

## **ISO 9000 CRITICAL QUALITY ELEMENTS FOR A CONSTRUCTION**

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### **INTRODUCTION**

It is learnt from the experiences of the countries that had pioneered the ISO 9000 Quality Management System in the construction industry, one of the main factor that impedes the success of implementing the system at its infancy stage is the quality consultants' lack of understanding of the industry [1]. Trying to apply the principles of ISO 9000 generic quality elements without understanding the processes and the parties involved in the construction industry will mount problems, far away to achieve a quality corresponding to the client's requirements and to the budget and time allocated for a particular project. As a generic quality model the ISO 9000 is designed with flexibility in mind [2]. As such each industry or organisation can develop its model according to its particular needs. Indeed, the ideal ISO 9000 system for manufacturing industry would be totally different from that of construction industry.

Unlike the manufacturing industry where most of the processes are managed under one roof, many parties that range from a client to a small trade sub-contractor were involved in the construction work to bring into the end product i.e. buildings, bridge, roads etc. In a large construction work, it is common to have a separate party that comprised of the project manager, the design consultants, the supervisory consultants and the main contractor. Each of them has their own specific functions and responsibilities from which the appropriate quality elements should be tailored to.

## **THE OBJECTIVE**

This study aims to identify the critical ISO 9000 quality elements for the construction project team specifically the project manager, the supervisory consultants and the contractors in order to ensure an effective implementation of a QMS in a construction project.

## **THE METHODOLOGY AND SCOPE OF THE RESEARCH**

The case study [4] was conducted at the Kuala Lumpur International Airport (KLIA) project. To ensure the quality of this project, the government implemented the QMS with specific reference to the ISO 9000 standards with regard to construction industry. The study was focused to the construction stage and therefore was concentrated on the critical quality elements for the Project Management Consultant (PMC), the Supervisory Consultants and the Contractors.

Multiple sources of evidence particularly archival work on the quality records kept at the PMC's office and interviews with the key personnel of the Department of Planning and Quality Assurance were extensively explored. Participant-Observation and survey through questionnaire techniques had not been used as the construction of the KLIA was at the final closing thus; most consultants and contractors were no longer based at the site office. The research activities had been divided into 6 tasks:

- Task 1 - Literature review on the principle of ISO 9000 and general roles of PMC, the supervisory consultants and the contractors. Interviews the PMC's personnel to understand the function of the parties involved in the project.
- Task 2 - Interpretation of ISO 9000 standards for the construction industry.

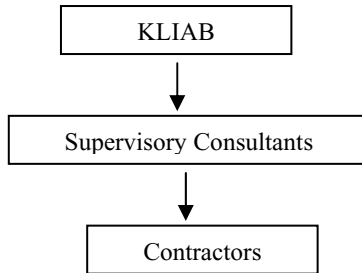
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- Task 3 - Developing Quality Requirements for each Quality Elements of ISO 9000 for PMC, Consultant and Contractor.
- Task 4 - Categorizing and Recording All Reported Non-Conformances under relevant Quality Requirements and Elements of ISO 9000.
- Task 5 - Identifying the Critical Quality Requirements for each Quality Elements for PMC, Consultant and Contractor respectively.
- Task 6 - Identifying the Critical Quality Elements of ISO 9000 for PMC, Consultant and Contractor respectively

### **THE KLIA'S CONSTRUCTION PROJECT TEAM**

The construction of KLIA comprised of 147 contracts where each contract amounts between RM 1million to RM 162million. More than 110 parties and 25 thousands employees from over 51 nationalities were involved in this project. Cross-culture interactions such as contradicting work culture and language barrier have posed many unavoidable problems at the same time.

In this construction project, Kuala Lumpur International Airport Berhad (KLIAB) acted as the PMC. It engaged supervisory consultants to supervise the work of various contractors. The relationships between these parties under the QMS are shown on Figure 3.1.



**Figure 3.1** Organizational levels in KLIA Construction Project  
**THE PROJECT MANAGEMENT CONSULTANT (PMC)**

KLIAB represented the government of Malaysia in making government-related decision. It was also responsible in the selection of consultants and contractors for this project. As PMC, KLIAB was obliged to ensure that the government’s requirements will be achieved that were to complete the project within the specified time, budget and specification. It acted as a leader to coordinate the work of all consultants and contractors so as to ensure a synchronized effort towards completing this project.

### **THE SUPERVISORY CONSULTANTS**

The role of the supervisory consultants were to inspect the work performed by the contractors and advised the KLIAB regarding the level of conformance demonstrated by these contractors. With their expertise, they were required to provide technical advice and services so that defects as well as non-conformance to the quality requirements can be more effectively identified and eliminated during the course of construction. In cases where non-conformances were identified, supervisory consultants must report immediately to the project manager and inform the contractors. They had to provide technical advice and support; and work together with the contractors to develop corrective and preventive measures to overcome these non-conformances and defects.

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Supervisory consultants were also responsible to check and verify all design specifications and work procedures fulfilled the quality requirements and complied with the regulations imposed by various authorities such as District Council and Fire Departments.

#### **THE CONTRACTORS**

The contractors were regarded as the executor of the construction works. They were the party directly responsible to convert the blueprinted quality requirements into reality. Thus, the quality of the product depended very much on the contractors. Under the QMS the contractors had to submit their quality plan, which includes the method statements and procedures of works to be carried out. This plan will be checked by the supervisory consultants to ensure that the procedures complied with the contract's specification and approved by the PMC prior to construction. During the course of the construction, the contractors had to follow strictly to the procedures stated in the approved quality plan.

#### **ISO 9000 QUALITY ELEMENTS**

ISO 9000 series of international quality standards were first published in 1987 by the International Organisation For Standardisation. The ISO 9000 series is a standardised quality system that has been approved by over 90 countries. ISO 9000 is the result of many countries and cultures trying to define the minimum instruction set for creating a complete management system of quality assurance. Table 3.1 below illustrates the content of the major titles under the revised ISO 9000 series.

**Table 3.1** The Titles of the 1994 Quality System Standards

<b>DOCUMENT</b>	<b>TITLE</b>
<b>ISO 9000-1:1994</b>	Quality management and quality assurance standards – Part 1: Guidelines for selection and use
<b>ISO 9001: 1994</b>	Quality systems – Model for quality assurance in design, development, production, installation and servicing
<b>ISO 9002: 1994</b>	Quality systems – Model for quality assurance in production, installation and servicing
<b>ISO 9003: 1994</b>	Quality systems – Model for quality assurance in final inspection and test
<b>ISO 9004-1: 1994</b>	Quality management and quality system elements – Part 1: Guidelines

There are 20 quality elements in ISO 9001. Table 3.2 provides typical guideline for a responsibility matrix in establishing the primary and support areas of management responsibilities.







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4.1 5	Handling, Storage, Packaging, Preservation and Delivery																		
4.1 6	Control of Quality Records																		
4.1 7	Internal Quality Audits																		
4.1 8	Training																		
4.1 9	Servicing																		
4.2 0	Statistical Techniques																		

Legend: ● (Major Role), ■ (Support Role), ▲ (ReviewingRole)

**QUALITY AUDIT RESULTS FOR KLIA’S CONSTRUCTION PROJECT TEAM**

According to ISO 8402, quality audit is defined as; “A systematic and independent examination to determine whether quality activities and related results comply with the planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives” [3].

Once a Quality Management System is being implemented in an organization, the organization has to examine the effectiveness of its resultant documented quality system. Auditing does not only

demonstrate that the organization has achieved compliance to its documented quality system but also serves as a monitoring device to ensure continuous compliance and improvement.

Quality audit was conducted frequently at KLIA construction project to ensure that the QMS was being implemented effectively. The results of the audit was analysed to identify discrepancies in the implementation of the system. All discrepancies such as no proper documentation and contravene the stated procedures that were recorded in the audit reports were tabulated accordingly – PMC, supervisory consultants and the contractors. The result for each party was then summarized in the form of bar chart as shown on Figure 3.2.

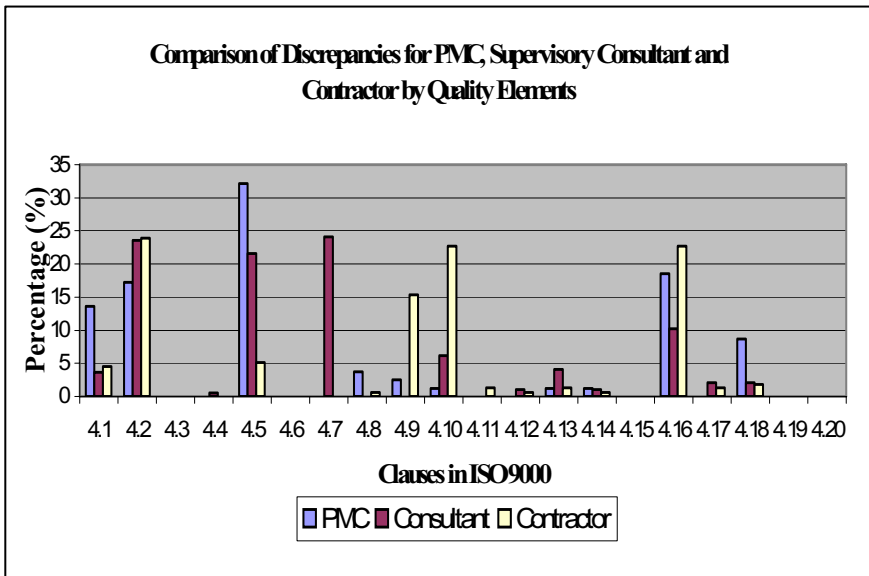


Figure 3.2 Comparison of discrepancies for PMC, supervisory consultant and contractor by quality elements

## **ISO 9000 CRITICAL QUALITY ELEMENTS FOR KLIA'S CONSTRUCTION PROJECT TEAM**

The data analysis presented above had enabled the identification of the critical quality elements for PMC, Supervisory Consultants and Contractors by using the Pareto concept (those 20% of elements that contribute 80% of the total discrepancies). The critical quality elements for each party are summarised as shown on Table 3.3.

According to the array of the most significant to the less significant, the critical quality elements of ISO 9000 for PMC are document and data control, control of quality records, quality system and management responsibility and for the supervisory consultants are control of customer supplied product, quality system, document and data control and control of quality records. Whereas, for the contractors the array is started with the element of quality system and then followed with inspection and testing, control of quality records and process control.

Due to their different job functions, the relevancy of the quality elements to each party varies and this explains the phenomenon shown on Table 3.3. Some quality elements such as Clause 4.16: Control of Quality Records, are critical and important for all three parties while there are other such as Clause 4.10: Inspection and Testing and Clause 4.9: Process Control which is important only to the Contractor; and not relevant at all to PMC or Consultant.

Table 3.3 Critical Quality Elements For KLIA’s Construction Project Team

Cl au se	Element	Percentage (%) of Discrepancies		
		PM C	Supervis ory Consult ants	Contra ctors
4. 1	Managem ent Responsi bility	13. 58 %	-	-
4. 2	Quality System	17. 28 %	23.59%	23.93 %
4. 5	Documen t and Data Control	32. 10 %	21.54%	-
4. 7	Control of Customer Supplied Product	-	24.10%	-
4. 9	Process Control	-	-	15.34 %
4. 10	Inspectio n and Testing	-	-	22.70 %
4. 16	Control of Quality Records	18. 52 %	10.25%	22.70 %

## **CONCLUSION**

Construction project involves various parties, which creates a 'quality chain' along the construction process. Identification of responsibility as such allows members of the parties to effectively focus all efforts towards the right direction of realising the client's requirement. This also provides accountability, which is utmost critical in achieving continuous quality improvement

The study had identified four major critical ISO 9000 quality elements for each key party involves at the construction stage. Each party have one common critical element to be concentrated upon that is the quality system. The critical quality elements for the PMC are document and data control, control of quality records, quality system and management responsibility. The supervisory consultants have to give emphasis on the quality elements of control of customer-supplied product, control of quality records, quality system and document and data control. The contractors have to concentrate more on the quality elements of quality system, process control, inspection and testing and control of quality records. These findings hopefully will improve the capabilities of the construction project team in implementing the QMS effectively by giving greater attention to the identified critical quality elements. In addition they will also assist the quality consultants to design the correct and proper training schemes in quality programmes for the construction project team.

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