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REENGINEERING OF ISO 9001:2000 DOCUMENT MANAGEMENT SYSTEM

COMPLIANCE WITH CONSTRUCTION INSPECTION PROCESS

THONG JIA WEN

A project report submitted in partial fulfillment of the
requirement for award of the degree of
Master of Science (Construction Management)

Faculty of Civil Engineering
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MAY 2008

I declare that this thesis entitled "Reengineering of ISO 9001:2000 Document Management System Compliance on Construction Inspection Process" is the result of my own research except as cited in the references. The thesis is not been accepted for any degree and is not currently in submitted in candidature of any other degree.

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Dedicated to:

My family

I would always cherish the love you

have shown to me.

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ABSTRAK

Sistem Pengurusan Kualiti atau "Quality Management System" (QMS) merupakan satu sistem keperluan dalam Industri pembinaan bagi tujuan meningkatkan kualiti dan menjimatkan masa serta kos. QMS ini perlu dilaksanakan bagi memenuhi keperluan spesifikasi yang ditetapkan dan juga menjamin kualiti produk kepada para pelanggan. Proses QMS ini biasanya melibatkan banyak dokumen yang memenatkan, memerlukan penapisan maklumat yang sukar, proses maklum balas yang memakan masa yang panjang serta kurang daya pengeluaran yang memerlukan kerja berpasukan. Dengan menggunakan ".Net Framework" yang mempunyai kebolehan membina satu model tersendiri untuk industri pembinaan dapat melakukan kerja-kerja seperti mendapatkan kelulusan, penyelarasan hasil pasukan dan menjana kerja-kerja peningkatan kualiti perkhidmatan. Organisasi antarabangsa yang mempunyai sistem teratur (ISO) telah dipilih untuk menyatukan proses pemantauan QMS ini dengan aplikasi .Net Framework melalui Pembantu Digital Peribadi atau "Personal Digital Assistance" (PDA). Dengan ini, proses pemantauan tanpa kertas dapat dilaksnakan di tapak pembinaan. Aksi-aksi pencegahan bagi kerja "Non-Conformances" yang dikenalpasti dapat dijana melalui "Process Workflow" di .Net Framework bagi memastikan peningkatan mutu yang berterusan.

ABSTRACT

Application of Quality Management System (QMS) in construction has become a norm to the construction industry to enhance cost, time and quality. QMS has required inspection to be carried out to ensure the product meets specified purchase requirement and provide quality product to customer. The determine process had resulted in exhausting documentation, extraction, slow feedback and lack of team productivity. As such, .Net Framework has the capability to build as a collaborative model for construction industry to get approval, coordination group effects and issue tracking for further improves to the quality of services. A potential International Organization for Standardization (ISO) company had been selected to incorporate with their inspection process in QMS by creating an application in .Net Framework through the integrating of Personal Digital Assistant (PDA) during inspection at site which paperless situation are to be adopted. Non-conformances had been identified and preventive action was issued through the process workflow in .Net Framework for implementing continual improvement.

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CHAPTER I

INTRODUCTION

1.1   Introduction

In contemporary organizations many working processes are connected with documents, i.e. recorded information structured and represented for human consumption. Sharing the collective knowledge stored in documents is, however, often impaired by the lack of a common technological and organizational infrastructure for enterprise document management (EDM, Sutton 1996). Sprague (1995) defines document management as:

"*creation, storage, organization, transmission, retrieval, manipulation, update, and eventual disposition of documents to fulfill an organizational purpose*".

The design and implementation of the document management functions above is only a subset of the challenges to be met in establishing successful DMS. To achieve high quality DMS, a lot of organizational support is needed (Meier & Sprague 1996). In managing process change initiatives, reengineering seeks to achieve radical changes in processes within a bounded time frame, whereas quality management or continuous improvement emphasizes improvement over an open-ended period of time (Davenport & Beers 1995). Quality assurance activities in organizations and their processes have traditionally been widely organized by quality management systems (QMS). The ISO 9000 series of standards offers a well-known

model to demonstrate the quality of products or services (e.g. ISO 9001, ISO 9002). ISO 9000 standards have, however, been criticized for their limitations (Braa & Øgrim 1994, Reimann & Hertz 1993). In some companies the external auditing of quality has been the most important motivation for the implementation of ISO 9000 standards. Quality award criteria (e.g. Malcom Baldrige Award Criteria 1995) instead explicitly address customer focus, benchmarking, organizational learning and continuous improvement, and require organizations to be able to prove that they actually use specific methods for these purposes. In some companies, continuous improvement of processes has been implemented by a quality system where the minimum quality assurance activities required by ISO 9000 standards have been augmented by activities typical in quality award criteria.

ISO 9001:2000 specifies requirement for a quality management system where an organization needs to demonstrate its ability to consistently provide product that meets customer and applicable regulatory and to enhance satisfaction through effective application of system, including processes for continual improvement (MS ISO 9001:2000). These regulatory and processes had been applied in construction inspection process for checking the product quality and specify area need to be improved for future lesson learned methodology.

The construction inspection process often requires real time monitoring and reporting, project evaluation and etc. However, construction projects typically take place in an environment where it is difficult for site officer and project engineer in the construction to gain access to conventional computers for use as real-time decision aids as the gone through the project evaluation, building M&E inspection or pre and post concrete quality inspection (Trefor, 2003) and apply the processes for continual improvement. The whole process also requires approval from site officer, project engineers, head of department and management representative concerned that it takes weeks to complete the cycle of inspection process.

Inspection process had been identified from the access of construction to the corrective and preventive action for continual improvement to the organization. In order to maintain continual improvement of the product quality, there is collective feedback through variety of channels such as processes and nonconformance

inspection checklist and that need to be reviewed for continual improvement opportunities. Employees in all functional areas, at all levels, have the authority and ability to propose and implement continual improvement whereby corrective action requests are documented and reviewed to prevent recurrence of non-conformances and preventive actions requests are reviewed for a risk-benefit assessment. As appropriate, preventive action is taken to address potential problems. All of these processes need data collection, proper documentation and structure to accomplish the needs with QMS.

1.2   Background Study

The real time inspection in site and approval from several parties is very time consuming that it has been recognized for sometime that capturing these data and approval through computer devices to enable with suitable wireless capability and document management system (DMS) can address these problem, thereby increasing operative efficiency and ensuring better integration with the existing QMS of the organization is essential

In order to create integration between QMS and DMS, the inspection process is carried out using information technology (IT) that interlinked with offline documents and online web portal. The offline documents include real time inspection checklist, corrective and preventive action forms and non-conformance forms that personal digital assistant (PDA) will be used whereby online documents are including the inspection workflow templates, checklists and forms that need to be approved, retrieved, collected and given feedback through the online web portal, .Net Framework. The offline documents in PDA are to be collaborating with desktop computer and linked to .Net Framework. Even though PDA is with wireless network connection but it received low feedback from the market because of experienced of frequent interruption in the network connection that either caused by weak radio signal or by interference and it also created few versions to the documents. After

inspection carried out, it will be synchronize with desktop computer and connect to the server (refer to Figure 3.1).

1.3   Problem Statement

Implementation of ISO 9001:2000 is to improve the Quality Management System, however one of the most daunting aspects of an ISO 9001 project is the documentation that needs extraction, longer process time, monitoring and reporting on each processes. The inspection process involved in construction industry is eventually very time consuming and potentially human error and discouraging the parties involved to complete the whole process and several parties involved on checking and approving the works. The consequences of this problem could lead to severe problems and reflect the quality of product. Besides that, managing the sequence of workflow of document and checklist during construction, many processes require people to work together in an organize way and in many cases processes generate a list of outstanding issue that it is difficult for issue tracking or versioning.

1.4   Objectives

The aim of this study is to develop an inspection workflow for collaborative construction. There are some specific objectives of this study, which are

- To rationalize ISO inspection human process workflow
- To create inspection process in .Net Framework that include offline and online DMS and review of preventive action for continual improvement
- To test and experiment the offline and online DMS in .Net Framework for construction
- To test the corrective and preventive action to be included in DMS for continual improvement in .Net Framework

1.5   Scope of Study

The scope of this study will focus on the integration of document management system (DMS) with an ISO certified developer in Johor Bahru on their construction inspection process that involved daily construction activities and process of continual improvement.

1.6   Significance of Study

Even though there are emerging a lot of software collaborating with IT tools in construction inspection process, there is rarely usage of integration of document management system for ISO 9001:2000 that collaboration of PDA and .Net Framework and the most importantly is that the application of continual improvement process in .Net Frameworkcan improve the effectiveness of the quality management system.

1.7   Methodology

The following methodology has been adopted in achieve the objective list previously and the layout of each chapter is shown in Table 1.1:-

1) Based on first objective, ISO inspection process manual need to be rationalized and translated into a work flow according to Quality Management System, the method of sourcing data regarding the inspection process, checklists and forms used will be interviewing an ISO certified developer in Johor Bahru.

2) In order to achieve second objective, study on the creation of inspection process in .Net Framework that includes offline and online documentation and review of corrective and preventive action for continual improvement. The workflow in .Net Framework must be assigned in sequence and assigned task list to authorize personal to get approval and feedback. A schematic inspection workflow had been pre-identified for the process (Figure 3.1).

3) To achieve third and final objective that need trial run or site experiment on the overall inspection process and test the corrective and preventive action carried out for future improvement to the organization

Method Use	Chapter	Result Achieved
Literature Review	**<u>Chapter 1 (Introduction)</u>** Consist of introduction of the entire study. It covers the background, problem statement, objective and methodology of the study **<u>Chapter 2 (Literature Review)</u>** Focus in literature review on the ISO implementation at construction, Document Management System, .Net Framework regarding the input of inspection workflow and approval from several parties	
	<u>Chapter 3 (Research Methodology)</u> Identify and determine the integration of DMS for ISO 9001:2000 compliances with inspection process and workflow in .Net Framework and offline documents in PDA	
Interviews Development	**<u>Chapter 4 (Development of Workflow Design)</u>** Identify ISO inspection process manual and work flow, how it adopted at current construction and data analysis	Objective 1 achieved
Data Input Trial Run Review Result	**<u>Chapter 5 (Trial Run and Results)</u>** Discussion on the offline and online DMS workflow and process using .Net Framework and ways of development and demonstration (Trial Run)	Objective 2, 3 and 4 achieved
	<u>Chapter 6 (Conclusion and Recommendation)</u> Conclude findings and recommendation for further study	

Table 1.1: Layout of Chapters

CHAPTER II

LITERATURE REVIEW

2.1   Introduction

The government of Malaysia has embarked the QMS programme in construction industry since 1994 through Construction Industry Development Board (CIDB). Since then the number of construction related companies certified with ISO 9001:2000 had increased. The problems encountered with the quality management system is the retrieval and extraction of information and data, creation of paper based documentation, longer process time, monitoring and reporting on each processes especially involved in process of building inspection. The inspection process involved in construction industry is eventually time consuming and potentially error-prone and discouraging the parties involved to complete the whole process and several parties involved in checking and approving the works. The sequence of work could lead to severe problems and reflect the quality of product.

A case study in an ISO certified company will be conducted for the process of reengineering the ISO 9001:2000 Document Management System (DMS) in construction industry. Reengineering is a method of maximizing the result of thorough information technology reorganization, one that affects all or most platforms, basic software solutions and applications domains. A crucial issue is restructuring of data components based on their dependency relationship, as established through

logical data models, This produces the nearest thing to an optimal order to follow in platform unification, database design and data mining, networking of available resources, system integration and overall performances (Dimitris N. Chorafas, 2001). To provide a dependable picture of information elements and data sharing requirements, reengineering must determine much more than how interface elements are generated and used among different platforms and systems. It must also list all other, non-interface information elements that are synonymous among system and are therefore shareable and it should establish if indeed they can talk to one another. Reengineering objectives and priorities must be synchronized with and agreed to by the end users.

2.2   Quality Management System (QMS) Requirements

Quality management system (QMS) is defined as "all activities of the overall management function that determine the quality policy, objectives and responsibilities, and implement them by means such as quality planning, quality control, quality assurance and quality improvement within the quality system" (MS ISO 8402, 1994). The general requirement of QMS is the organization shall establish, document, implement and maintain a quality management system and continually improve its effectiveness in accordance with requirement of the International Standard (MS ISO 9001:2000). Control of records is very important in QMS whereby records shall remain legible, readily identifiable and retrievable. A documented procedure shall be established to define the controls need for the identification, storage, protection, retrieval, retention time and disposition of record (MS ISO 9001:2000).

In order to meet the customer requirements, the organization shall establish processes to ensure that monitoring and measurement can be carried out and are carried out in a manner that is consistent with the monitoring and measurement requirements. The organization shall plan and implement the monitoring, measurement, analysis and improvement processes needed to demonstrate conformity

of the product, to ensure conformity of the quality management system and to continually improve the effectiveness of the quality management system (MS ISO 9001:2000). Corrective and preventive action is essential for further improvement to quality management system that the organization shall take action to eliminate the cause of nonconformities in order to prevent recurrence (MS ISO 9001:2000).

There are eight (8) principles in ISO 9001:2000 such as customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making and mutuality beneficial supplier relationship and one of the principles that emphasized but less implemented in the organization is continual improvement. The continual improvement of the organization's overall performance should be a permanent objective of the organization and its key benefit is improved organizational capabilities and reacts quickly to opportunities. Continual improvement is a process of increasing the effectiveness of your organization to fulfill the quality objectives. Organizations can also expand their management systems by extending the ISO 9001:2000 structures to comprise the requirements of the ISO 14001 Environmental management systems. The structural and organizational requirements of the two management systems have been designed to be compatible (OMNEX, ISO 9001). Figure 2.1 shows the model of process-based quality management system.