformance will be noted and included in the audit report.

Closing Meeting - The main purpose is to present audit observations to the senior management in such a manner so as to ensure that the results of the audit are clearly understood.

Audit Report - The report is written by the team leader and a copy of the report becomes a quality record. As stated in Stimson (1998), the fundamental purpose of the report is to discuss non-conformances, so it should identify items to be taken for corrective action and suggest a schedule for doing so.

Corrective Action Requests (CAR) - A meaningful audit will allow non-conformance to be rectified. CARs are designed for the auditor to highlight the areas of non-conformance so that the audited department can respond to the findings.

3) Follow-Up Action

An audit will only be complete when the CAR's are completed. Corrective action and subsequent follow-up audits should be completed within a timely period to be agreed or as per the company's quality manual.

Principle Three – Management Involvement

ISO 9000, Clause 4.1.2.2 Management representative, sets out the responsibility of the management appointee under the QMS. This appointment is necessary to ensure that the QMS is properly implemented and maintained and at the same time, to communicate the vision and mission of the ISO 9000 initiative. (Hutchins, 1994)

According to Johnson (1997), management responsibility is arguably the most important component of the Standards. Its placement confirms what quality professionals have always known that management responsibility is an absolute pre-requisite to the successful pursuit of quality.

The following are a list of responsibilities of the management appointee:-

- Designates a representative with authority and responsibility for implementing and maintaining the requirements of the Standards and reporting on the QMS performance to management
- Establishes, documents and publicize management policy, objectives and commitment to quality and customer satisfaction
- Defines and documents the responsibility, authority and relationships for all employees whose work affects quality
- Conducts review of the quality system in conjunction with other members of the management executive and maintain records of these reviews
- Identifies and provides resource requirements necessary to ensure proper functioning of the quality system

It must be remembered that ISO 9000 is not prescriptive in itself to a product or service. The Standard only provides a framework for quality and in the long run for quality improvement. The two common misconceptions are that the ISO Standard itself is a QMS and it provides some guarantee on product quality (Jackson and Ashton, 1995).

Principle Four – Educating the Employees

ISO 9000, Clause 4.18 Training, requires training to be provided to "all personnel performing activities affecting quality". The success of the QMS is dependent on how well the reason for quality and its value is communicated to the employees. Therefore, without understanding and cooperation, the employees will fail to take ownership and not support the system (Hutchins, 1994). This may also lead employees to think that they will be penalized if any items are found not in compliance. In order to avoid such misconceptions, the management has to play an important role in changing the mindset of the organization.

It is suggested by many authors that during the audit period the auditors need to get the auditees involved and agree to the deficiency exists in the system so that corrective action can be carried out successfully. Making the most of the IQA will therefore create greater

employee involvement, improve job satisfaction and provide opportunities for continuous improvement.

These four principles formed the basis of the questions used in the case study interview and questionnaire surveys discussed in the Data Analysis section of this paper.

Maintaining Currency of Certification

The conduct of the IQA is very similar to the ISO 9000 third party assessment process, except that the company plays a prime role. Many companies maintain the system with minimal implementation in order to meet the requirements of the external auditor (Thomas, 1996). A company that relies solely on the minimum frequency of IQAs to monitor the system will receive few benefits and could easily lose third party certification. The external auditor's role is merely to oversee and report how well the system is maintained according to ISO 9000.

The implication of these findings are now considered in a broad contractual context and in the light of case studies and surveys conducted on this issue in Singapore.

Data Analysis

The collection of data in connection with current practice and that application of IQAs in Singapore was undertaken by Goh et al (2000) in the first half of 1999. This data was based on three case studies and the responses of thirty companies to a questionnaire.

The findings may be summarized under the headings previously identified in this paper as consisting of a) Training of Auditors, b) Audit Plans and Procedures, c) Management Involvement and d) Training employees.

a) Training of Auditors

Training of internal auditors was not contentious with some 83% of respondents providing training.

b) Audit Plans and Procedures

Two of the responses from this section present problems. The most serious is the relatively high percentage of 53% of respondents that feel the IQA should only be carried out once a year. While this complies with the requirements of ISO 9000, Clause 4.17 Internal Quality Audits, it does means that contracts of less than one years duration are not subject to audit during their currency. Considerable portions of longer contracts will have been undertaken before they are subject to audit. It is most unlikely that such firms are well positioned to meet the Lean construction criteria identified by Howell (1999) or the transparency aspect required by Ballard and Howell (1998). They do meet the requirements of certification to ISO 9000 under third party audits.

Equally disturbing is the response on carrying out follow-up action arising from the audit. Only 40% of respondents undertook this action. This aspect is basic to achieving Howell's (1999) "degree of match between SHOULD and CAN".

c) Management Action

In 87% of the respondents the IQA process had management involvement. The precise degree of involvement was not established as a relatively unsophisticated survey instrument was necessary to ensure adequate participation rates. Obviously the importance of this issue in a Lean construction context is the nature of the management involvement in project controls. While the Lean criteria of Ballard and Howell (1998) of "project–as–production-system" is not evidenced by these findings it does point to a shift away from the "current activity or contract centered perspective" that dominated thinking prior to the introduction of ISO 9000.

The critical issue is what management action follows the results of the IQA. The IQA identifies for management the aspects of the process that need attention. If these IQAs are conducted at a frequency that is inadequate to permit the undertaking of corrective action then management cannot claim to be genuinely involved but simply meeting ISO 9000 certification maintenance.

d) Training of Employees

The survey questions on the issue of training of employees in the QMS indicate that the response figure of those that do not undertake training of employees could be as high as 20%. This figure is made up of 7 % that did not provide training and a further 13% with no opinion on this question. Given that all respondents were employed in ISO 9000 certified companies and would meet normal pre-selection criteria, this result demonstrates yet again the risk associated with relying entirely on third party certification.

Conclusions

This paper has examined the role of IQAs within the overall context of ISO 9000. The guiding principles of an effective IQA have been identified as follows:-

- Training
- Audit Plans and Procedures
- Management Involvement
- Educating the Auditees/Employees

The effect of each of the above four (4) main factors has a resultant force that determines how much the organization benefits from IQA in terms of its contribution to the evaluation of QMS.

The undertaking of IQAs as a basis of evidence of an effectively implemented QMS has been examined. The process also looked for evidence to demonstrate a capacity to meet the requirements of Lean construction in relation to Howell's (1999) SHOULD and CAN criteria and the transparency aspects of Ballard and Howell's (1998) criteria.

In addition to the above factors, the objectives for obtaining and the reasons for keeping ISO 9000 certification have been examined through the case studies and external surveys. These factors are believed to be the drive to achieve an effective QMS.

Having compiled, collated and discussed the results from the case studies and surveys, this section derives the conclusions with regards to the ways IQAs are being conducted and their contribution to QMS.

The following conclusions are derived in respect of the above factors highlighted.

Objectives for Obtaining ISO Certification

As far as objectives for obtaining ISO 9000 certification are concerned, customer requirement and a good QMS were found to be the initial objectives for the ISO Certification for most companies.

The Four (4) Principles of an Effective Internal Quality Audit

The only way to determine whether a QMS works is through checking and monitoring its implementation and this can be achieved through a properly conducted IQA.

The following conclusions in respect of the Four (4) Principles to developing an effective IQA are derived from the results of the case studies and surveys discussed in Data Analysis.

Principle One - Training

A majority of the companies acknowledged the importance of having trained internal auditors and had sent their staff for external training.

Principle Two - Audit Plans and Procedures

Results show that most companies do not carry out IQA more frequent than the minimum required by ISO 9000 Standards of once a year. Thus it can be concluded that most companies are not regulating the frequency of their IQA.

This once a year frequency must raise serious doubts about the efficient implementation of a QMS. In the absence of the full adoption of the most fundamental techniques that Lean construction has transposed from manufacturing, it is unlikely that this level of frequency will satisfy the principles of Lean Thinking and Lean Production.

Principle Three – Management Involvement

The findings of this research show that management is substantially in support of the ISO 9000 certification and therefore IQAs are being supported since they are part of the mandatory requirement under the ISO 9000 Standards. It is not clear if the support would be maintained if ISO 9000 certification ceased to be a motivator.

Principle Four - Educating The Auditees/Employees

There is no doubt that every company has one way or the other educated their staff on the overall objectives of their QMS. Nevertheless, their personnel are not educated on the particular importance of the requirements and objectives of the IQA. There is a continuing need for further education and wider dissemination of information on the IQA, in order to overcome the potential weakness of inaccurate feedback from the auditees.

Contribution of Internal Quality Audit to Quality Management System

It is widely acknowledged that an IQA is indeed an effective tool to evaluate the QMS. Yet, when comes to the ranking of its contribution to the QMS, it is ranked as contributing the least. Thus, unless an IQA is properly conducted its potential is limited.

Recommendations

The results of these research findings show that IQA is an effective tool to measure the effectiveness of the QMS.

Therefore, in order to realize the full potential of IQA, the following recommendations are made to increase the usefulness of it and to improve the effectiveness of the IQA.

Increase in Effort by Management

There is a need for encouragement from the management to get total involvement from all the staff. This will include promotions on the QMS and emphasizing the IQA through seminars, talks, games, brainstorming sessions, etc. related to QMS and IQA. In addition, management need to conduct IQAs at a frequency that will permit them to undertake corrective action rather than the identification of problems after they have been created.

Internal Quality Audit training for All Level of Staff

All staff, including the management, need be sent to attend IQA training so that there will be true feedback of the QMS's strength and weakness.

Increase the Frequency of Internal Quality Audit

The frequency of IQAs should be regulated according to the specific requirements of the individual company rather than just adhering to the minimum required of ISO 9000 Standard that is only once a year. This frequency must be increased to ensure clear demonstration of compliance with DID, compliance with the actual requirements of SHOULD and the capacity to embrace the concept of CAN. Once this progression has been established then the principles of Lean construction can be embraced.

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