MANAGING QUALITY MANAGEMENT PROCESSES IN A NAVAL SHIP CONSTRUCTION COMPANY: A QUALITATIVE CASE ANALYSIS

MOHAMAD KAMAL BIN MOHAMAD DASUKI

DOCTOR OF MANAGEMENT

UNIVERSITI UTARA MALAYSIA

DECEMBER, 2015

MANAGING QUALITY MANAGEMENT PROCESSES IN A NAVAL SHIP CONSTRUCTION COMPANY: A QUALITATIVE ANALYSIS

MOHAMAD KAMAL BIN MOHAMAD DASUKI

Thesis Submitted to

Othman Yeop Abdullah Graduate School of Business,

Universiti Utara Malaysia,

In Fulfilment of Requirement for the Degree of Doctor of Management

Kolej Perniagaan
(College of Business)
Universiti Utara Malaysia

PERAKUAN KERJA TESIS / DISERTASI
(Certification of thesis / dissertation)

Kami, yang bertandatangan, memperakukan bahawa
(We, the undersigned, certify that)

MOHAMAD KAMAL BIN MOHAMAD DASUKI C 95708

calon untuk Ijazah **DOCTOR OF MANAGEMENT**
(candidate for the degree of)

telah mengemukakan tesis / disertasi yang bertajuk:
(has presented his/her thesis / dissertation of the following title):

MANAGING QUALITY MANAGEMENT PROCESSES IN A NAVAL SHIP CONSTRUCTION COMPANY: A QUALITATIVE CASE ANALYSIS

seperti yang tercatat di muka surat tajuk dan kulit tesis / disertasi.
(as it appears on the title page and front cover of the thesis / dissertation).

Bahawa tesis/disertasi tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan, sebagaimana yang ditunjukkan oleh calon dalam ujian lisan yang diadakan pada: **23 Disember 2015.** *(That the said thesis/dissertation is acceptable in form and content and displays a satisfactory knowledge of the field of study as demonstrated by the candidate through an oral examination held on:*
23 December 2015).

Pengerusi Viva *(Chairman for Viva)*	: **Prof. Madya Dr. Nor Hasni Osman**	Tandatangan *(Signature)*	
Pemeriksa Luar *(External Examiner)*	: **Prof. Dr. Amran Md. Rasli**	Tandatangan *(Signature)*	
Pemeriksa *Dalam* *(Internal Examiner)*	: **Dr. Hendrik Lamsali**	Tandatangan *(Signature)*	

Tarikh: **23 Disember 2015**
(Date)

Nama Pelajar (Name of Student) : **Mohamad Kamal Bin Mohamad Dasuki**

Tajuk Tesis / Disertasi *(Title of the Thesis / Dissertation)* : **Managing Quality Management Processes in a Naval Ship Construction Company: A Qualitative Case Analysis**

Program Pengajian *(Programme of Study)* : **Doctor of Management**

Nama Penyelia/Penyelia-penyelia *(Name of Supervisor/Supervisors)* : **Prof. Madya Dr. Mohd. Rizal Razalli**

Tandatangan *(Signature)*

PERMISSION TO USE

In presenting this dissertation in fulfilment of the requirements for a postgraduate degree from Universiti Utara Malaysia, I agree that the University Library makes it freely available for inspection. I further agree that permission for copying of this dissertation in any manner, in whole or in part, for scholarly purpose may be granted by my supervisor(s) or, in their absence by the Dean of Othman Yeop Abdullah Graduate School of Business. It is understood that any copying or publication or use of this thesis/dissertation/project paper or parts thereof for financial gain shall not be given to me and to Universiti Utara Malaysia for any scholarly use which may be made of any material from my thesis/dissertation/project paper.

Request for permission to copy or make other use of materials in this thesis, in whole or in part should be addressed to:

Dean of Othman Yeop Abdullah Graduate School of Business
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman

ABSTRACT

This industrial research study investigates the challenges encountered in the quality management implementation in a naval ship construction and maintenance company. This study will provide a proper view of the work completed in the process of ship construction and maintenance, especially in the Quality Department and will recommend improvements in quality, particularly in the building of a ship. Specifically, it aims to deeply examine the application of quality management knowledge and tools in the process-based work inspection planning, work monitoring activities and record-keeping information management. Additionally, the role of the Quality Department in the ship construction projects has been the main focus of this research study. In achieving the objectives, this case study has applied the qualitative approach which involved activities such as interviewing the focus group especially in Quality Department, observing the work-related activities that involve with quality work inspection process and reviewing quality-related documentation base on the ship construction work report and quality work inspection activities. The results of the three approaches were then triangulated and analysed by using Nvivo software for identification of relevant themes that normally use by qualitative researcher. The study has revealed the importance of team work and high understanding among various departments in managing the inspection planning and work-related information. It has identified the issues that had occurred in during the research, provided an analysis that can benefit the company and contributed to academic knowledge and also enhance the company's vision and mission. Furthermore, with proper improvement activities aligned with the actual work process will also result in higher productivity and quality of work processes as well as reducing the difficulties and problems encountered in the implementation of the quality management of this company.

Keywords: quality management, construction, inspection, monitoring, information management, cost of quality

ABSTRAK

Kajian penyelidikan industri ini menyiasat cabaran-cabaran yang dihadapi dalam pelaksanaan pengurusan kualiti bagi syarikat pembinaan dan penyelenggaraan kapal Tentera Laut. Kajian ini akan memberi satu pandangan yang betul tentang perlaksanaan kerja yang lengkap dalam proses pembinaan dan penyelenggaraan kapal, terutama di Jabatan Kualiti dan ia akan mengesyorkan peningkatan dalam bidang kualiti, terutamanya dalam bidang pembinaan kapal. Secara spesifik, matlamat kajian ini adalah untuk memeriksa dengan mendalam penggunaan ilmu pengetahuan dan alatan pengurusan kualiti dalam proses perancangan pemeriksaan kerja, aktiviti pemantauan kerja dan pengurusan penyimpanan rekod maklumat. Selain itu, peranan Jabatan Kualiti dalam projek pembinaan kapal telah dijadikan fokus utama kajian. Untuk mencapai objektif, kajian kes ini telah mengunakan pendekatan kualitatif, di mana ia melibatkan aktiviti-aktiviti seperti temubual kumpulan fokus terutamanya dalam Jabatan Kualiti, memerhati aktiviti-aktiviti yang berkaitan kerja yang melibatkan proses pemeriksaan dan menyemak dokumen kualiti yang berkaitan dengan dokumentasi asas mengenai semua laporan aktiviti pemeriksaan kualiti dan juga laporan kerja-kerja pembinaan kapal. Dapatan kajian daripada tiga pendekatan tersebut kemudiannya telah digabungkan dan dianalisis dengan menggunakan perisian Nvivo untuk pengenalpastian tema-tema yang relevan. Kajian ini telah mendedahkan kepentingan kerja berkumpulan dan persefahaman yang tinggi antara jabatan-jabatan dalam menguruskan perancangan pemeriksaan kerja dan pengurusan maklumat yang berkaitan kerja. Ia juga telah mengenal pasti isu-isu yang berlaku di dalam penyelidikan ini, dengan menyediakan analisis yang boleh memberi manfaat kepada syarikat dan menyumbang kepada pengetahuan akademik dan juga meningkatkan visi dan misi syarikat. Di samping itu, dengan adanya penambahbaikan yang diselaraskan dengan proses kerja sebenar akan dapat meningkatkan produktiviti dan kualiti proses kerja tersebut dan juga dapat mengurangkan kesukaran dan permasaalahan yang dihadapi dalam pelaksanaan pengurusan kualiti syarikat ini.

Kata kunci: pengurusan kualiti, pembinaan, pemeriksaan, pemantauan, pengurusan maklumat, kos kualiti

ACKNOWLEDGEMENTS

Alhamdulillah. *Salawat* and *Salam* to our Prophet Muhammad s.a.w, his family members, companions and followers.

In completing this research, I would like to acknowledge the intellectual sharing of many great individuals.

My foremost gratitude goes to Dr. Mohd Rizal Bin Razalli, my supervisor, Dr. Hendrik Bin Lamsali , Internal Examiner and also Dr. Amran bin Md Rasli, External Examiner, for devoting much of their expertise and precious times in guiding me to reach the final stage of this research, a full of colours journey. Thank you, for all that you had done.

I would also like to extend my appreciation to other academicians in UUM for their teaching and motivation in my journey for this industrial Phd.

Undoubtedly, this thesis would almost be impossible to complete without the assistance of many officers of the ship construction company. Some of them assisted me far beyond my expectations; thank you so much for your help, particularly during data collection. To all my family members, especially to my wife and my brothers, thank you so much for your support and prayers. I am also indebted to others, the kind and brilliant people, for their help and support during all the stages of this study.

TABLE OF CONTENT

Title	Page
TITLE PAGE	**i**
CERTIFICATION OF THESIS WORK	**iii**
PERMISSION TO USE	**iv**
ABSTRACT	**v**
ABSTRAK	**vi**
ACKNOWLEDGEMENT	**vii**
TABLE OF CONTENTS	**viii**
LIST OF REFERENCES	**x**
LIST OF FIGURES	**xi**
LIST OF TABLES	**xiii**
LIST OF ABBREVIATIONS	**xiv**
CHAPTER ONE: INTRODUCTION	
1.1 Introduction	1
1.2 Background of the Study	1
1.2.1 Quality Department in ABC Sdn. Bhd.	5
1.2.2 Quality Department work responsibilities	11
1.3 Problem Statement	14
1.4 Research Questions	19
1.5 Research Objectives	20
1.6 Significance of the study	20
1.7 Limitation of the research study	22
1.8 Organizing of the thesis	23
CHAPTER TWO: LITERATURE REVIEW	
2.1 Introduction	25
2.2 History of Quality	27
2.3 Quality management in project completion	32
2.3.1 Quality Planning (QP)	37
2.3.2 Quality Control (QC)	42
2.3.3 Quality Improvement (QI)	47
2.3.4 Quality Management System (QMS)	53
2.3.5 Total Quality Management (TQM) in project completion	58
2.3.6 International Standardization Organization (ISO)	69
2.4 The relationship between Quality Management and the construction industry	78
2.4.1 The implementation of quality management in the construction industry	78
2.4.2 The problems with quality implementation in the construction industry	88

	2.4.3	The concept of organization in the construction industry	94
		2.4.3.1 The impacts of the implementation of Quality Management on the management structures	96
		2.4.3.2 The impacts observed in the production structures	100
	2.4.4	Inspections, Verification, Monitoring Activities and Statistically Process Control (SPC)	104
		2.4.4.1 Inspections	104
		2.4.4.2 Verification	109
		2.4.4.3 Monitoring	111
		2.4.4.4 Statistically Process Control (SPC)	118
	2.4.5	Record documentation management in the construction industry	122
	2.4.6	Centralization of data information	131
	2.4.7	Project Risk and Quality Management in Construction Industry	140
	2.4.8	Cost of Quality Management in Construction Industry	146
2.5	Initial Conceptual Framework		155
2.6	Summary		156

CHAPTER THREE: METHODOLOGY

3.1	Introduction		157
3.2	Case Study Methodology		158
3.3	Overview of Research Methodology		161
3.4	Research plan		163
3.5	Population		163
3.6	Sampling procedures		164
3.7	Data Collection Strategies		164
	3.7.1	Interview approach	166
	3.7.2	Observation and monitoring of QC daily inspection activities	173
	3.7.3	Document Review	176
3.8	Data analysis procedure		178
	3.8.1	Data reduction	182
	3.8.2	Data Display	183
	3.8.3	Data drawing and verification	183
3.9	Chapter Summary		184

CHAPTER FOUR: RESEARCH FINDING

4.1	Introduction		185
4.2	Research work process		185
	4.2.1	Working with data files	186
	4.2.2	Working with nodes	187
	4.2.3	Coding Recorded Data	188
	4.2.4	Analysis option	188
4.3	Participant of profiles		190
	4.3.1	Result of Participant profiles	192
4.4	Problems Encountered during Research		197
	4.4.1	Theme No.1: Work inspection planning of ship construction project	198

4.4.1.1 Problem Encountered: Theme No.1 200
4.4.1.2 Summary of Problems for Theme No.1 207
4.4.2 Theme No.2: The problem occurred in work inspection monitoring 209
4.4.2.1 Problem Encountered: Theme No.2 211
4.4.2.2 Summary of Problems for Theme No.2 214
4.4.3 Theme No.3: Work information management 216
4.4.3.1 Result of finding for Theme No.3 216
4.4.3.2 Analysis of Theme No.3 218
4.5 Chapter summary 219

CHAPTER FIVE: DISCUSSIONS, RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction 221
5.2 Discussion 221
5.3 Recommendation 223
5.3.1 Work inspection planning 231
5.3.2 Work inspection monitoring activities 233
5.3.3 Work information management in preparing of work quality report 236
5.3.4 Implementation of the new work process 239
5. 3.4.1 New database model for quality inspection database 240
5. 3.4.2 Total inspection record and record monitoring 247
5. 3.4.3 Traceability of documentation record and time report preparation 254
5.3.5 Recommendations for Future Studies 254
5.4 Conclusion 256

REFERENCES **257**

Appendix A The Research Trail Record
Appendix B Case Study Protocol Interview
Appendix C Case Study Transcript Interview
Appendix D Form of Information Test Request Form
Appendix E Project Verification

LIST OF FIGURES

Figure		Page
1.1	Organization Chart of the Department of Quality of ABC Company	6
1.2	Quality Department Work Inspection Process	11
2.1	The timeline on integration of best quality practices	31
2.2	Quality trilogy	35
2.3	PDCA Control Cycle	40
2.4	Inspection based on Quality Control	45
2.5	Eight Elements QMS implementation	57
2.6	Five Elements Construct of TQM implementation	62
2.7	TQM Control process	67
2.8	A Comprehensive Approach to Quality	68
2.9	The QMS Basic Process	73
2.10	ISO 9001:2000 Requirement	77
2.11	The relation between main research studies and quality management	78
2.12	Construction triangle	81
2.13	Project Management Triangle	82
2.14	SPC Interactivity	120
2.15	Relationship between QM and SPC in Customer Satisfactions	121
2.16	Record Management and its Conceptual Framework	129
2.17	Data, Information and Knowledge Attributes	136
2.18	Information Flow in Quality Management	139
2.19	Information Flow Barrier in Quality Management	140
2.20	Risk Management Plan	143
2.21	Risk Level Matrix Mapping	144
2.22	Model of optimum quality cost	151
2.23	Quality Cost Framework	153
2.24	The proposed conceptual framework	155
3.1	Research Question Adaptation for Convergence of evidence	168
3.2	Process flow for interview session	168
3.3	ORJI Model (Action Research framework)	175
3.4	Process flow for document review	178
3.5	Process flow for data analysis	179
3.6	NVIVO Software program procedure	180
4.1	Age of Participants	193
4.2	Education Background of Participants	194
4.3	Work Experience of Participants	195
4.4	Work Expertise of Participants	196
4.5	Partial work inspection process flow in procedure of inspection and testing	199
4.6	Problems in work monitoring activities	215
4.7	The result of work inspection process for record management	219
5.1	Previous work inspection process flow before improvement	224
5.2	New improvement work inspection process flow	225
5.3	The new organization chart for the Quality Department	229
5.4	Improved quality inspection management system main process	238

5.5 A system database model for quality inspection database 241
5.6 A system database model process flow for quality inspection database 243
5.7 New quality report monitoring system 247
5.8 Previous system traceability and report preparation 251
5.9 New system traceability and report preparation 253

LIST OF TABLE

Table		Page
1.1	Rejection and Rework Inspection Record 2007 - 2012 for the construction of 4 ships	17
2.1	The timeline on Quality Evolvement and integration of best quality practices	28
2.2	Definition of TQM	60
2.3	Five standard series in the ISO 9000 quality management system	70
2.4	Elements of Quality Management (QMS) Model	72
2.5	The internal and external benefits of ISO 9000	76
2.6	List of selection factors influencing the framing of risk assessment	146
3.1	Research question and data collection strategies	166
3.2	A part of Research Trail Record	169
3.3	List of observations for QC Inspection Activities	175
4.1	Nodes derived from all sources	186
4.2	Total no. of participants by section	191
4.3	Profile of participants	192
4.4	List of the problems encountered during the research	197
4.5	List of the problems related to work monitoring activities	214
4.6	List of the problems related to work information management	216

LIST OF ABBREVIATIONS

CPD	Continuous Professionals Development
IPENZ	Institution of Professional Engineers New Zealand
IQA	Internal Quality Assurance
ISO	International Standards Organization
ITRF	Inspection Test Request Form
JIS	Japanese Industrial Standard
MSIC	Malaysia Standard Industrial Relegation
ORJI	Observation Reaction Judgment Intervention
PDCA	Plan Do Check Act
QA	Quality Assurance
QC	Quality Control
QI	Quality Improvement
QIR	Quality Inspection Record
QM	Quality Management
QMS	Quality Management System
QP	Quality Planning
RM	Ringgit Malaysia
SQC	Statistical Quality Control
TQM	Total Quality Management
VE	Value Engineering

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The presentation of this chapter starts with the research background of the study, problem statement, research questions and research objectives, limitations of the study and the significance of the study. The main focus of this study, carried out on a ship building and maintenance company, is to identify in detail the implementation of quality management work functions in carried out in the company.

1.2 Background of the Study

Technological advances and diversification of industries have brought significant to considerable changes in the growth of the Malaysian economic structure. According to The Malaysia Standard Industrial Classification 2000 (MSIC 2000), which functions as a framework for the accumulation and compilation of industry statistics from all different sources. The industrial sector is considered to be one of the most important contributors to the Malaysian economy (Arumugam, Ooi, & Fong, 2008). This industry contributes to the expansion of economic activity in the country, and primarily responsible for the infrastructure development throughout the country.

In addition to all the activities under the term industrial sector, there is also the ship building industry which in no small way has shaped the nation's economy. The nation's ship building industry which had its beginning in the construction of fishing boats and vessels has slowly developed into a full-fledged industry building all types of shipping vessels and among them is the construction of naval ships for our the Malaysian Navy.

MSIC 2000 defines construction as:

Construction includes all units mainly engaged in constructing constructions, roads, railroads, electricity or other transmission lines or towers, pipelines, oil refineries or other specified civil engineering projects. In general, units mainly engaged in the repair of constructions or of other structures are also included in this category, as are those engaged in the alteration or renovation of constructions, preparation of sites, demolition or excavation. Units mainly engaged in providing special construction or construction trade services such as structural steel erection, carpentry, bricklaying, concreting, plumbing, plastering, floor and wall tiling or roof tiling and the installation or laying of floor coverings such as carpets or linoleum, are included in this category (page:110-113).

The definition and the term "construction" have commonly been used for a mixture of activities that involve the conception, designation, renovation, repair and demolition of structures and modification work (Said, 2005). Generally, there are three types of construction that have been carried out in Malaysia. They are: the construction of buildings, large scale construction and the manufacturing industry. The construction industry normally produces heavy or durable, large and expensive goods; it also requires a large geographical area. A ship construction and maintenance company is an example which comes under the ambit of the construction industry and it is also part of the maritime sector in Malaysia.

The characteristics of the manufacturing industry are unlike others due to the unique characteristics of the industry itself (Said, 2005). These characteristics are the products' physical form, structure of the process, organisation and industry, requirement factors and scheme of pricing. In fact, it is the dissimilarity of the manufacturing industry that makes this research unique besides the fact the company involved in this study is the first local ship construction and maintenance corporation in the country involved in a naval ship construction project.

Currently, the ship building and maintenance industry is one of the most important contributors to the construction sector in Malaysia. It has contributed to the progress and development of the country and will continue to play and important role in the growth of the country's economy.

However, the ship building and maintenance industry in Malaysia has still not been able to reach a level of which it can be proud of. In the development of this industry, the number of ships produced is still small compared to other countries. Nevertheless, the demand for shipbuilding and maintenance has been increasing constantly in line with the economic development of the country.

Malaysia is strategically located for the benefits of the shipping industry. Besides its location, economic stability is also a plus factor which should attract more shipbuilders to consider the country as its manufacturing centre. Currently, here are many ship construction and maintenance companies in Malaysia, but only one of them is wholly owned by Malaysians and is involved in naval ship construction. The selected company was been choose because this company is the first ship construction company that uniquely involved with the naval ship construction activities.

Due to sensitivity and confidential issues, the name of the company and other information will not be disclosed in order to avoid any leaks of information to the competitors of this company. To protect the identity of the company, this study will name this ship construction company as ABC Sdn. Bhd.

The case study is based on the work execution or implementation of quality management in the ship building and maintenance at ABC Sdn. Bhd. The study is to identify the full range of the weaknesses and problems encountered in the work implementation of quality management in this company with regards to the completion of projects, especially in ship construction and maintenance. One of the tools and techniques used to develop and maintain the quality improvement process in companies is Quality Management (Bunney & Dale, 1997; Jafari & Setak, 2010). However, the tool and technique applied in the construction industry is different from other management research (Xia & Gong, 2014).

Arshida (2012) mentioned that each company in the construction industry has had problems and weaknesses in the implementation of quality management. Well organized and progressive companies usually fared better with the implementation of quality management. Quality is a key enabler to being competitive in the marketplace and it is commonly used in many organisation; it also engenders competitive advantage by providing products that meet or exceed customer needs and expectations (Lee & Zhou, 2000; Arshida, 2012).

Comparisons on the implementation of quality are shown in many studies as described by Al-Saket (2003), Azizan Abdullah (2010), Zairi (2013), and Chin-keng & Abdul-Rahman (2011). The comparisons are based on the work implementation of quality in manufacturing sectors, focus group of the research, the research problems and also the methods of the research methodology.

Some companies or organizations created one department normally known as the Quality Department or QA/QC Department. It generally deals with the quality of materials and also to monitor the implementation of quality management

In this company, it is known as the Quality Department, consisting of various sections that monitor and regulate the implementation of quality management. It will generally ensure that the work process has complied with the rules or work procedures that have been set up by the company. It also certifies that quality products are made according to specifications and requirements, especially in the ship completion project. This study will be focussing only on the Quality Department.

1.2.1 Quality Department in ABC Sdn. Bhd.

The Quality Department has been established as a supporting department in this company. The objective of this department is to implement the quality policy and quality objectives of this company in accordance with the quality standard. The details of units and sections that are involved in the ship construction and repairing project organisation of the Quality Department is explain in Figure 1.1.

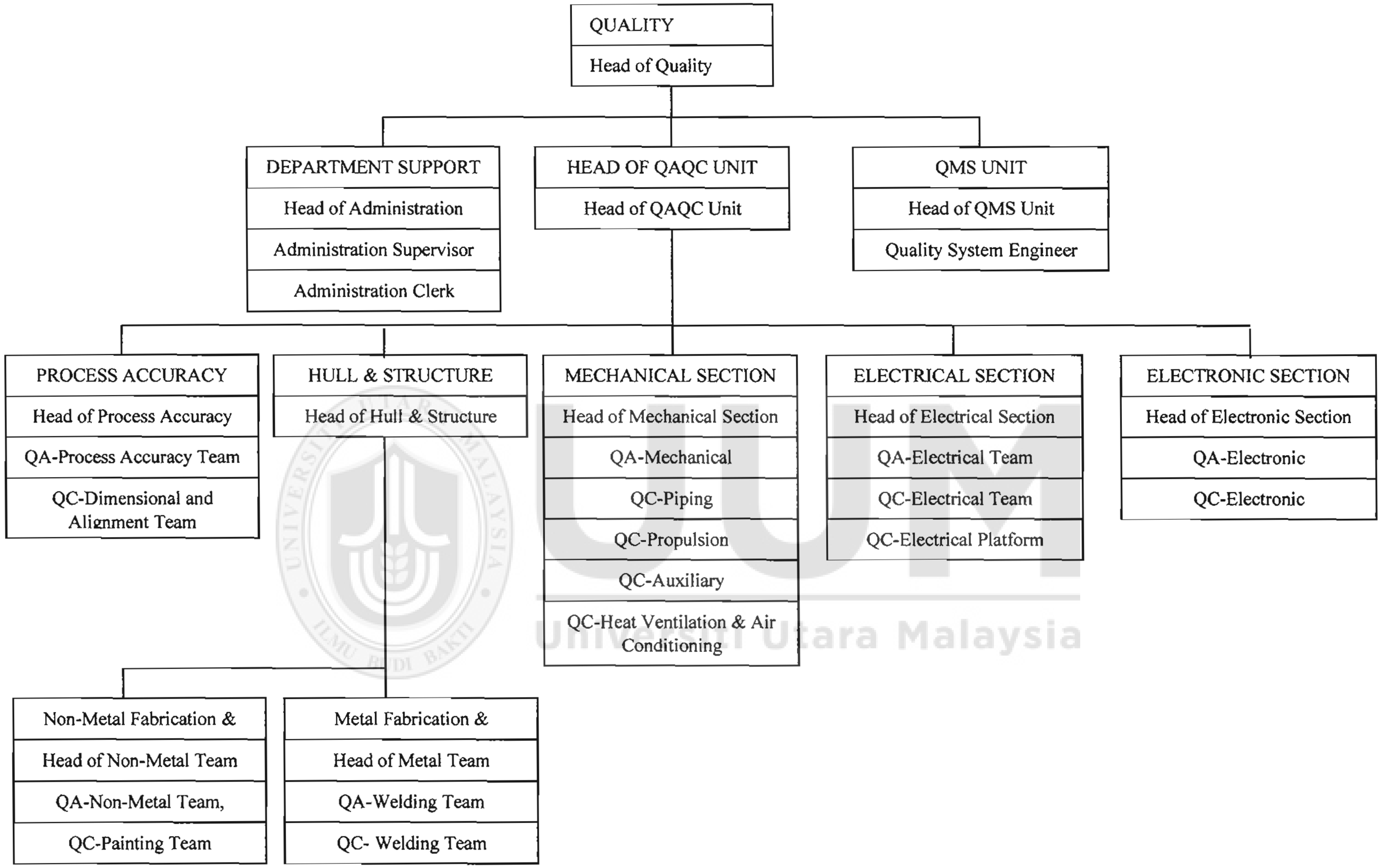


Figure 1.1: Organization Chart of the Department of Quality of ABC Sdn. Bhd

Job responsibilities:

The administration unit handles all administration work, maintain proper register, record and filing of all related documentation and correspondence, to assist typing, preparation and distribution of all related correspondence and documentation, to maintain proper filing of leave records, to process office invoices, bills and personnel travelling claims for payment action, input system for attendance Daily Time Sheet (DTS).

Other than that, the administration unit is responsible in work notification such as maintenance request and leave record, create order of stationery, clothing and all related items, and also proper distribution and/or safekeeping and collecting, administrating stationery requirements, delivery and collection of mail and store items, maintenance of office utilities, facilities and office equipment's for department usage.

Then, the Hull Section. It manages all the activities with regard to the structure of the ship and welding activities. This section is divided into 2 teams; Non-Metal Fabrication and Welding Team, and Metal Fabrication and Welding Team.

- Cutting Process (On-board repair),
- Fit up inspection (Weld preparation on the Bevelling, Edge preparation, Alignment and Gap),

- Welding (Welding Current, Welding Electrode, Welding Sequence and Pre-Heat),

- Visual Inspection & Non-Destructive Testing (NDT) – (Weld Appearance, Weld size, Welder ID, Dye Penentrant, Testing/MPI, Radiography Testing/UT and Ultra Sonic.

- Surface Preparation (Work condition, Contamination of surface, Equipment, Blasting Media, Shaft Edges, Excessive pitting and Corrosion trap)

- Apply coating - Primer to final coat (Wet film thickness, Drying/curing of paint and Recoating interval)

Mechanical Section, this section is divided into four (4) teams; they are Auxiliary, Piping, Heat Ventilation Air-Conditioning and Propulsion. The main responsibility is handling the mechanical work activities.

- Workshop Survey - Inspection & Testing (Wear & Tear Inspection, Pumps, Steering Gear system, Sea Water system, Fresh Water system, Sanitary system, Diesel oil separator, Main engine lube oil priming, Provision lift, Nuclear Biological and Chemical Defence-NBCD Equipment and system, Lifting Appliance, Winch, Anchor and anchor windlass, Bilge Separator, Lathe machine, Drilling machine, Compressed air system, Control pitch propeller, Bow Thrusters, Stabilizing system, Examine Fin Stock and gauge

Bearing, Clean Hydraulic Oil Cooler Tubes, Equipment pressure test

- Workshop Survey - Inspection & Testing (Wear & Tear Inspection, ACU Compressor, ACU Conditioning Unit Condensers, Evaporators, TRV, Chillers, Driers, Gauge, Sight Glass "Moisture indicator", Thermometer, Control and Safety Device, Conditioner, System Valves, Heat Exchanger

- Pipe Work Visual Inspection

- HAT (Pipe And Valve – On Board Functional Test For Repair Product)

- Service & Inspection - In Workshop (Propeller, Propeller Pitch measurement, Shafting, Shaft straightness check, Clutch plate, Gear Teeth, Bearing, Gear Box Housing, Shaft Axial Trust Block "Trust Pad & Collar" and Engine Component)

- On board (Shafting, Bracket alignment check and align, Cut less bearing clearance, Rudder Wear & tear inspection, Preservation and Rudder clearance/ Gauge bearing clearance)

- Engine Monitoring System (Gauges, Sensors, Switches, Fuel Solenoid Valves, Tacho Generator, Cable, Visual check, Calibration of gauges & sensors, Cable continuity check, Functional test "switches, fuel solenoid valves" for good working condition)

Next section is called the Electrical Section which is responsible for handling the electrical work area especially on the installation of electrical equipment such as switchboard, panelling, generator set, battery set and electrical consumable. Inspection activities on cabling, functioning and load test activities. This section also works on ship platform monitoring activities with regards to the control and fire alarm.

Next, the Electronic Section. This section is responsible for the special task of communication, navigation, combat, weapon and electronic activities.

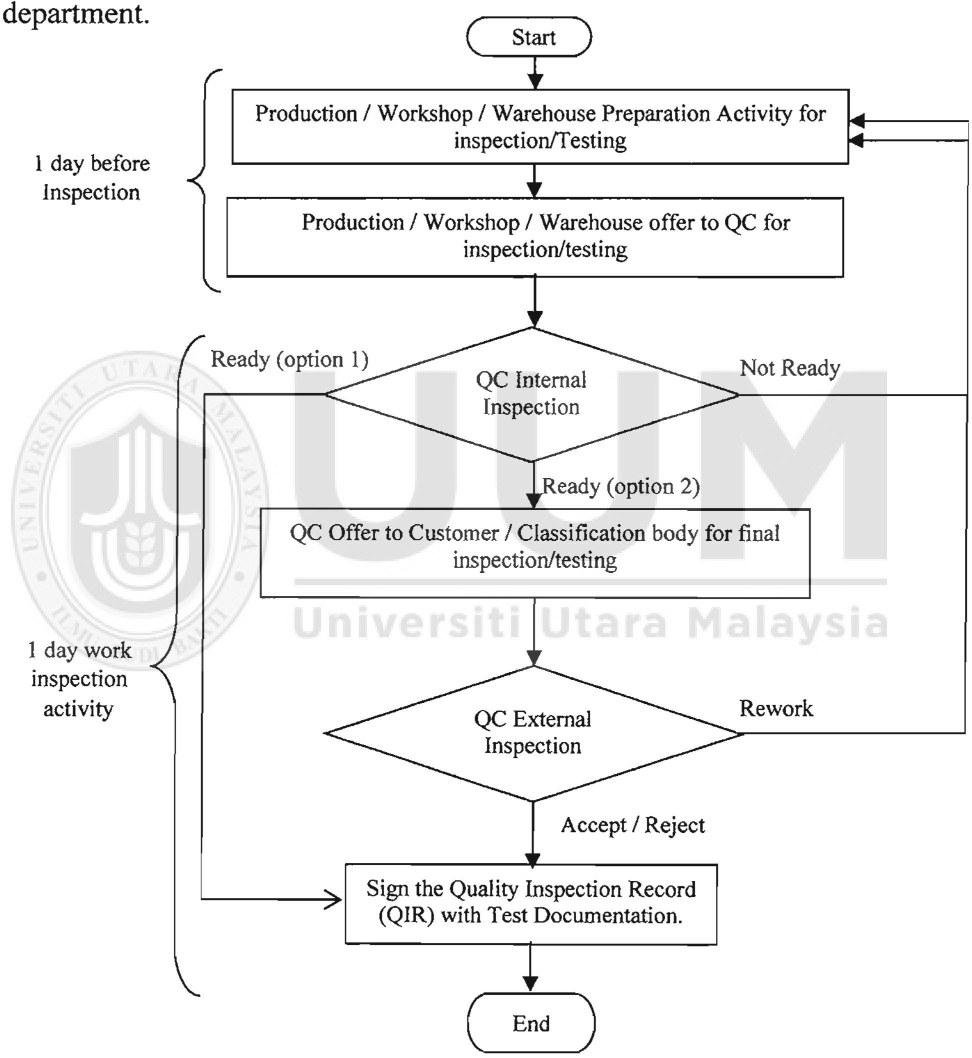
Accuracy and dimensional Section, this section is responsible for handling the dimension and levelling work activities. The work involvement in this section includes:

- Dimensional and control of hull structure
- Alignment of mast module
- Alignment of master reference plane (MRP) – before undocking
- Ship Deflection

And the last section is called Quality Management System. This unit is responsible in managing all ISO 9001 related matters, such as managing the procedure and work instruction in the shipyard, conduct internal audit, management review on quality audit and customer satisfaction, managing non-conformities partially, and handling on renewal certification audit from certification body.

1.2.2 Quality Department work responsibilities

The responsibility for implementing the quality policy and fulfilling the claim to quality, as well as for continuously improving the quality capability of the process and process chains is delegated to the management of this department.



Source: Inspection & Testing Activities Procedure

Figure 1.2: Quality Department Work Inspection Process

The work process of the Quality Department is explained as part of the general work process in Figure 1.2.

The responsibilities include: the quality of work carried out by personnel within their respective department or section, verifying approved procedures were followed within their department or section and that any necessary complementary procedures were established, implemented, reviewed and updated as required, ensuring that all staff were adequately experienced in their relevant disciplines to perform the duties of their position in a satisfactory manner, ensuring that all staff were familiar with the established procedures and ensuring that corrective and preventive actions were taken in their respective department for discrepancies in the quality system.

The responsibility for implementing the quality policy and fulfilling the claim to quality as well as for continuously improving the quality capability of the process and process chains is delegated to the management of this department. The responsibilities of the department are: verifying the quality of work carried out by personnel within their respective department or section, verifying approved procedures are followed within their department or section and that any necessary complementary procedures are established, implemented, reviewed and updated as required, ensuring that all staff are adequately experienced in their relevant disciplines to perform the duties of their position in a satisfactory manner, ensuring that all staff is familiar with the established procedures and ensuring that corrective and preventive action is taken in their respective department for discrepancies in the quality system.

Implementation of quality management should not be considered a liability of the company, although there are some companies and organizations feel it is a burden and a difficulty (Hoonakker, Carayon, & Loushine, 2010). The implementation of quality management is a smart move to ensure that products were of a high quality that met the required specifications and customer needs. Quality management can create a new approach in improving skills and developing resources that take advantage of opportunities and evade risks (Lee & Zhou, 2000).

Implementation will also ensure that work is being carried out according to plan and make certain that the objectives of the company or association are achieved. In the vision and mission of a company, the main focus is to deliver products according to the specifications and requirements, as well as the implementation of effectiveness in quality management.

Quality management is expected to be at its most efficient when an established company wishes to improve its competitive position through long-term improvements in product performance and also customer satisfaction (Lee & Zhou, 2000b). Speaking of quality, the focus will be on ISO Standard. ISO 9000, which is the base line in quality matters. It functions as a guide to ensure continuous improvement of any organization or industry. In the ship construction industry, quality implementation has also been widely used as a basic guideline towards the ISO Standard. The details of ISO 9000 will be further explained in *Chapter 2: Literature Review* (see: The ISO 9000).

In the implementation of quality management of this company, there are also various obstacles that will have an effect on the achievement of the implementation. The most critical obstacle in the implementation of quality management in the construction industry is attributed to the weaknesses in management itself (Hoonakker et al., 2010).

The weaknesses in the work execution for implementation of quality management can be seen in the dissemination of information. Quality Management has also been implemented in all types of construction and organization structures by developing and managing quality assurance program (Battikha, 2003)

As described by Al-Saket (2003), Azizan Abdullah (2010), Zairi (2013), and Keng & Abdul Rahman (2011), many related obstacles are related to the weaknesses in the implementation of the system in quality management. These results from inefficient management, and some limitations and problems of implementation at the ground level.

1.3 Problem Statement

The main focus of this research is looking at the problems occurring in a work construction project towards the date of project completion. One of the issues involved the quality management work implementation, which is the responsibility of the Quality Department.

This issue was studied by Haupt & Whiteman (2004), and according to them, construction firms have been continuously struggling with Quality Management implementation especially in TQM. Historically, construction has been an industry unenthusiastic in implementing the transformation. As a result, it has remained behind in adopting this process.

The problems that exist in this particular industry are due to: lack of work skill, technical knowledge, low productivity and poor quality standard. The increase in the number of problems related with quality involving the ship construction industry is the main focus of this study.

The implementation of quality management is the main responsibility of the Quality Department. Weaknesses in the implementation of quality management caused by the management itself will have a major impact on the work process, especially during project completion. Said (2005) indicated that there are weaknesses and problems which were due to poor management and lack of responsibility.

Haupt and Whiteman (2004) have found that there are several weaknesses in the implementation of quality management at the construction site such as too much paperwork, elements of the work force, the difficulty of measuring results, the contract offered and the reluctance of suppliers in the implementation of the quality management system.

Generally, problems and weaknesses come from various aspects. In this study, the problems were identified based on work observation and the implementation of quality management that was performed by the Quality Department in the completion of ship construction and maintenance projects.

The following issues need to be addressed and studied in accordance with the implementation of quality management by the Quality Department; the first factor that has a big impact on project completion is the problem which started during work inspection planning, particularly in the QC work activities.

According to the business dictionary, planning is a basic management activity that involves any formulation of detailed plans. It aims to achieve the optimum steadiness of all loads with the available resources.

In this company, work processes are designed and prepared by other units in the Planning Department and sometimes they are requested by other departments according to the inspection requirement of a related project. The work process, which includes carrying out the inspection activities during construction and on-going maintenance, sometimes does not reflect the involvement of the Quality Department

Each inspection activity is planned and conducted only after receiving the instructions from the production site; the instructions were often seen as being incomplete and inaccurate, and not according to the plan laid down in the planning of the project. The consequence of ineffective planning can interrupt the inspection activities and sometimes result in cancellation. Even when the activities have been carried out, there can also be many problems appearing in the work process, for example incomplete installation, malfunctioned equipment, installation errors and so on. In addition, there are duplication and postponement of inspection activities due to poor work planning.

Poor planning will possibly result in waste or rework if the problems are not quickly identified and rectified; Table 1.1 shows the project management report for construction of four ships. Once the trouble has been fully recognized, the corrective action can be quickly implemented to eliminate repetition of the problems (Santos, Formoso, & Tookey, 2002).

Effective planning should be done to ensure there is no error or mistake in the completion of the project. Each plan must be concerned with all the expected risks; failure to observe this will slow down the completion process of the ship construction and maintenance.

Table 1.1
Rejection and Rework Inspection Record 2007 - 2012 for the construction of 4 ships:

Description	Ship No.1	Ship No.2	Ship No.3	Ship No.4
Total Inspection Activities	3253	2228	5584	7941
Total Rejection & Rework	1157	522	2024	2241

Source: Project Management Report Company ABC Sdn. Bhd.

The second factor is related to the work monitoring activities, especially in the work completion of the ship construction and maintenance work process. This factor is also related to work inspection planning because planning needs to be managed and organized with other parties. Work monitoring activity involves internal inspection and work observation activities. For example, an inspection activity requires the client or classification body to attend the inspection as stated in the contract and mentioned in the project quality plan and also inspection test plan document. If QC inspectors are not aware of the work status, it will jeopardize the work acceptance and also credibility of quality in the work process itself. Unorganized work planning, lack of work monitoring and remarks from clients will increase the number of work rejections. The responsibility of QC is to accept the work according to the requirement and standard on behalf of the company and also the client. It is important to ensure that all work procedures have been performed according to the rules.

Therefore, the monitoring work process must be planned and conducted according to the QC work inspection planning. Progressive monitoring activity refers to the construction of process mechanism for the work process (Derek, Walker & Keniger, 2002). As in the ship construction, monitoring activities, besides having a positive impact, will also ensure that no work repetition needs to be done. Based on ISO 9000 Standards, it is necessary to raise a certain quality standard that seeks quality management in reducing wastage in terms of rework, so that work is carried out correctly, the first time (Pheng & Yeo, 1997).

The third factor that is also important to the project construction is the problem of not having a good information management system which is critical in order to prepare a good quality work report. Documentation control and reporting for quality inspection activities are also part of the project completion requirements. The source of the information is based on the work inspection record. Records are defined as "*Information created, received, and maintained as evidence and information by an organization or person, in pursuance of legal obligations or in transaction of business*" (Borglund & Engvall, 2014).

This issue is related to the difficulties in collecting and analysing records of inspection in preparing or producing a good quality work report; it is also considered as a factor in delaying of work acceptance in a ship construction project. The work inspections records are controlled and compiled by QC inspector personnel and they do this for all the sections.

In order to ensure that there is no confusion in information related to inspection activities, all records and reports must be collected and analysed properly and regularly. This analysis should be made in accordance with the categories and information needed by the management level.

As an example, if the inspection and quality record was done by person A and a job report was made by person B, the absence of person A in providing complete information will result in difficulty for person B to prepare the job report. The same goes for problems in inspection record storage.

The difficulty lies in the retrieval of information in order to avoid any misunderstanding and delays in the delivery of data information. As an example, person A keeps a record and keeps it in file A, then person C takes file A to review the inspection records, while individual B is searching for the file for a work report.

The issue on information management, which is critical in preparing a good quality work report, must be given serious attention. The success of project completion is always depending with good information management of documentation control.

1.4 Research Questions

These research questions refer to the problems that occur in the ship construction company, especially with the Quality Department work process. By identifying and understanding the issues in the research questions, it will help to study and describe in more detail the structure of the research. Below are the three research questions:

1. How effective is the work planning done by the Quality Department in the inspection planning activities during the work process in ship construction projects?
2. How to overcome the problems of work monitoring activities including internal work inspection, work observation and surveillance in the work process of the project completion, especially in ship construction project?

3. How to improve the work information management process in preparing a good quality work report?

1.5 Research Objectives

The purpose of this case study is to find a way to overcome the shortcomings and difficulties encountered in the implementation of quality management for the ship construction company.

The objectives of this study will thus help in understanding the actual research, and will also serve as a guide to ensure the study does not stray away from its original purpose. Three objectives of the research study are as follows:

1. To propose improvement in the work inspection planning of the ship construction and maintenance activities in the Quality Department work process.
2. To propose improvement in work process monitoring especially on internal inspection, observation and surveillance activities in ship construction and maintenance project.
3. To propose improvements in the work information management process in the preparation of a good quality work report with respect to ship project completion.

1.6 Significance of the study

The main focus is to provide an opportunity to establish a new perspective in the study of the construction sector, especially in a ship construction company. This study will provide a proper view of the work completed in the process of ship construction and maintenance, especially in the Quality Department and will recommend improvements in quality, particularly in the building of a ship. While highlighting the needs of the research, the significant approach of talking about the importance of thoroughness in academic research will always be a part of practicality and applicability (Friedman, 2003).

The purpose of the study is in accordance to the company objective: to identify how quality management affects the ship construction project especially in the Quality Department work process, to identify in more detail the issues or problems that occur in this company during construction, to provide an analysis of the study and suggestions that can improve and enhance the quality of management in preparing quality ships and to accomplish the company's mission "*to provide excellence in quality and timely delivery of products and services and to maximize stakeholder return*".

Since this research is concerned with the construction and maintenance activities of a ship building industry, a suitable system information management that will handle the collection and analysis of information on inspection activities is proposed. This is because the current practice is that the each independent section handles its information management system. The absence of a good information management system will render the information invalid and inaccurate. By using a common database system i.e. a centralised information management system, the department can provide better quality data reporting; it can also improve the reliability of the data, certainty of decision making, eliminate redundancy in equipment, personnel and monitoring methods, and allow the user to sense and remove all causes of the difficulties even if the sources are not monitored directly (Al-Najjar & Alsyouf, 2000).

The study is intended to find a way to overcome the shortcomings and difficulties encountered in the implementation of quality management for a ship construction company with regard to project completion, especially in work inspection planning, work monitoring activities and information management in preparing a good quality work report. These three main issues are important in ensuring the quality of products or services by the company. It will also, indirectly, benefit other industries by sharing the knowledge about the work process activities especially those related to quality management

1.7 Limitations of the research study

There are limitations that restrict this study in its search for information such as duration of field work is limited, and this is the first ever study undertaken specifically on the naval ship construction and maintenance industry in Malaysia. This company has given its consent for the study to be conducted, however, due to the sensitivity and confidentiality issues, the name of the company and other information is not disclosed in order to avoid any leaks of information to the competitors of this company. In fact, it was not possible to compare problems faced by the ship construction and maintenance companies because of sensitivity and confidentiality issues.

In conclusion, this case study focuses only on the Quality Department in this company. Despite these sensitive issues, the study should be able to recognize the weaknesses and vulnerabilities of the improvement process.

1.8 Organization of the thesis

This thesis consists of five chapters. The *first chapter* attempts to justify the background of the research study, problem statement, research questions, and the research objectives, significance of the study and limitations of the study. This is a case study which focuses on the research that has been done at a ship construction and maintenance company in Malaysia. The purpose of this study is to discover in more detail how the execution of the implementation of quality management in the ship building company operates and can be improved. This chapter will also provide an industrial point of view that can aid academic knowledge.

The *second chapter* presents selected literature on related topics to facilitate a comprehensive analysis and understanding of the current research. The literature review presents relevant theories, the definitions of quality, Quality Control (QC), Quality Planning (QP), Quality Improvement (QI), Quality Management System (QMS), Total Quality Management (TQM), The implementation of quality in construction industry, The problems of quality management implementation in construction industry, Quality Management Organizational in Construction Industry, Inspections, Verification and Monitoring Activities and Record Documentation Management in the construction industry are included.

The *third chapter* describes the research methodology applied in this research, as a case study with a qualitative approach using descriptive methods of data collection procedures and data analysis techniques to be applied to the research questions. This chapter includes a discussion of the basic research design, sample selection, data collection and management methods, reliability and validity issues, data analysis strategy, and ethical considerations. It also outlines the general research design and rationale working on this study.

The *fourth chapter* explains the results of the research through interviews; observations and document review that will be generated in themes or categories or identify patterns.

The *fifth chapter* discusses the findings, draws conclusions based on the examination of study results and review of the literature in the field, discusses the implications of the study for practice, and makes recommendations for further research.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The chapter presents a review of the literature on the relevant theories and research related to the study. The objective is to provide a background and present the arrangement of the study. The review begins with an overview of the history of quality, followed by the significance of the study and the discussion on quality management in construction projects. Additionally, information about quality is explored and explained in detail. The summary of this chapter serves as a synopsis and an outline of the literature that gives context for this study.

According to Steward (2004), the purpose of conducting a literature review are as follows: first, it combines a variety of different results, and provides opportunities for researchers to understand the areas that they know most, and second, the literature review allows researchers to deal with questions that are directly and indirectly related to research reviews. With the ability to summarize and synthesize related research to advance a particular topic further, literature review also provides a clearer understanding of the whole research process in great details. It also helps in the learning process and in terms of the information communicated (Denney & Tewksbury, 2012). While the main objective of a literature review is to assist academician, the concept of literature itself is nevertheless often misunderstood.

The literature review begins with an exploration of terms related to the research area. The eight key terms used in the research are: (a) quality management, (b) construction, (c) inspection, (d) monitoring, (e) record management, (f) data information and (g) cost of quality. Various databases are used in this research, both independently and in various combinations.

This research is an in-depth study on the quality management in a naval ship construction and maintenance company. The primary focus is rather extensive, involving the basic theories relevant to the understanding of quality management. Each step in the writing process development, based on the understanding of the relevant journal, will facilitate the delivery of this literature review.

All journal articles or references are cited according to the key terms used in the study. In this literature review, all the journal articles are from 2015 and before.

The focus of the study is on quality management with a particular focus on a ship construction project in Malaysia. Comparison and documentation review of previous studies have been done to find any significance with the present study.

Thus far, research on quality management practices conducted in Malaysia has been focusing mainly on the manufacturing industries, such as the work by Rose, Md. Deros, and Ab. Rahman (2013), Mad-Lazim, Ramayah, and Ahmad (2008), Azizan Abdullah (2010), Ali, Zin, Hamid, and Ayub (2010), Raimona Zadry and Mohd Yusof (2006) and Hayati Habibah, Khairul Anuar and Fazli (2014).

In this chapter, eight main studies are explained: (a) The implementation of quality in the construction industry, (b) The problems of quality implementation in the construction industry, (c) Organization concept in the construction industry, (d) Inspections, Verification, Monitoring Activities and Statistically Process Control; (e) Record documentation management in the construction industry; (f) Centralization in data information; (g) Project Risk and Quality Management in Construction Industry; and (h) Cost of Quality Management in Construction Industry.

In addition, the definition of quality and its relationship with the management process in the construction industry are also explained in this study. They include Quality Control (QC), Quality Plan (QP), Quality Improvement (QI), Quality Management System QMS), Total Quality Management (TQM) and also the ISO standard.

2.2 History of Quality

Quality has been closely developed and linked to population growth and industrial activities. According to Sharma (2010), quality development has its own contribution and it has taken many years with the invaluable efforts from all quality Gurus. Today, quality adopts a holistic approach equipped with scientific instruments.

The evolution of quality can be traced all the way back to The Middle Ages, beginning in the early 19th century. The timeline of evolution and integration of best quality practices are shown in Table 2.1 and Figure 2.1.Every completed work was evaluated and inspected by the skilled workers to ensure that quality standards were met in all aspects of the finished product. This practice would also result in customer satisfaction. The same goes with the history of quality management which has gone through a number of changes since it was first introduced. The main goal of the quality implementation, however, remains the same.

Table 2.1:
The timeline on Quality Evolvement and integration of best quality practices

Time	Event
1910s	The poor quality product found by the inspectors then would be scrapped, reworked or sold as lower quality. This stage is also called Salvage Sorting Corrective action identified sources of non-conformance - Ford Motor Company. This is also called the era of specialization verses generalization.
1920s	- Industrial Revolution: a) mass production b) unit verification c) defective product - Taylor's conception of work - Measurement, comparison and verification activities - Focus on the quantity produced The idea arose that quality control can help to distinguish and separate two types of process variation; firstly the variation resulting from random causes and secondly, the variation resulting from assignable or special causes. A process can be made to function predictably by separating the variation due to special causes. The main processes which help products and services to meet customers' needs are inspection and quality control, which require greater process control and lower evidence of non-conformance.
1930s	- Sampling inspection, use of statistical tools. - First concerns regarding prevention: identification of causes for defective products and focus on the finished product - Seven Basic Quality Tools: 1. Flowcharts and Process Maps 2. Check lists 3. Cause-effect diagrams 4. Pareto diagrams

5. Histograms
6. Scatter diagrams
7. Control charts

1950s Total Quality Control which forms the basis for TQM (Feigenbaum, 1961).To integrate the efforts of quality development, quality maintenance and quality improvement.

1960s
- First quality standards
- Customers' specifications
- Preventive actions
- System's approach
- Started the concern about involving everyone in the organization
- Focus on the manufacturing process

1970s
- The revolution of quality was pioneered by W. Edwards Deming
- The concept of quality and its definition have been widely discussed in literature. It has been described in terms of conformance to requirement (Crosby, 1979)
- Evolution from the Quality Warranty phase
- Integration of quality on global management
- Quality Circles
- Audit
- Focus on the work process

1980s
- Deming comes up with Total Quality Management (TQM) (American Society for Quality (ASQ), 2010). The exploration and production companies began integrating this management system into their business. The conformance with internal requirement by improving products, services, processes, culture.
- Management Principles:
    a) Responsibility delegation
    b) Staff autonomy
- Satisfaction of needs and expectations
- Struggle for improvement

- Adaptation needs
- Change management
- Focus on the organizational process

  In 1981, the Motorola Company incorporated TQM. Design of experiments and statistical control techniques to devise the Six Sigma methodology. They target to achieve a target level of 3.4 defects per million opportunities or below, thus reducing variability in processes, improving profits, lowering costs, and reducing on the cycle time.
- Fitness for use (Juran and Gryna, 1988)
- Quality Management System: a set of organisational measures which transmit maximum confidence that a given quality level is being achieved with the adequate resource consumption. Characteristics:
    a) External focus: at the client
    b) Global approach and as an integral component of the organization strategy
    c) Horizontal vision within the organization, from top management to staff
    d) Includes all the concerned parts
    e) Continuous learning and adaptation to change
- Tools and methodologies:
    a) Re-engineering
    b) QFD – Quality Function Deployment
    c) Benchmarking
    d) Inquiries: clients and staff
    e) Brainstorming
    f) Balanced Scorecard

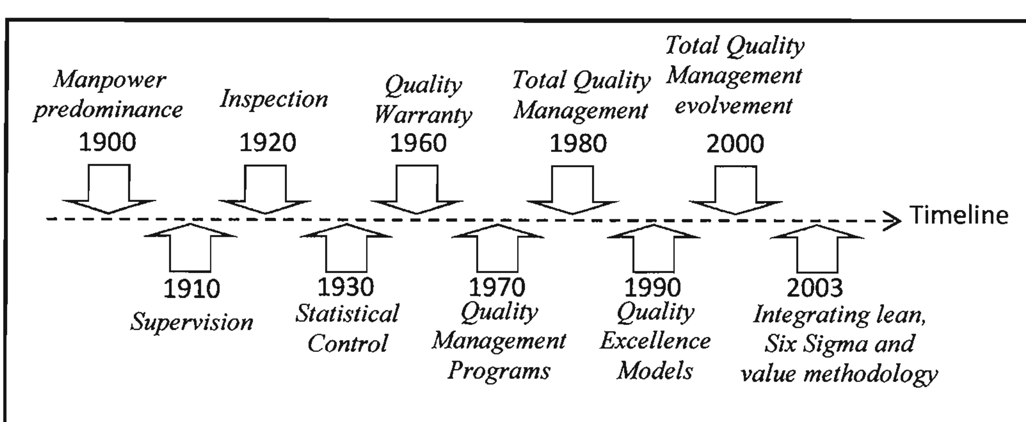
1990s Quality excellence model, Lean and Six Sigma are world-class strategies that provide a synergy in business processes from the respective roles of process optimization (lean) and reduction of product defects (Six Sigma)

  a) Orientation guide
  b) Flexible and adaptable instrument
  c) Self-assessment and continuous improvement models

	d) Support on the pathway to excellence e) Focus on customer
2000s	Reducing and managing variation (Deming, 2000).Total quality management (TQM) evolved as a common term among organisations in different parts of the world.
2003s	- Value Engineering (VE) gains a reputation as a forgotten lean technique. The integrating lean, Six Sigma and value methodology as a formula for superior continuous improvement. - VE is a powerful design methodology that harnesses existing organizational creativity and knowledge resulting in superior innovative products. Integrated suite provides tools to improve productivity, lower cost, improve quality, and shorten time-to market

Sources:
(Mahajan, Agrawal, Sharma, & Nangia, 2014; Setijono & Dahlgaard, 2008; Sinha & Kheradia, 2011; Ahmad & Elhuni, 2014)

Table 2.1 illustrates the changes and improvement in the concept of quality from 1900 until 2003. The timeline shows how the concept, which started by just focusing on Manpower predominance, has evolved into much a more holistic and scientific field. In fact, it can be further developed by integrating with the latest work technology.



Sources: Compiled by author

Figure 2.1: The timeline on integration of best quality practices

2.3 Quality management in project completion

In order to provide further understanding of quality and its elements, the term and definition of Quality will be explained in this part. According to Al-Saket (2003), the definition may be subjective; it has different significance to different people under varying circumstances. When speaking of quality, the meaning of the term should be clearly defined. These are many definitions of quality. Oxford Dictionary explains that quality is a degree of excellence of the product or service provided. Juran and Godfrey (1998) state that quality is related to customer satisfaction or dissatisfaction with the product; in addition, fitness for use, and also conformity to the specifications. The definition of quality has also been discussed by other researchers such as McManus and Wood-Harper (2007). According to them, the definition of quality has been mentioned and verified by the International Organisation for Standardization (ISO), and the standards are widely used.

Hassan, Baksh and M.Shaharoun (2000) and Zairi (2013) argued that Deming (1986) did not describe quality in a single phrase but asserted that the quality of any product or service depends on the customer's definition. Deming (1986) also defined quality as "*satisfying the customer beyond expectations*" and aimed at the customer requirements, both present and future. The quality system can help to deal with any changes to the product while maintaining a high quality of care (Kunkel, Rosenqvist, & Westerling, 2007). Furthermore, it states that quality is a relative term that is subject to change, depending on the customer's needs.

The definition of quality from the dictionary also does not really facilitate to explain its meaning because it is too vague. There are several different understandings of the meaning of quality. Liang (2010) suggested that in general, it can be used as a process for tracking and inspecting defect and ensure products are produced to meet the technical requirements. As an example, a high specification product is inherently of a higher quality than a lower specification product. While Lee and Zhou (2000) gave a simple definition of quality by suggesting that if specifications meet customer requirements, the product can be considered to satisfy quality specifications. With the definition made by several authors, "Liang (2010), Lee and Zhou (2000)" could foresee that there was confusion with the meaning of quality theoretically, even though the original purpose of explaining the meaning of quality was to give an idea of how the process of quality is implemented.

The execution of quality has been carried out by various means, however according to Lau, Zhao and Xiao (2004), they believed that the best way to implement the development of quality management is through the examination oriented approach , as well as the strategy approach. The concept and practice of quality is a good step to maintain the objective of the exercise. It is sometimes seen as a drastic action but it is a necessary action to ensure that it works.

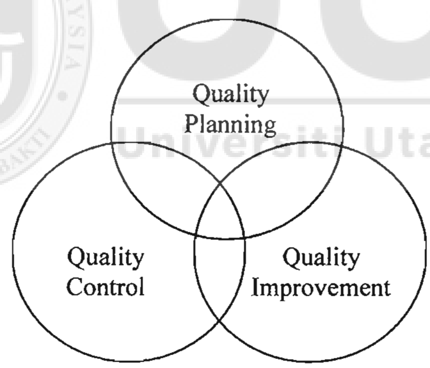
All industries are required to adopt a certain standard for their finished product; similarly, the construction industry also needs to embrace quality and offer value for money for their finished products in order to guarantee customer satisfaction (Chan & Tam, 2000). By incorporating social and environmental performance as part of their responsibility, this will affect the cost involved in the implementation of quality management even though it will raise some interests in the company. It also aims to ensure that the increase in implementation costs will not cause problems in the quality of financial matters reported.; Pun & Nurse, 2010; Water & Vries, 2006). They agreed that quality management can contribute significantly to the overall performance of companies. Any organization that manages the company's management usually emphasizes on improving work performance and ensures that no significant costs are incurred in any of the work process done.

The philosophy and guiding principles that represent the basis of continuous improvement is part of an organization's quality management practice. Customer satisfaction, which is among the key focus of companies, can be realized through the implementation of quality management practice. The implementation of continuous improvement is considered to be effective because it involves everyone in the company. (Abd.Manaf, 2005; Karia & Abu Hassan Asaari, 2006).

The principle behind quality implementation in the construction project is to understand the concept of quality as applied in the project completion, focussing especially on construction planning. Instead of just focusing on producing improved products and services, quality management practices programs should also think about reducing costs, getting more satisfied customers, and achieving better bottom line financial performance (Su, Li, Zhang, Liu, & Dang, 2008). The quality improvement process normally depends on a certain level. Bunney and Dale (1997) mention that improvement depends on the application of certain tools and techniques of quality management.

Price (2003) also mentions about the improvement process in assisting in the development strategy of a construction organization. It is important to first identify the tools and methodologies that should be used. By using the tools and methods in the implementation of quality management, it will be easier to achieve progress. To ensure the understanding of the importance of the implementation and improvement, it should be emphasized by all.

The achievement of project completion in the ship construction industry can be defined in a quality trilogy as shown in Figure 2.2. The basic concept of the trilogy that manages the quality-oriented process consists of three basic features: (1) design quality, (2) quality control, and (3) improving quality. Typically, each process is universal; it is run by an order of that similar activities (Juran, 1986). The relationship between these three major components will show how the project has been organized, controlled and improved (Azizan Abdullah, 2010; Al-Saket, 2003; Keng & Abdul Rahman, 2011; Zairi, 2013).



Source: (Juran & Godfrey, 1998)

Figure 2.2: Quality trilogy

The three major components have been accepted to be part of the quality management concepts (quality planning, quality control components and the requirement of quality improvement), in which performance depends on resource management, responsible management, quality management system, product realization, measurement, analysis and improvement. Each of this component is a very important element in ensuring the implementation of quality management concepts. Besides each component being conducted in an orderly manner, it should also not be limited in any appropriate adaptation when the implementation is carried out

The strategic management practice tends to be complex and it frequently includes many different people who are involved in the improvement activities (Price, 2003). Bunney and Dale (1997) stated that the three quality components-Quality Planning, Quality Control and Quality Improvement"- are used in any part of the organization as needed, especially in group work quality improvement. These three basic managerial processes are called a quality trilogy (Azizan Abdullah, 2010; Al-Saket, 2003; Keng & Abdul Rahman, 2011; Zairi, 2013) through which the management of an organization can achieve the following quality management objective which are:

1. Quality control: to emphasize control and preventive actions which address quality problems and the correction of defects. It involves making a product that is free of any deficiencies;
2. Quality improvement: to look for opportunities and gaps to execute quality enhancement procedures before any problems occur; and
3. Quality planning: to give and provide the work force an opportunity to engage in producing good quality products that meet consumers' requirements.

Therefore, quality can be defined as meeting specifications, meeting customer needs / expectation, transparency of service delivery, process control, achieving desired results, continuous improvement, competitive advantage, added value for society, best value for price, cost effectiveness, performance measurement, more for less, satisfaction of stakeholders, doing the right things, doing things right, and lastly, doing the right things right.

Even though understanding of quality in the construction industry is important, one must not forget its relationship with management and the most basic understanding of the concept must not be forgotten. It means that quality management is a necessity in managing all activities and tasks for any construction or project. In order to maintain the required level of excellence and confidence levels, management should focus on quality of design, implementation of quality improvement and quality control.

2.3.1 Quality Planning (QP)

A part of quality management is found in Quality Planning (QP). QP is conducted throughout an organization to accomplish its objectives. Sabella, Kashou, and Omran (2014) stated that strategic planning is an idea that is based on practice; organizations that possess these skills will have a higher probability to improve their performance. Indeed, quality planning is very important in the completion of any project. Juran and Gryna (1988) see quality planning as being part of managerial process which compare the actual performance to stated goals. It is also to evaluate and compare actual performance and to take action on the differences in the managerial process.

As quality planning in the manufacturing supply chain requires effective planning context, it always starts with customer needs and also documentation of all information received. It is one of the requirements that has not been adequately explored, either in the supply chain or quality management literature itself. The original model was to describe a relationship between strategic planning and the production supply chain.

In order to understand the work process in a new plant, it is necessary to explain adequately the quality requirements for each part. According to Batson and McGough (2006), the quality of the planning process will help each employee in ensuring the production planning and distribution costs are in accordance with the predetermined requirements. In fact, specifying any quality management innovation is actually real quality planning (Duffner, Freudenstein, Hohenstein, Skalej, & Grote, 2001).

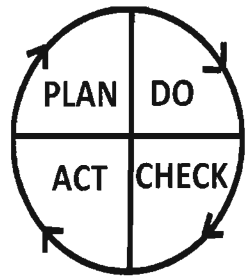
Kläs, Nakao, Elberzhager, and Münch (2010) mention that the planning activities of quality assurance (QA) are very challenging because they are very systematic and require the development of a complex system. It requires the ability to ensure that implementation of the technique is applied correctly and effectively and all defective content of manufactured articles should always be regularly checked. Normally, this plan is controlled and managed by QA personnel when they monitor the progress of the work activities.

A risk-based approach, which is to avoid a massive waste of force, usually affects the quality control plans, especially for complex manufacturing process. An analysis model was developed to optimize the quality control plans (QCP). Bettayeb, Bassetto, and Sahnoun (2014) mentioned that it is subject to the inspection capacity and objectives that are exposed to risks. This will give an overview of the compliance and operational use of the approach and the potential benefits in terms of reducing exposure to the risks. With the progress of the work, the quality control provisions of the proposed model and algorithm that are easy to understand would avoid any excessive production of scrap.

Each product quality planning is a fundamental part of quality assurance in all manufacturing process. To achieve this, Dai, Maropoulos, Tang, Huo, and Cai (2010) suggested that during each phase in the development of a product, the quality of a resource can be distributed through the implementation of the quality based on the original goal.

A proposed method of design quality is suggested by applying risk assessment and planning tasks that are translated into product development priorities of each risk assessment received. Each comprehensive model has been developed to address shortcomings with quality issues found in the traditional functions. Next, a method based on mathematical calculations and algorithms to describe the goal of every risk assessment will optimize the selection and order process. Indeed, the purpose of this planning is to solve every problem related to the distribution of quality planning and quality goals.

The methodology for conducting quality management is also known as Deming Cycle or PDCA cycle; *Plan, Do, Check, Action* (PDCA) (Al-Saket, 2003; Landin, 2000). This methodology is quite popular in the construction industry because of its direct approach towards the implementation of quality. Abdul Rashid (2002) is concerned with the early detection in removing the complications in implementing process, and this concern will be described in the PDCA cycle.



Sources: Adapted from Abdul Rashid (2002)

Figure 2.3: PDCA Control Cycle

1. Plan – To decide your goals and build up a process for achieving these goals
2. Do – To execute your plan
3. Check – To evaluate and countermeasure the results of your plan and its implementation
4. Action – To take required actions in establishing quality control

Quality planning (QP) consists of the following elements: identify both internal and external customers; find out customer needs; build up product features that act in response to customer requirements; establish quality objectives that can meet up with customers' needs; develop a work process that can construct the needed product features; and provide work process competency – to show that the process can meet the quality objectives under the working conditions.

Quality planning is concerned with the organization's goals and product characteristics as well as its work processes. Suppliers and customers are very important because they are also expected to take part in the work planning i.e.

customers can play a part in identifying client desires and find the factors associated with customer satisfaction. These processes should establish the following goals: meeting customer needs, meeting specifications and being the most economical.

In addition, quality planning is a well-organized process to make certain that a structured order of activities is completed. According to Senaratne and Jayarathna (2012), these activities will guarantee that an organization can produce quality products on time, and reach the customer's exact specifications at the lowest cost. Meanwhile, a Quality Plan is part of a work program that has been structured and prepared for construction by quality control management. The inspection tests for any construction project are normally explained in the quality planning arrangement.

According to Al-Ani and Al-Adhmawi (2011), quality planning requirement consists of the following: to determine and plan the inspection test activities, to identify the quality plan, to carry out inspections tests matters listed in the technical requirements and understanding contract, to submit the work plan before the start of work for the client's approval following the award of the contract and to update the work plan during the project realization as an indicator of the current situation of manufacturing, construction, inspection and testing and to re-submit the work plan, especially to the client.

The quality plan will also include the following requirements:

1. Recognition of the characteristics that need to be inspected and to be tested.
2. Identification of required inspections, tests and special processes and their relative locations in the construction process.
3. Identification of hold points beyond which the activity shall not proceed until the satisfactory results of the inspection tests have been publicized and documented.
4. Provisions for the client to insert witness points at which activities will be observed and monitored.

Each organization will conduct its own method to obtain such information as well as solutions to solve problems. According to Meiling, Backlund and Johnsson (2012), commitment by all parties involved in the PDCA method is essential; it is also important to use it as the basic tool in work planning activities which is key to collecting facts from all parties, but without fully appreciating the significance of the planning phase, normally it will cause time-consuming activity.

2.3.2 Quality Control (QC)

The next element in the quality trilogy is quality control (QC) - the set of actions or techniques that have been used to ensure all quality requirements are met. "*Doing the thing right*" is commonly applied in quality culture (Walker & Keniger, 2002). Generally, quality control has become increasingly important in the work inspection activities for product based items. Milliken and Colohan (2004) mentioned that there is much confusion in identifying the true definition of quality and this can lead to internal problems in which each processing point may be different from each other.

Many academicians including Kleywegt (2007) would argue about the definition of quality, which can sometimes be another element of control to change the focus of policy, without understanding the actual meaning. Quality control is described as a mediator analysis model which can identify unusual aspects or in other words, it can detect errors in the construction model or repair process (Kleywegt, 2007).

According to Cairns (2011), quality control is applied to all stages of investigation. It can play an important role in ensuring the effectiveness of the implementation since the result of the implementation of quality control can also be recorded. Paszkiewicz, Farbos, O'Neill, and Moore (2014) mentioned that there are many challenges that must be faced to ensure the effectiveness of quality control data, and with the methods adopted by quality management, it can simplify and facilitate the control process.

The details of the QC method are as follows: to choose controlled subjects referring to the things that need to be controlled; to choose appropriate units of measurement; to establish and set up measurements; to establish work standards performance; to measure the actual work performance; to understand the dissimilarity (actual versus standard); and to take any action on the dissimilarity. QC is done either by inspection of each unit or by sample testing with actual measurement i.e. testing that is supervised by the manufacturers' own final product control team (Khan, Azhar, & Mahmood, 2008).

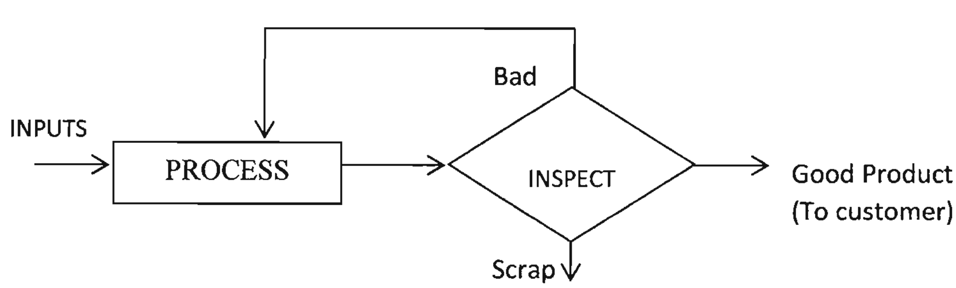
According to Zairi (2013), Juran specifies a detailed method through his "*quality trilogy*". The criteria for quality control are easily available and can be used widely in the identification process, Vaudel, Burkhart, Sickmann, Martens, and Zahedi (2011) suggested a method and tools for quality control and impartiality of the parameter identification. It will be carried out using a detailed search, thus providing a significant improvement over the standard introduction. It is stated that the insufficient quality control may lead to repeatable error and rework (Köcher, Pichler, Swart, & Mechtler, 2011). This control method is more efficient in making sure every detail is in accordance with a predetermined standard.

One of the purposes of quality control is to help each operator to decide whether the results of the analysis of the resulting system can be accepted ; every decision taken is very important to ensure that mistakes will not be repeated (Hurley, 2001). Each unit containing information about techniques for determining when a decision is under control or out of control should always be on the side of the operator to facilitate the decision to be made.

Each different quality control method can detect any error during analysis. This is because the results can be compared with different levels of efficiency according to the type of error and the method itself. Each prevalence and number of observations can impact the results of the analysis.

Efficiency in the regulation can be measured by examining the graph. Badrick (2003) explained about efficiency, which according to him, each regulatory control is only part of the analysis process itself and it is also equally important in the event of a failure in the working process. After each decision is determined, sometimes there are mistakes that can only be accepted and used as the limit in the regulatory system of quality control. Quality control and quality improvement are not only being applied in the field of engineering but it is also important for businesses that are considered strategic. According to Montgomery (2009),by implementing quality control, organizations will continue to maintain their competitive advantage.

Inspection based on quality control, which is the conventional approach to manufacturing work, is to rely on the construction that created the product. Meanwhile, the QC scope is to inspect or check the final product and monitor all items to ensure that they meet the product requirements and specifications. Inspection activities are the most important way or approach in controlling the quality of products as well as training good quality inspectors (Lau et al., 2004). QC work is very important in every part of the manufacturing process, especially to confirm the status of the products before they are marketed.



Source: Adapted from Antony and Taner (2003).

Figure 2.4: Inspection based on Quality Control

Figure 2.4 shows a simple work process diagram for an operating process based on the QC method. It shows that if the product is acceptable, it will go directly to the customer. If the product is bad but can be reworked, it will go back to the work process, if not it will go to scrap. In this case, the function of quality control can be considered a cost saving practice; it determines whether the reject product can be reworked or not. According to Wang, Wang, and Li(2012), these activities involve an approach known as "*detection*" or "*inspection*". Quality control is one of the procedures that reduces time and cost but it is also a task that is difficult to perform.

Process control requires constant data collection of the process activities. Each step in assessing the quality of data that is commonly used is always associated with each case-control study and is carried out in the case-control study of the association (Anderson et al., 2010). Woo and Law (2002) stated that each control process is identified and documented in accordance with the requirements set out by the Quality Control and it depends on the following three matters:

1. The physical need is to identify a physical object that includes customers, vendors and employees
2. Control or management process is a requirement to identify something indescribable logically or physically, examples include records QC parameters, the rate of fabricating a product, operating parameters and also the corrective actions required.

3. The sequence of information requirement is identified as a problem that cannot be explained and it also has its own information.

The above includes the product inspection results, documentation record, work order, in-process inspection, final inspection, inspection measurement and specification, and material inspection records. All information needs to be explained in more detail and clearly. This is because every information must be explained with proof and should be easy to understand.

2.3.3 Quality Improvement (QI)

The third element in the 'Quality Trilogy' is Quality Improvement which Juran and Gryna (1988) stated that these improvements will bring result based on a new approach in terms of preparation and establishment of a management.

This is supported by Gelle and Karhu (2003) who said that in each and every development of quality-related information, the primary focus should be on the management of good quality. All these elements need to be emphasized because they will make it easier for the implementation of quality management, especially in construction work process.

Quality improvement has been part of the Japanese culture. The two terms associated with quality improvement in Japan are Kaizen (Japanese for '*small improvement*') and Kairyo (Japanese for '*one great improvement*'). The former is a systematic approach that focuses on an organization's processes and it can be conducted by any worker. Meanwhile, Kairyo is conducted principally by adopting the work improvement on a project basis and is usually undertaken by a specific group of workers.

The aim of quality work improvement is to remove and eliminate internal and external waste failures. According to Samoutis et al (2008), quality improvement usually requires a substantial financial investment and also careful consideration in the design to maximize the benefits and potentially huge profits returns. Mjema, Victor, and Mwinuka (2005) mentioned about the benefits and potential of quality improvement which they categorized into three areas: defect preventive action, improvement work actions, and cost of quality insufficiency. The aims of Quality Improvement implementation are as follows:

1. To provide evidence the need for improvement;
2. To determine specific projects for improvement;
3. To manage and organize a guide for the projects;
4. To discover the cause of the problem; it is necessary to carry out diagnosis for the problem.
5. To identify and make a diagnosis to find these causes;
6. To give and provide remedy;
7. To provide evidence that the remedies are effective and useful under operating conditions; and
8. To provide evidence for control to maintain the gains.

In general, organizations are driven by the following factors: to persevere the competitive environment; to catch up with increasing customer satisfaction levels; to overcome the shortcomings of new technology; and to work together with each other through an ever-changing quality criteria. Improvements can either be small or in constant steps of improvement and can be one extreme step taken regularly (Al-Saket, 2003).

Karia and Asaari (2006) mentioned that employees, who are the actual agents of change, are most directly affected by the process of quality improvement. Improvements aimed at improving the quality of work must be in line with every employee; it is important to ensure that all employees abide by the changes that have been implemented in the company.

Quality improvement will provide the potential to increase quality according to a predetermined plan. Bunney and Dale (1997) mentioned that the first important point in the quality improvement process is to focus on the internal customer and internal supplier interface, and usually performed during the application through the department for analysis by the organization involved. Meanwhile, Waaijers and Van Der Graaf(2011) explained that by conducting investigations in the operational aspects, a concept of quality will be executed. It is intended to deepen the various phases in the life cycle of research data on production, management and reuse.

According to Al-Saket (2003), there are five stages that are commonly used in Quality Improvement which are:(1) the implementation of a program for improvement, (2) the improvement of standard-setting principles, (3) the preparation for program execution, such as setting up of a quality committee, (4) the elimination and removal of delays and obstacles which may prevent work implementation and (5) the development and improvement in checking the results.

For organizations to benefit from QI, it has to be part of their culture which means that all quality activities should be continuous. (Al-Saket, 2003; Pun & Nurse, 2010).This is important because all employees must be trained to identify the direction of quality improvement in their organizations.

Quality is derived from two groups: suppliers and clients. The client is, however, more important than suppliers because the financial resources usually come from them. The level of standard of quality will be the measure of the degree of client satisfaction (Battikha, 2003). The saying that the customer is always right is indeed true because without customers, it is difficult to do any business.

Battikha (2003) mentioned that the process of implementing and improving quality is actually an expensive and difficult process. The seven tools of quality control explained by Bunney and Dale(1997) are fundamental to the success in improving quality. They will provide the management team with a more realistic reason for the need to support quality control before moving to more complex control processes. The steps required in achieving quality improvement are as follows: measure and control the current quality level; plan any actions and activities to improve the quality; carry out the work activities; determine if the expected improvement has been achieved; and measure and control the quality level. Groocock (2006) suggested that in commencing a quality improvement program, the organisation should be capable of carrying out these actions.

Using quality management to implement quality improvement process, Battikha (2003) reminded organizations the importance of quality and not to just be concerned about the volume of production and cost reduction. This improvement programs require a greater focus to ensure that each production can be improved and ultimately, increase profitability for the company.

For companies, the factors and components required for success include being aware of quality performance improvement and wisely adopting a suitable technical support. A commitment and obligation to continuous improvement can lead to long-term advantages (Webster, 1999). Each approach is not easy to be done except by focusing on it wholeheartedly and to improve quality performance requires a thorough understanding to ensure that no mistakes are made.

Friman (2004) conducted a study to investigate the effect of improvement in transportation on customer satisfaction. The result showed that increase improvements in the transport system did not affect customer satisfaction. The difference in terms of total satisfaction and accident which happens in the service has nothing to do with any quality improvement. Hu, Cheng, Chiu, and Hong (2010) stated that service quality has a positive effect on customer loyalty and customer satisfaction. Both of these effects are important to ensure a quality of service that gives a good impression of a company

Apparently improved service improvement will exert a powerful impact on customer satisfaction. Studies conducted on quality of patient care found that continuous improvement had addressed the issue of quality of service. Dehghan, Sheikhrabori, Sadeghi, and Jalalian (2013) mentioned about a quality improvement program in a government clinic whose mission is to identify whether the clinical governance will improve the quality of documentation services. All the improvements in implementation of Quality Improvement target every service and the mission of an organization is only to give a better service and satisfaction to their customers. It also further strengthened the company's vision and mission.

A production system normally produces a final product following the standard quality characteristics. The system's fundamental function has direct influence on the output and it becomes the main focus of new quality improvement activities (Irianto, 1995). Creating a strong design will reduce the variance in design parameters and it has always been a major focus in the performance improvement. Selecting parameter levels will always minimize and reduce the variation in the quality characteristics of the product.

In addition to these three components in the completion of a project, the quality management system is the main pillar for the integration and implementation of ship construction activities. It is also supported by a number of additional elements in quality management such as quality management systems (QMS), total quality management (TQM) and ISO standards. All of these elements will further strengthen the implementation of quality management in ship construction activities.

2.3.4 Quality Management System (QMS)

Al-Saket (2003), Elghamrawy & Shibayama (2008), Leopoulos & Chatzistelios (2014), Said, Ayub, Razaki, & Kooi (2009) define quality management system 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. Indeed, quality management concerns a customer-oriented philosophy of quality-focused management for continuity of improvement in which lessons learned from previous problems are used to enhance and improve the future products or services in order to maintain existing customers, win back missing customers and receive new customers.

A framework based on the quality of management information processes is purposely created to increase productivity based on a new version of ISO 9000, approved in 2000 (Chin, Kim, & Kim, 2003). These standards have been executed particularly in construction projects. An information model has been developed to carry out the management information system based on the quality of the work process called ISO 9000 quality management information systems. The system incorporates scheduling non-conformance reports process covering quality, inspection and testing process, and corrective actions during the construction phase.

Quality management also involves a defect preventing method. According to Landin (2000), it is concerned with preventing defects and problems by knowing the elements, including attitudes and also the environment. Quality management is a new activity in the construction area and currently, companies have their own approaches to implement a quality system, but the basic requirements for implementation are based on the requirements of the ISO Standards.

Demand for good quality management system (QMS) by organizations is growing because it leads to the production of high quality products (Rao, 2006). As far as the Malaysian Construction Industry is concerned, the application of QMS is on the rise as there are obvious benefits to be gained from it. The four advantages which companies will have when they implement QMS are: enhancement of organization image and reputation, improvement of performance and customers' satisfaction, establishment of documentation procedures & instructions and improvement in quality of service .Today, there are many companies that have recognized QMS, a tool which has helped them to achieve their business goals

For improvement to take place, companies should take the initiative to strengthen their quality management systems by providing additional resources to their external quality assessment program. Ridderhof, Van Deun, Kai, Narayanan, and Aziz (2007) mentioned that with special consideration on the quality of the assessment, it will provide companies with new programs such as management and leadership skills. This is because QMS promotes the development of an accreditation program to ensure adherence to standards to improve the quality and credibility of a system. Moreover, QMS application can enhance the image and reputation of an organization, as QMS is a versatile and flexible management tool that an organization can use to improve its goals, efficiency and profitability.

As mentioned earlier, the Implementation of QMS is to ensure that services meet the standard quality requirement.Despite this, many companies are not embracing QMS due to factors such as lack of awareness, lack of QMS exposure among employees, and lack of understanding and continuous professional development (CPD). In addition, the terms used in the implementation of QMS standards could be unclear, uncertain or imprecise.

Also contributing to its lack of acceptance is poor guidance in training programs which affects the CPD at every level of management. Instead of focusing on the restricted perspectives of QMS and tending to look for the achievement of quality itself, Walker and Keniger (2002) explained that the evaluation of the processes should be prioritized.

Management should make an effort to focus and manage quality systematically. Said et al. (2009) proposed that companies enhance management effort to train all levels of management in conducting Internal Quality Audit (IQA), put in place a proper documentation system, increase the understanding of QMS, encourage new technology usage, monitor participation levels of management in training and motivation programs and provide reference and guidance for ISO 9001:2000. The implementation of QMS must be done properly and managed within the requirement of ISO standard.

The implementation of QMS in the Malaysian construction industry has been taking place for more than 20 years, starting in 1993. The awareness of quality project delivery had already been developed earlier. Nevertheless, failure in realizing the added value from the system, including the acceptance and commitment towards the implementation of the system, still remain a major barrier and issue that need to be addressed.

According to Walker and Keniger (2002), QMS is one of the important tools needed to achieve a project's objective. To improve the competitiveness of an organization, quality management system implementation focuses on customer needs and provides quality training for all levels of management in an organization. The ability and willingness provided by the manufacturers to meet customer needs will result in more projects being generated because of excellent service provided by such organizations.

QMS implementation benefits many industries. As an example, the implementation of QMS in the automative industry, has enhanced the application of training and employee relation activities (Semiz, 2011). Meanwhile, the implementation of QMS in the construction industry normally measures the effectiveness of the system by using performance indicators. Leong, Zakuan, Mat Saman, Ariff and Tan (2014) stated the objective of QMS implementation in project management. They mentioned about the QMS variables that had been extracted from the literature review and project performance indicators that were established from the theory of project management. All the research data was obtained and analysed using correlation and regression analysis.

QMS is able to improve and enhance the service quality of the firm, at the same time, increases market share, clients' satisfaction, income and morale of employees (Samsudin, Ayop, Sahab, & Ismail, 2012; Walker & Keniger, 2002). Pheng and Shiua (2000) explained that QMS is derived from the common guidelines contained in the ISO 9000 standards, and also found in the construction work process.

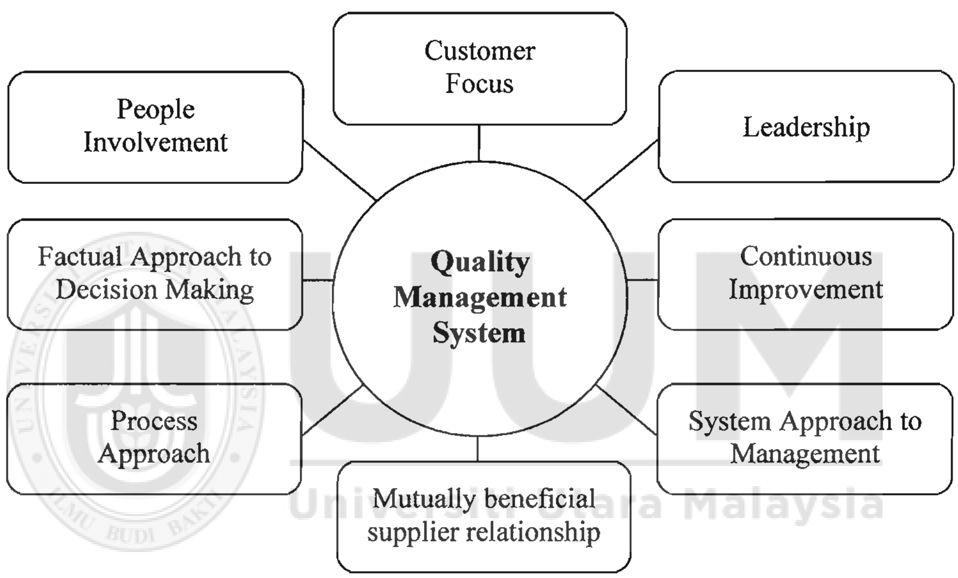


Figure 2.5: Eight Elements of QMS implementation

As shown in Figure 2.5, Quality Management System involves eight elements as follows:

1. Customer focus
2. People Involvement
3. Leadership
4. Factual approach to decision making
5. Continuous Improvement
6. Process Approach

7. System approach to management
8. Mutually beneficial supplier relationship

Service organizations should implement a comprehensive quality management system because it gives a competitive advantage for them. By adopting QMS, they will be able to enhance the quality of their services more effectively.

Yang (2006) demonstrated the feasibility and effectiveness of QMS in other companies in his study. However, enhancements are also needed in some aspects of quality management in other service industries. By managing QMS in their daily work process, the result can be used as a benchmark which is a useful reference for any service organization that has yet to adopt QMS as part of their management practices.

2.3.5 Total Quality Management (TQM) in project completion

Total quality management (TQM) is also a part of quality management (QM). According to Karia and Asaari (2006), the three basic ingredients of TQM are: quality, customer satisfaction, and continuous improvement. Supported by Hansson (2003), TQM is a set of concepts in integrated management. In comparison with other concepts such as quality assurance or quality control, TQM is broader since it embraces the whole organization, not just focusing on a part of the manufactured goods. It is an umbrella for concepts and ideas related to the quality field.

TQM and quality performance are also related to one another in the manufacturing organization in Malaysia. Arumugam et al.(2008), Pun and Nurse (2010) clearly mentioned in their research about the important of practicing TQM that can lead to improvement in the quality of work, especially in improving customer satisfaction.

TQM is also defined as a management system that needs the commitment of the top management which is crucial in ensuring customer satisfaction; it is also the final objective of the organisation's management initiative (Abusa & Gibson, 2013; Karia & Asaari, 2006).

TQM concepts ensure efforts are in place to achieve the appropriate level of quality of the products and thus they should be well planned and monitored regularly (Keng & Abdul Rahman, 2011). The core of direct and definite objectives of quality in business are "*to get it right first time, on time, and on budget*" (Brooke, 1994).

Efforts to achieve sustainable performance is aimed towards achieving organizational excellence. According to Karia and Abu Hassan Asaari(2006) and also Krasachol and Tannock (1999), to achieve this goal, a bundle of theory, innovations, a mixture of management thinking, tools and techniques must work in harmony. These are effective methods of improving work, at the same time encouraging participation and inspiration.

The philosophy behind TQM is not an issue and should not be questioned since its credibility and reliability have been demonstrated in different countries around the world. It has been shown that organizations complying with TQM will gain competitive advantage and a steady market share. A detailed description of the definition through difference quality interpretation can be seen in Table 2.2.

Table 2.2:
Definition of TQM

No.	Description
1	According to ISO 8402:1994, management activities to determine the overall functioning of quality management in accordance with the quality policy, objectives, and responsibilities and implement a quality system better as quality planning, quality control, quality assurance and quality improvement.
2	Japanese Industrial Standard (JIS 8101-1981), this standard defines the system as a technique for reasonably producing a goods and services that meet the customer's needs.
3	TQM is an effective system for integrating the quality-improvement, quality-development and quality maintenance efforts of the different groups in an organization. To enable engineering, production, marketing and service at the most reasonable levels which allow for full customer needs.
4	To practise QC in this area: develop, design, produce and service, a quality product which is most useful and reasonable satisfying the consumer needs
5	A mutual form of undertaking business that relies on the talents and capabilities of both labour and management. It also practises the continual improvement in quality and productivity using team-work.

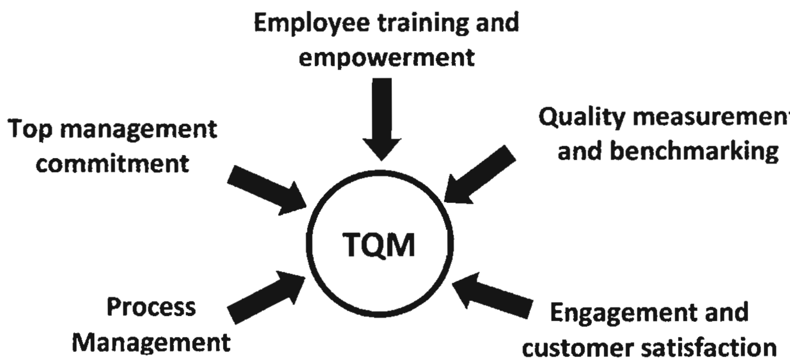
Source: Adapted from Al-Saket (2003)

Before starting any business, an organization must begin by identifying customer needs, followed by the design stage, then manufacturing and finally, inspection. The philosophy mentioned by Al-Saket (2003) is that quality cannot be accomplished by applying only the inspection at the end of the process, but it is a part of all of the work process, and integrates all interdependent components until it achieves the objective of the whole association.

Ishikawa (1981) said that quality refers to quality of everything: work, service, information, processes, divisions, and people, including all levels of workers, system, company and objectives. In brief, it is total quality (TQ) or company-wide quality.

TQM management must provide the workers with awareness, understanding and training; the workers must comprehend the company's processes and objectives as well as how their roles fit in with the company so that they give all their efforts to improve the company. The term TQM has been defined in several ways as well, but in general, the implementation of TQM is one of the major accomplishments of being through high quality products (Karia & Asaari, 2006; Krasachol & Tannock, 1999).

According to Juran (1986), the workforce can assist management in Quality Control, Quality Improvement and Quality Planning. There are five elements in TQM implementation. These elements are shown in Figure 2.6.



Source: Adapted from Bayazit & Karpak (2007)

Figure 2.6: Five Elements Construct of TQM implementation

However, Bayazit and Karpak (2007) in their review of the literature on TQM, discovered six elements which are : top management co-operation, customer focal point, supplier quality management, people management, continuous improvement and process management.

The above six proposed TQM elements are strongly supported by many authors (Abusa & Gibson, 2013) as the critical accomplishment factors for TQM implementation, and are particularly recognized in several developing countries e.g. Libya, Saudi Arabia, Kuwait, Palestine, Malaysia, and Turkey. Whether there are five or six elements, they are critical or important success factors for the implementation of TQM.

Deming (1986) outlined a new theory of management based on the following 14 points (Su et al., 2008):

1. create constancy of purpose in order to improve both products and services;

2. learn a new philosophy and reject commonly accepted levels of delay and mistakes by understanding that it is possible for something to be done right the first time;
3. cease the dependence on mass inspection to achieve quality by incorporating quality into the product;
4. end the practice of awarding business based on the price tag alone;
5. Improvements must be continuous and not just a one-time effort. Management must look for ways to reduce waste and constantly improve quality;
6. institute on-the-job training to ensure that employees are trained properly;
7. institute modern methods of responsive supervision;
8. drive out fear;
9. break down barriers between departments;
10. eliminate slogans, exhortations and numerical targets for the work force – these have never helped anyone to do a better job;
11. eliminate numerical quotas for both the work force and management;
12. remove barriers that rob people of their right to take pride in their work, such as misguided supervisors, faulty equipment and defective materials – people are anxious to do a better job and become distressed when they are unable to do so;
13. institute a vigorous program of education and retraining; and
14. take action to accomplish the transformation.

TQM has always been termed a customer-oriented and quality-focused management philosophy for attaining continuous improvement. It refers to a new idea in which the focal point is shifted from the quality of products to the quality of all matters within an organization. In other words, it packs together all aspects of a business to increase customer satisfaction by applying continual improvement in performance and strategic objectives, and requires an integrated effort among workers at all levels.

The process of generating quality in work improvement must begin with the management; the commitment and involvement of management is very important in creating a quality culture in any organization. According to Abdul Rashid (2002), the main role of management is to determine and verify the feasibility of implementing TQM practice.

The main objective of TQM is meeting the rising expectations of the customer by having continuous improvement in technical and managerial processes which help an organization to gain a competitive advantage. The benefits of TQM have been well documented but in general, the implementation will improve the productivity in a manufacturing industry, reduce product cost, and enhanced product reliability (Polat, Damci, & Tatar, 2011). The same goes with Idris, McEwan, and Belavendram (1996) who also mentioned the five main benefits of the implementation which are improvement in customer satisfaction, cooperation, productivity, communication and competency.

The two main concerns in guiding and influencing the organization's objectives and business process are quality standards and customer satisfaction.

TQM is a comprehensive management approach that aims to meet customer needs (Jabnoun, 2005). This happens because it focuses on customer satisfaction, and the importance of culture in the process of designing, producing and improving products and services.

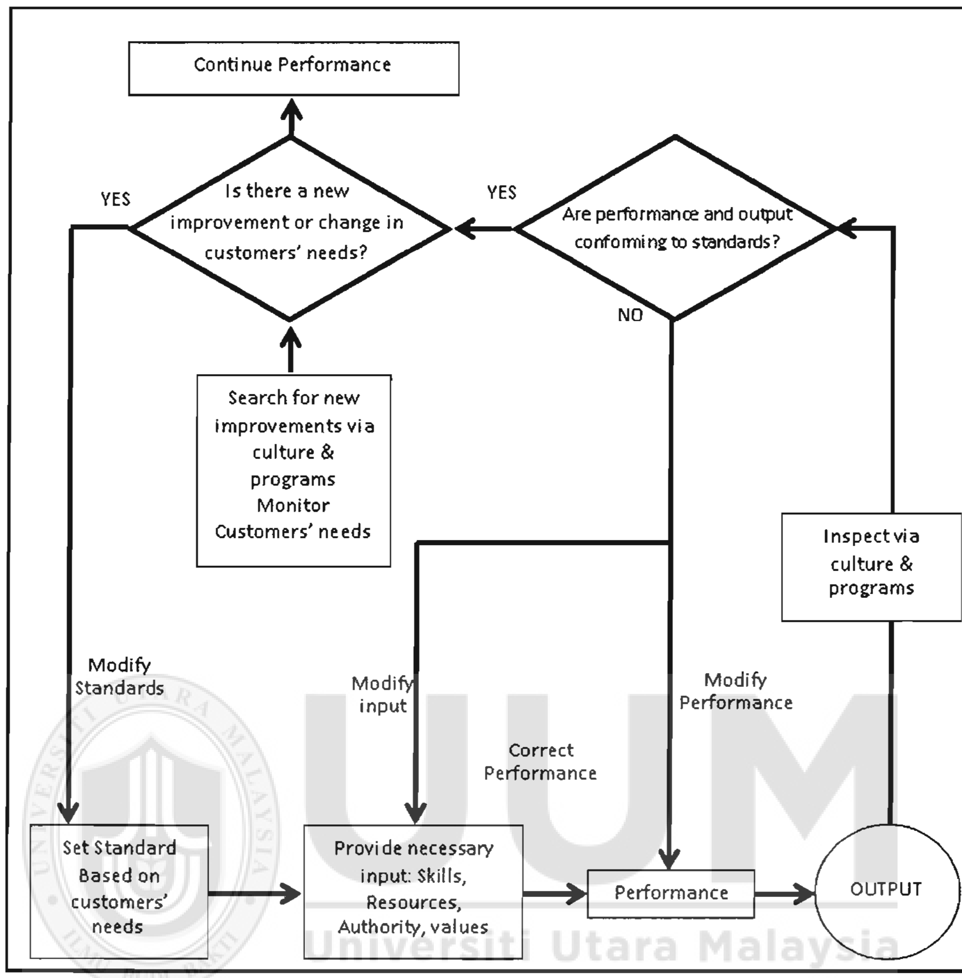
The main inputs of TQM are: customer satisfaction requirement, business environmental factors, and feedback loop of supplier-customer chain output. The supplier and business process must be directly influenced by the requirements of quality standard and customer satisfaction.

For companies to accomplish their business objectives, the management should use a process approach, executed using a PDCA cycle. In addition, management needs to utilize TQM tools and techniques such as Statistical Quality Control (SQC), implement a teamwork approach, provide quality leadership, conduct training programs and create a quality team. All these, besides continuously following the PDCA cycle (Al-Saket, 2003).

With the adoption of TQM control processes, the two issues which are necessary in order to conform to quality standards; improvements in customer needs and performance and output are resolved. In following the process flow of control, it has been rectified according to customer needs and that the standard has been used from the beginning of the control process. The important information of TQM process flow has been set as an improvement and standards according to the customer needs.

According to Hoonakker et al. (2010), among the problems faced by the ship construction industry are costs, productivity, safety and health. With the implementation of TQM, the industry has managed to achieve better construction results. Nevertheless, the effectiveness of this implementation depends on the seriousness in implementing TQM, as some firms or companies totally abandoned their implementations while others attained award-winning outcomes.

The implementation of TQM has benefitted companies as it involves all levels of management. With TQM, issues such as work improvement and also performance are addressed in detail within the company. Figure 2.7 illustrates the TQM control process. It shows that the process of improvement and performance are interlinked with customer satisfaction.

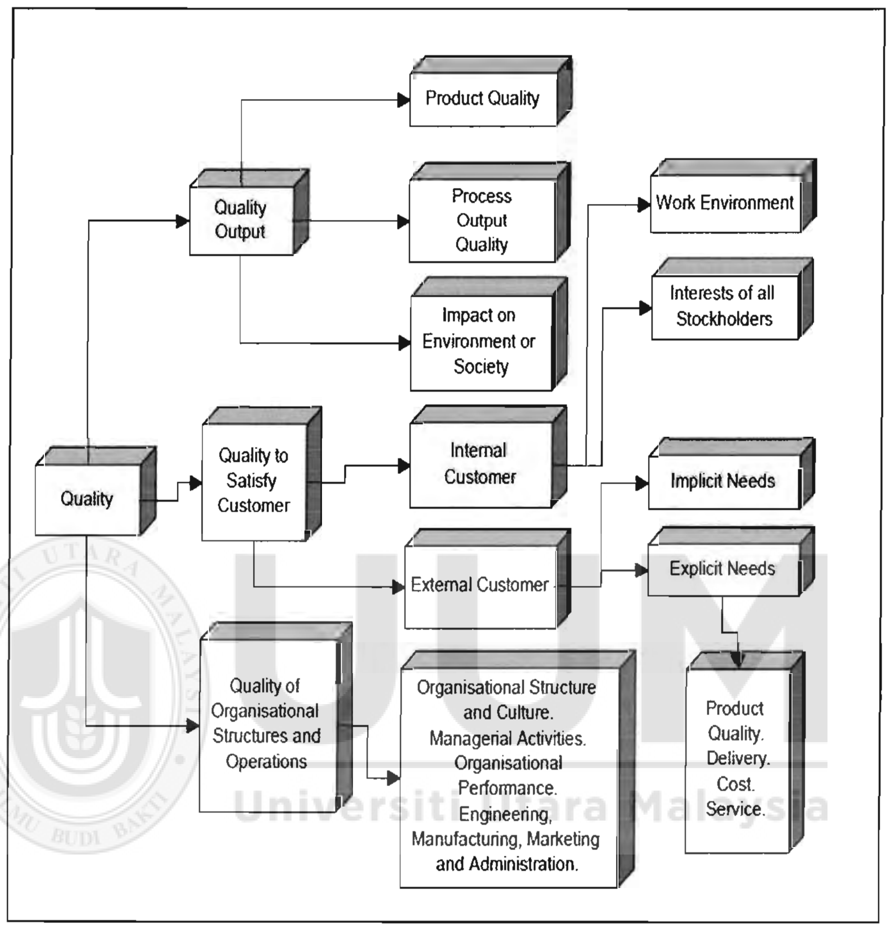


Source: Adapted from Jabnoun (2002)

Figure 2.7: TQM Control process

As shown in figure 2.7, quality is divided into three and each partition has its functions and needs.

According to Hoonakker et al. (2010), they concluded that it is necessary to transpose, manipulate and translate the principles, practices and techniques used for TQM manufacturing to construction. It has been noted that TQM techniques have been used widely and effectively in manufacturing and industrial engineering to control the work process and to avoid any imperfections and problems before they occur, as well as controlling costs.



Source: Adapted from Al-Saket (2003)

Figure 2.8: A Comprehensive Approach to Quality

Currently, only a few studies have been conducted to observe the effects of TQM implementation in the construction industry. One of them examined how this implementation affects customer satisfaction. The study concludes that for the first time, an empirical study has definitely shown that TQM implementation is positively related to customer satisfaction. Meanwhile, in a study done by Hoonakker et al. (2010) to monitor TQM in jobsite activities, the positive effect of the implementation is recognised to have speed up projects and at the same time help grow the profitability and productivity of the company.

The five quality activities most commonly applied by companies that have engaged TQM after accomplishing ISO 9000 are: quality awareness programme, internal quality audit, supplier improvement activities, TQM and SPC (Idris et al., 1996).

2.3.6 International Standardization Organization (ISO)

In general, the increasing application of TQM concepts and the quest for ISO Certification by organizations have contributed to the systematic endeavour of reducing inconsistency within the construction sectors (Santos et al., 2002). The most important justification for implementing the ISO standards is improving company performance (Idris et al., 1996). Therefore, ISO plays an important role in guiding the work processes carried out in organizations by making sure that they are according to the standard.

ISO certification stands for certain minimum quality standards that organizations should meet and assure a consistent quality of products, services and processes. It is understandable that ISO certification is not an identical package that can be valued in the same way by every association. ISO certification gives no assurance or promises of the quality of products or that the service of an organization is enhanced relative to the quality of other organizations. ISO does not certify automatically that organizations have good quality products (Singels, Ruël, & Water, 2001).

The ISO 9000 series is a common quality management system designed by ISO. This standard summarization of ISO 9000 is supported by the elements that are required in the quality management system of an organization. Pheng and Shiua (2000) stated that quality management systems (QMS) approved based on ISO 9000 standards are now a general characteristic in the construction industry in many countries. Strongly supported by Walker (2000), he mentioned the quality standards for ISO 9000 but did not recommend any specific quality instrument; it is the responsibility of the accredited company and would be subject to any review, modification and enhancement. The ISO 9000 quality management system plans to achieve quality objectives through proper documentation and work procedures.

ISO 9000 stresses the need to build the procedures and systems of the association. Inspection activities and services are not sufficient to guarantee quality and to avoid any reminders. These problems can be eliminated by the execution of a quality assurance system such as ISO 9000; this system stresses prevention rather than correction.

Table 2.3:
Five standard series in the ISO 9000 quality management system

No	ISO 9000 Series	Description
1	ISO 9000	To provide guidelines for the execution of quality management system models especially in the definition and conception of quality. ISO 9000-9001 - Revision of ISO 9000 (1991) ISO 9000-9002 - Guidelines for the application of ISO 9001, ISO 9002 and ISO 9003 (1991) ISO 9000-9003 - Guidelines for the application of ISO 9001 to the development, supply and maintenance of software (1991)

2	ISO 9001	To provide a QMS model in design, manufacturing, development, services and installation
3	ISO 9002	To provide a QMS model in manufacturing, services and installation.
4	ISO 9003	To provide a QMS model for testing activities and final inspection.
5	ISO 9004	To provide guidelines in execution of quality management and its system essentials. It describes the fundamental requirements to generate, implement and maintain the quality of organizations systematically and efficiently.

Sources:
McManus & Wood-Harper (2007), Pheng & Shiua (2000), and Said (2005)

The standards tools in the ISO 9000 family include: ISO 9001:2008 (sets out the requirements of a quality management system), ISO 9000:2005 (covers the basic concepts and language), ISO 9004:2009 (focuses on how to make a quality management system more efficient and effective) and ISO 19011:2011 (sets out guidance on internal and external audits of quality management systems).

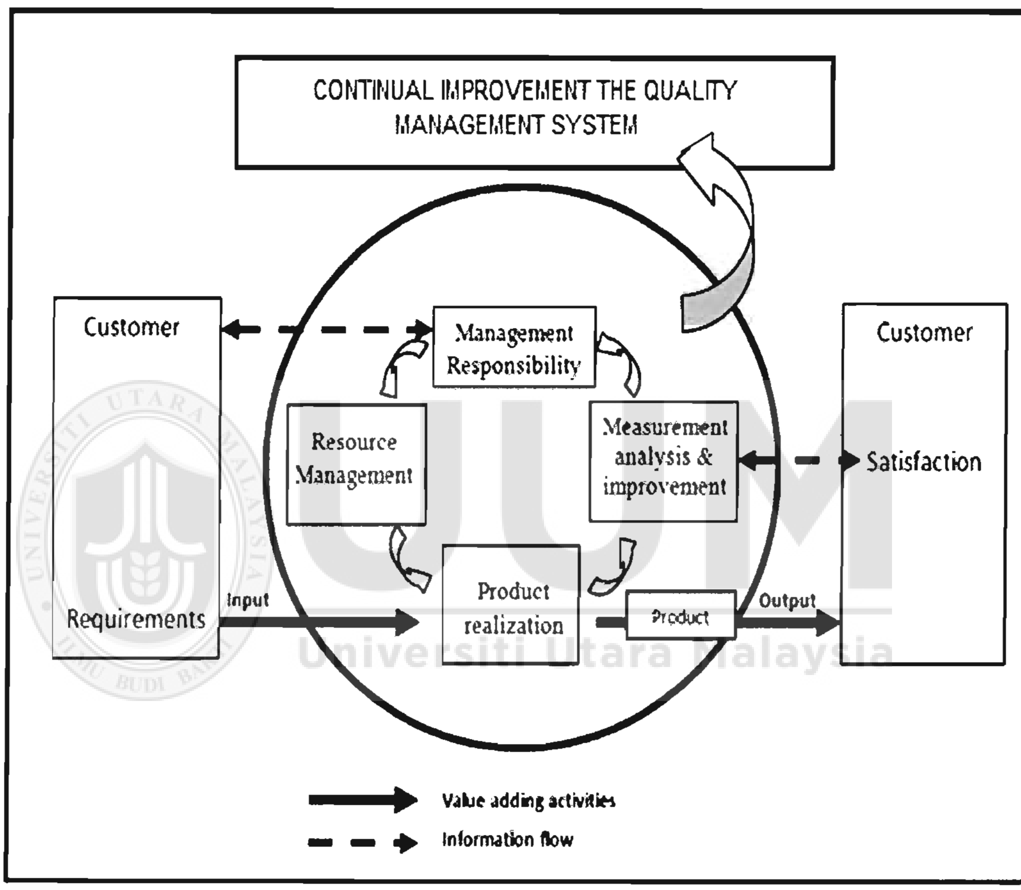
A new ISO 9001:2015 version is forthcoming; the current standard has been under revision since 2012. The next version is expected to be published in December 2015 and will replace the current version, if the ISO members vote favourably in March 2015. The revision will not change the scope of the standard. However, the new version will affect the ISO structure or the so-called high-level structure. According to Singels, Ruë, and Water (2001), the process-oriented methodology is maintained within the topics consisting of change management, risk management and knowledge management.

Table 2.4:
Elements of Quality Management (QMS) Model

No	Elements	ISO 9001	ISO 9002	ISO 9003
1	Managements responsibility	√	√	√
2	Quality System	√	√	√
3	Contract Review	√	√	√
4	Design Control	√		
5	Documents and Data Control	√	√	√
6	Procurement	√	√	
7	Product Control Supplied	√	√	√
8	Identification of Product	√	√	√
9	Process Control	√	√	√
10	Inspection and Testing	√	√	√
11	Inspection of Testing Tools, Measurement and Testing	√	√	√
12	Inspection and Testing Status	√	√	√
13	Product Control (Does not meet the specification)	√	√	√
14	Correction and Prevention Action	√	√	√
15	Operation, Storage, Manufacturing and Delivery	√	√	√
16	Quality Record Control	√	√	√
17	Internal Audit Quality	√	√	√
18	Training	√	√	√
19	Feedback	√	√	
20	Statistical techniques	√	√	√

Source: ISO Standard

Organizations or companies may choose any of these series based on their business activities. The standard processes for products and services are illustrated graphically in Figure 2.9, the general requirements for a QMS standard, as follows:



Source: ISO (2000)

Figure 2.9: The QMS Basic Process

The evolution of the ISO 9000 model has been continuously revised since 1987 (Erel & Ghosh, 1997). The acceptance of the ISO 9000 series grew rapidly from 1987 to the 1994, and continued from 1994 to 2000. In 2008 a new version was launched as a new series of ISO 9000, also known as ISO 9001:2008. The existing requirements in the 2008 version explain the clarifications to ISO

9001:2000. The integration of these versions is to make the model more comprehensive and more convenient for all. ISO 9001:2008 has five main structures:

1. Quality Management System – Documentation requirement, to execute and maintain this system and continually improve its effectiveness, quality manual, control of documents, control of records.
2. Management Responsibility – customer focus, organizational commitment, quality planning, quality policy, management review.
3. Resource management – resource distribution, services work environment, human resource development.
4. Product realization – process planning, design and improvement, procurement, manufacturing and service operation, provider relationship process and measurement of supervising tools.
5. Measurement, Analysis and Improvement – product control, measurement and monitoring that do not achieve the requirements and specifications, corrective action, analysis of data, preventive action and planning for continuous improvement.

The ISO 9000 may be a complex quality system, but it has been set and explained in detail. QMS certification gives better assessment in manufacturing. According to Said (2005), the benefits of the implementation of ISO 9000 are:

1. Improvement in quality of products: enhanced efficiency of the organization through streamlining the work process and its operation. Currently, all European countries require companies to have this certification.
2. Modernization of companies in internal operation because this will provide recognition and enhance the image of the company.
3. Better documentation: To enhance the work documentation of procedures within the organization.
4. Enhancement of internal communication.
5. Systematic approach to personnel training: To inform and educate the workforce on the importance of quality while enhancing work efficiency.
6. Enhancement of employee quality awareness.
7. Competitive advantage: To build client confidence by meeting quality requirements.
8. Improvement of customer demand and attract new customers.
9. Improvement in the company's reputation, especially in customer confidence for goods and services given.

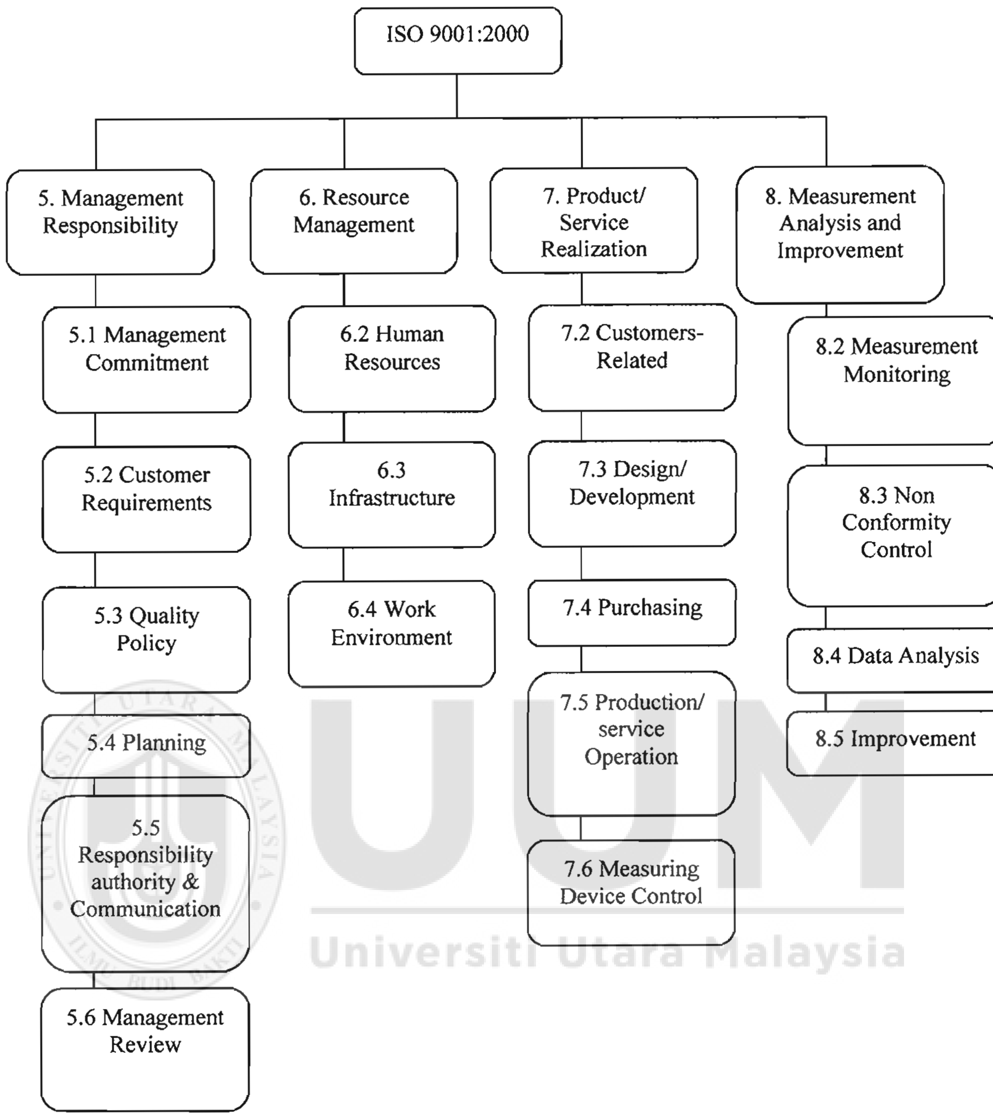
The term, ISO 9000 certification, has been defined in several ways and in general, it can provide many internal benefits such as improved methods of working, improved documentation, and also enhanced quality of work (Pheng & Yeo, 1997; Singels, Ruë, et al., 2001).

Table 2.5:
The internal and external benefits of ISO 9000

Internal benefits:	External benefits:
1. Enhanced company communications	1. Access to domestic market
2. Improved documentation	2. Better competitive edge
3. Improved methods of working	3. Higher perceived quality of work done
4. Improved quality of work done	4. Improved profitability
5. Reduced scrap and reworking	5. Access to overseas markets
6. Greater client focus	6. Having a valuable marketing tool
7. Improved employee morale	7. Improved client satisfaction
8. Improved performance appraisal	8. Improved supplier relations
9. Increased efficiency and productivity	

Sources: Pheng & Yeo (1997), Singels, Ruë, et al., (2001).

According to Singels, Ruël, et al., (2001), an organization performance is dependent upon the role played by the organization itself. It is, therefore, important to understand that ISO certification alone does not automatically result in an enhancement in performance; in other words, ISO certification alone does not lead to an enhancement in the performance of organizations.



Sources: Zeng, Lou, and Tam (2007).

Figure 2.10: ISO 9001:2000 requirements

In conclusion, companies with ISO 9000 certification will have many advantages. Therefore, the construction industry companies have to take this opportunity to understand and implement the ISO 9000 quality management system in their organizations.

2.4 The relationship between Quality Management and the construction industry

As mentioned earlier, there are eight main studies which are relevant in understanding the relationship between quality management and the construction industry. These eight items are presented in Figure 2.11 below.

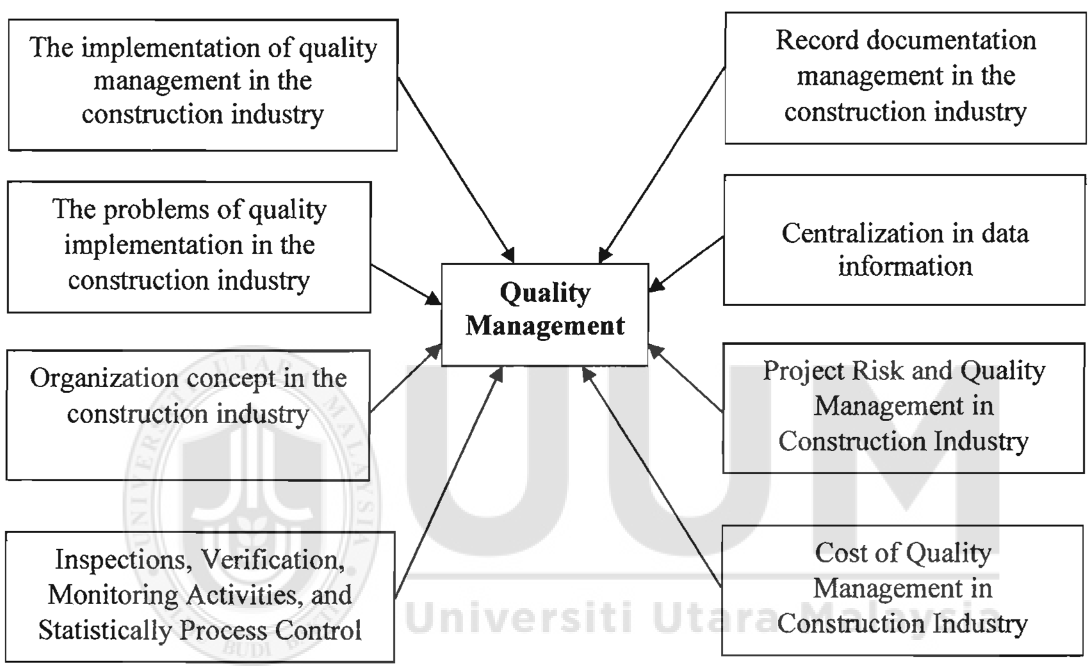


Figure 2.11: The relation between main research studies and Quality Management

2.4.1 The implementation of quality management in the construction industry

Gremyr and Elg (2014) explained that the implementation and utilization of quality management (QM) concepts are normally considered being very important for organizational effectiveness and development. Knowledge about the quality system is an important factor when new quality programs are to be implemented (Landin, 2000). To understand more about the drop quality in certain construction fields, the definition of construction should be understood before implementing the quality system. Effective implementation is understood by several terms but in general, it is relying on motivation and awareness about quality, and this can be guaranteed by providing training to inspire the necessary approaches (Brooke, 1994; Sohail, Rajadurai, & Rahman, 2003).

Quality construction researchers (Hoonakker et al., 2010) have given different definitions of quality performance and it is not easy to find an accurate meaning of quality in the construction industry The characteristics of construction industries are different given the nature of its physical features and especially in the final product. In mass manufacturing, finished goods are normally distributed to retailers or sold directly to customers without any special documentation. This development frequently consists of a series of steps that are carried out by a specific team that will turn the management concept into reality (Gremyr & Elg, 2014).The theories of implementation involve a process that integrates a predefined theory with the aim of recuperating in a detailed way. A specific assessment group defines how an execution process should be planned.

One of the theories in project quality considers the suitability of decisions within the broader cost, design integrity, timeliness, quality objectives and management structure of the project; this will be verified by a proactive and thorough quality culture (Walker & Keniger, 2002). The objective of this implementation ,stated by Khan et al. (2008), is to guarantee that the activities of a particular project are performed in accordance with all contractual terms, codes and standards. At the same time, the arrangement of construction activities involving larger units cannot be changed. Moreover, the construction industry has three other characteristics that differ from those of manufacturing activities: one-of-a-kind projects, on-site production, and complications, for example, temporary multi-organization and regulatory involvement.

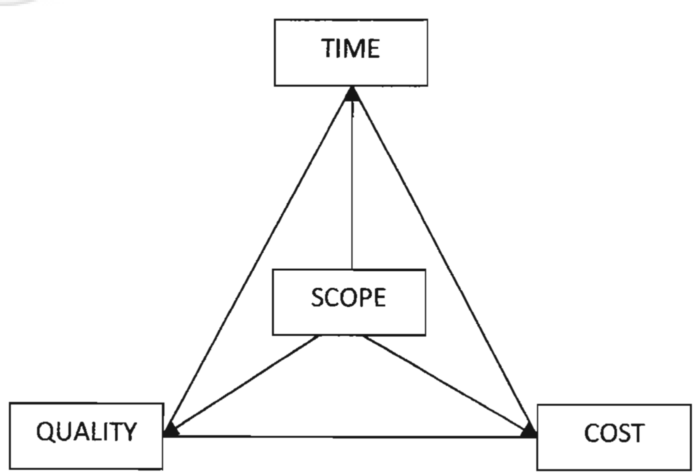
According to Salem, Solomon, Genaidy, and Minkarah (2006), on-site production refers to construction which is site-position manufacturing, and applies to ship and airplane manufacturing that can be moved after assembly, as opposed to fixed-position manufacturing. Next, one-of-a-kind production, in general, refers to manufacturing which uses specialized tools and equipment to make standardized units, allowing only an incomplete level of customization by the dealer.

In addition, Price (2003) added that complexity in manufacturing means many components from dissimilar sub-assemblies can be straightforwardly controlled and managed because normally suppliers are selected early in the design stage. The selection of suppliers in the early stage of the design will ensure the reliability of the product or manufacturing work flow using suitable technology, layout and specialized facilities that can be prepared by them (Salem et al., 2006).

Quality can also be described from the functional point of view which is a process which conforms to the project's requirements. Using this explanation, a quality project can be described by such expressions such as ease in understanding of the drawings, specifications and level of difficulties, project budget, simplicity of work process, energy efficiency and ease of maintenance. It also can be described as meeting the requirements of the owner of the project, the designer, construction and regulatory bodies (Arditi & Gunaydin, 1997).

The threefold significance of quality in the construction industry are: ensuring the necessary features of the final project are within the required product specifications; completing the work on time; and getting the work done within budget. As mentioned by Liberatore and Pollack-Johnson (2013), quality is recognized as an important component of every project management and it is related to time and cost. A quality construction project has to consist of all these. In fact, quality of construction is directly linked with conformance to specifications and suitability for the user, and it has been supported by the research conducted by Wan Yusoff, Mohammed, Misnan, Mohd Yusof & Bakri (2006).

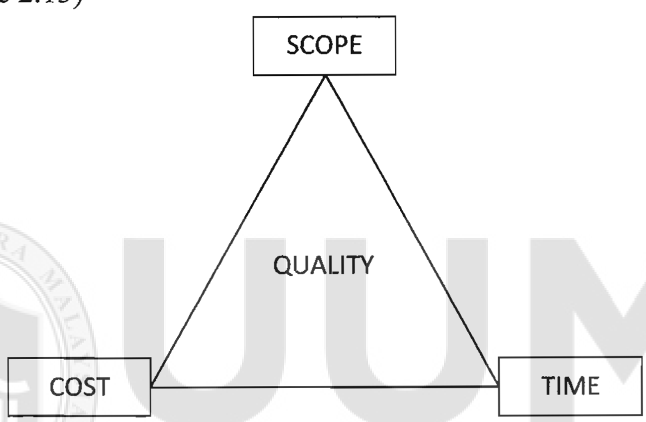
Any construction industry can also be defined in the above manner; the differences are only in the product orientation and the construction work process. The implementation of quality is shown in Figure 2.12.



Sources: Adapted from Dagbjartsdottir (2012)

Figure 2.12: Construction triangle

The concept of quality in the ship construction industry can be seen and considered as one form of the triangle as seen in Figure 2.12. According to Dagbjartsdottir (2012), the contractor must produce within the planned budget and meet the schedule cut-off date while reaching the necessary quality level. This construction triangle also relates with the project management triple constraint or the Iron Triangle in which quality is placed as the fourth refinement constraint. (Refer to Figure 2.13)



Sources: Adapted from Wyngaard (2012)

Figure 2.13: Project Management Triangle

As mention by Cuellar (2010), this triangle is able to hit each of the components with agreed upon functionality. The same situation applies to ABC Sdn. Bhd, in which the focus of the project management team is to look in more detail into each component of the project completion without missing any information.

According to Ramanathan, Narayanan & Idrus, (2012), there has been a number of projects which are experiencing serious delays, with cost being one of the major factors contributing to the situation. This stems from a design that exceeds the time and the estimated costs to be borne. As described by Abdul

Rashid (2002), the cost or budget is dominated by other more important priorities even when there is design deviation leading to cost acceleration. It also been described by others (Dagbjartsdottir, 2012; Walker & Keniger, 2002) about the project scope in which there must be a sense of balance among these three components.

Time management, as with cost and safety measurement, is accomplished through a reliable series of meetings held on a daily basis with relevant parties who also have their own toolbox meetings with their employees to discuss any work activities on that day (Abdul Rashid, 2002). As supported by Santos et al. (2002), this process is a matter subjected to changeability, delivery time, quality and cost of the process which may vary; small variation in quality or any part of these three elements can influence customer satisfaction. It was found that in addition to meeting the needs of customers, quality can be achieved by increasing the emphasis on quality and performance (Chan & Tam, 2000).

Typically QC in ship construction involves meeting the requirements with minimum standards of material and workmanship in order to ensure the performance capability according to the ship design. As stated by Al-Ani and Al-Adhmawi (2011), the purpose of ensuring compliance which is based on the results of the inspections, is to use it as the basis for accepting or rejecting the product.

The type of rejection depends on the items being inspected, for example rejection of a batch of incoming materials such as plate, piping or valves. This is the foundation for non-conformance or contravention of a significant design condition. The procedures for this QC practice are explained in the following sections.

An implicit statement in traditional practices assumes that QC is a concept which is based on an acceptable and satisfactory quality level, allowing an acceptable portion of defective items. Materials acquired and delivered by the suppliers or work performed by an organization is inspected or checked with the result passed as "up to standard" or "acceptable", which means that the percentage of defective items is within the acceptable quality level.

Normally, all problems with materials or goods are corrected or repaired after the delivery of the product. In ship inspection, the objective is always to be in total quality control. In this work process system, no defective items are authorized anywhere in the ship construction or building process. Meanwhile, zero defects have always been the main goal, although it will not be realized on a permanent basis. Even though the number of defects have been largely reduced year after year, the goal or objective is to continue motivating companies to implement TQC

This concept and approach to implementing QC were originally developed in manufacturing firms or construction companies in Japan and Europe, but have since been applied in many countries. The best-known formal certification for quality improvement is the International Organization for Standardization's ISO 9000 Standards (Sohail et al., 2003). ISO 9000 highlights excellent documentation, a series of cycles of planning, quality objective implementation and review.

Total Quality Control (TQC) is a commitment to quality shared in all parts of an organization and normally involves many aspects. To ensure safe and effective construction procedures, design reviews should be treated as the most important element. Other elements consist of extensive training for staff, detecting flaws and weaknesses by examiner and other staff, and maintaining tools and equipment.

Material providers are also compelled to ensure zero defects in delivering goods. In the beginning of the process, all materials from a supplier or provider are inspected and batches of goods are checked thoroughly with any defective items returned. Of course, TQC is difficult to apply; the inconsistency in the workforce, the unique nature of each capability, the huge number of subcontractors and the cost budget for making necessary investments in education and procedures make TQC programs in ship construction very complicated. Nevertheless, a commitment to enhance quality even without any support from the company to reach the goal of zero defects, can make a real gain to the company.

It is apparent that quality is relative to cost that is incurred in the construction process. The quality cost could be reduced in any organization (Mjema et al., 2005) if extra effort is put into prevention activities. In the best condition, there will be no defective and rejected products after production. Quality costs need to be identified and recognized before any decisions are made by the management (Dudgikaret al., 2012). The quality costs can be categorized as follows: failure costs, the costs of demolishing and reconstruction, the cost of production time, delays to other work gangs, appraisal costs, the costs of inspection and testing. The prevention costs is the costs of providing better designs, more training to reduce failure costs, and more maintenance.

Prevention costs are related to activities undertaken to make sure that that the whole work process provides quality products and services. Meanwhile, the appraisal costs are related to the level of quality measuring, achieved in the work process and failure costs are incurred to correct quality in products and services before releasing them to customers.

The purpose of the implementation of quality in the construction industry has been described in several ways. In general, it is to identify what sort of understanding of quality is needed with regard to the construction work process, including the effect of quality on costs (Ali et al., 2010; Dudgikar, Kumthekar& Khot, 2012).

The cost involved in making certain that things are done right the first time is called the price of conformance and money that is wasted when work is unsuccessful and fails to conform to customer requirements, is called the price of non-conformance (Schiffauerova & Thomson, 2006). As mentioned by Al-Ani and Al-Adhmawi (2011), the requirements of quality management in construction projects are determined by these three main points:

1. Quality assurance program – an efficient quality assurance that meets the work quality requirements should be planned, established, implemented and maintained.

2. Suitable organization – the management strategies, objectives and responsibilities must be clearly defined. To make sure that the quality assurance has been applied, a representative must be appointed to check the design, manufacturing, construction or delivery of goods and at the same time, competent enough to resolve any quality matters.
3. Necessary Quality Assurance Documents – QA is responsible for preparing the Quality Assurance Manual and Quality Plan (refer to 2.2.1: Quality Planning).

The Quality Assurance Manual will address the following items:

1. Organization – It shall identify and describe the precise organizational method in the suitable organizational article.
2. Quality Plan – It shall identify the group of responsibilities in specifying the quality plan and describe its main ideology and characteristics with regard to adequate procedures.
3. Quality Assurance Procedure – The outlined and cross-referenced plan shall be integrated in the documents of QA procedures. All the references to QA procedures shall be accessible to the QA representative.

The implementation of quality management in the construction industry, in particular the ship construction project, aims to achieve the followings: ensure that the work is carried out in accordance with a predetermined design; monitor the progress of the implementation of the construction work, understand the requirements before implementing the quality system, understand the relationship between motivation and awareness on quality and provide training in implementing the quality approaches. The outline and the references are needed as guidelines in this implementation.

2.4.2 The problems with quality implementation in the construction industry

According to Keng and Abdul Rahman (2011), the problems in quality management implementation are defined as issues typically observed in the construction management plan. Quality Management in the construction companies faces an uphill challenge due to continuing intellectual discourse and prescriptive advice (Abdul Rashid, 2002). The most critical factor impeding the implementation of quality management in organizations is human resource. It has been observed that operational and cultural barriers play a role in the implementation of a quality system. In addition, Brooke (1994) mentioned that in implementing TQM process, without the commitment of staff and management, it is bound to fail.

As explained by Ali, Kamaruzzaman, Sulaiman, and Peng, (2010), the factors which enhance quality in construction are: continuous improvement, statistical process control, benchmarking, customer satisfaction, human resource management, employee involvement, teamwork, training and education, culture, resources, uses of technology, quality management systems, construction industry, specific factors, codes and standards, drawing and specification and constructability of the design. The same can be said about cost which is very important and is one of the major concerns in quality implementation (Rodchua, 2006).

Obstacles to quality implementation in construction and manufacturing sites have been well documented (Haupt & Whiteman, 2004b), examples include a lot of paperwork, temporary nature of the employees, complexity in measuring results, field employees who consider TQM as unrelated, low on subcontracting tender, and subcontractors who are not interested in using TQM.

Tang and Kam (1999) mentioned that to make engineers comprehend and agree to use the system for implementing ISO 9001 is a very difficult task because of the lack of efficient communication and weak support from management. The usually perceived reasons, mentioned by Chan and Tam (2000), are related to quality implementation for the client, project environment, project team leaders and project management procedures.

According to Landin (2000), ISO 9001, which applies to the construction processes, have many concepts and explanations which are seen as being too complicated and theoretical to comprehend. It seems difficult and hard to use ISO 9001 even though it actually can help develop a company's competitiveness, in addition to become well-organized. There are several obstacles related to quality management implementation (AbdulRahman, 1997), when commitment to and involvement in QA and QM implementation have not been developed on a full scale; the same goes for the different levels of work hierarchy, and normally the implementation is limited and executed at the construction stage only.

Quality is always an issue because it involves the involvement and commitment of all workforce in the organization (Brooke, 1994). The lack of understanding of its importance in all departments, unwillingness to change from the existing system, difficulty in understanding the quality standard requirements, documentation control and also time and/or cost are examples of circumstances that deal with the issue of workers' commitment. The most common barrier to implementation of ISO 9000 is the lack of understanding and unwillingness to change the existing system and difficulty in understanding the requirements. The variation of difficulties faced by organizations during the certification process as stated by Erel and Ghosh (1997) and supported by Hoonakker et al. (2010) are listed below:

1. The nature of the construction work process is one of the barriers to quality implementation: normally the projects are on a large scale, require intensive employment and are rarely situated in the same location; the labour force tends to be temporary; and command varies depending on the client's perception of the cost of the construction project.

2. Many groups of contractors or teams are involved in a similar construction work process, and they normally try to guard their own interests. There are three primary participants in the traditional construction industry: the proprietor or client, the architect/ designer engineer, and the general contractor.

3. Non-standardisation in the construction process: the contractors in the construction generally want to make some changes and to make sure that there is quality throughout the project but they conduct the process

without knowing the actual work process standard. Products are normally produced in one-offs and the production processes normally differ from one another.

4. The construction bidding for work process. Normally the bidding process will start with the release of a project description; the description is mainly for public review and the details of the project can be different according to the understanding and perception of the project manager, but usually the experienced contractors know the details that were specified so that they can create a comparatively precise bid for the job.

The obstacles to solving quality improvement in the construction industry are as follows: inability to handle and manage conflicts among partners in the construction process; standardisation; the competitive bidding process and pre-qualification; and also transforming the work culture. To overcome any disagreement among all partners in the construction work process, the option is to take the form of either of a single or long-term contract covering a number of strategic projects.

Another aspect of project collaboration in construction is as follows: normally, to complete a project in the most efficient, cost-effective manner, it requires the cooperation, collaboration of effort among contractors, setting common goals, keeping lines of communication open and solving problems together. The principle in project collaboration is that all parties attempt to work as much as possible as if they were in one organisation. To be successful, this requires considerable commitment, real trust and mutual understanding and also discipline.

Standardisation of work process is one of the main barriers that have been highlighted in the implementation of quality in the construction industry. Construction projects are usually not identical because they are normally unique and even similar projects may differ, depending on the scale of the project itself. The differences depend on the final product; construction projects are not repetitive as in the manufacturing process and sometimes the construction process cannot begin with similar planning.

Standardisation in the pre-assembly system is not a recent development; modular frameworks have been in existence and in general use for development or procedures, components or products; there is stability, repetition and a record of successful practice. The biggest obstruction to quality implementation is the competitive bidding process and pre-qualification, as has often been mentioned in the construction work process. The competitive bidding process will solve the problems with service quality when the pre-selection and pre-qualification of contractors in the bidding process have been applied. Low cost normally means low in quality standards.

Therefore, to meet a minimum requirement of pre-qualification criteria usually requires bidders to be evaluated in terms of experience, performance, safety, or management programmes; the project owner can thereby reduce the risk of working with a poorly performing sub-contractor. In shifting or transforming the work culture in the construction industry, this method is definitely difficult to implement as the organizational culture is an amalgamated trend.

In adapting TQM and other innovations, many aspects of organisational culture play important roles, but until now the perspective of culture in the construction industry has hardly been studied (Oney-yazic, Arditi, & Uwakweh, 2006).The key to success mentioned by Henderson, Mcadam, and Ireland (2000) lies in ensuring that every unit or section of the organisation focuses on the strategic objectives and the targets linked to quality improvement. There are four different organizational cultures stated by Cameron and Quinn (2011) which are:

1. *Clan culture* (family-type organisations) – the nature of work based on family or tribe that emphasizes consensus and commonality of goal and value. It also the most collaborative and least competitive form.

2. *Adhocracy culture* (entrepreneur, dynamic and creative organisations) – the goal is to cultivate flexibility, creativity and adaptability. The key to success is adopting rapid changes and innovation.

3. *Market culture* (externally oriented organisations) – the type of corporate culture which emphasizes competitiveness not only between organization but also between employees. It is the most aggressive and capitalistic model.

4. *Hierarchy culture* – a structured and formalised workplace with steadiness in the work process; the main focus of this culture is predictability and efficiency.

The conclusion is that problems in quality management implementation are always human-related. The needs and requirements to change always depend on the readiness and willingness of the personnel themselves. If this problem cannot be resolved and dealt with properly, then the probability of failure in the implementation of quality management is high.

2.4.3 The concept of Organization in the construction industry

Any operating organization must have its own organizational structure in order to manage and operate the organization efficiently. As agreed by Chan and Tam (2000), the management system is mainly concerned with the assessment in decision-making for controlling and planning the endeavours of the organisation. The organizational structure will tell us the nature of an organization and its principles. It is, therefore, important to know and understand the function of an organization structure.

The structure of an organization depends on the principles and the character of the business. Many organizations follow their particular work structure which can be categorized into teams and departments. Nevertheless, there are organisations that adopt an amalgamated organisational structure. According to Hunter (2002), a vertical and horizontal complex project-based work process will also have large numbers of specialized staff, partially derived from the matrix structure.

In order to reach the required level of quality, the quality department is required to abide by the quality management system concepts which is applied to the construction work process. It has been explained by Campmans-Kuijpers et al. (2013) that it is important to understand the elements required for comprehensive management of optimum quality at all levels of the organization. This has been supported by Al-Ani and Al-Adhmawi (2011) who said that each department must be directed by the top management of the company. Meanwhile, for the quality department to have quality management system, it will have to pursue the following objectives (i) to improve quality of the work process; (ii) to improve the performance of workers by conducting training for them in the concepts and awareness of Quality Management;(iii) to create and develop QM personnel that are competent enough in handling and managing quality, especially with regard to the requirements of management; and (iv) to facilitate the flow of quality inspection information activities between the quality management department and the top management of the company.

In many organizations, interest and awareness in quality management is often lacking. It is often the case that it is a struggle to implement and sustain the progress of the implementation of quality management. According to Azaran (2008), there is an impression of incompetence and ineffectiveness which usually involves cost, human resources and customers which result in companies losing their competitive edge. One way to address this issue is by detailing the duties and responsibilities of employees. Normally, the general profile of the qualifications, skills and personality will be applied to the potential employee.

It is possible to make this position function well and this can be achieved by identifying the characteristics and skills that are necessary by analysing the duties and areas of responsibility. This process is very important in achieving successful recruitment (Bednarek-Michalska, 2002). To clarify the level of their importance, a number rating can be allocated to the listed descriptions.

2.4.3.1 The impact of the implementation of quality management on the management structures

The general overview of quality management practices and implementation is that it will create additional knowledge which pave the way to organizational performance (Linderman, Schroeder, Zaheer, Liedtke, & Choo, 2004).

Generally, before an organization is set up, it should have a purpose and mission; in other words a strategic plan which acts as a mechanism to generate a set of effective goals and approaches. With the implementation of a quality management in the organization, it will have a set of operations which are clear and in line with organizational goals and strategies which have been put in place. As explained by Fournier-Bonilla, Watson, and Malave (2000), this is because each task found in a highly effective plan requires knowledge, patience, time, and perseverance. There is no doubt that some organizations are willing to devote the time and energy required to produce a plan that works. The management must, therefore, ensure that their organizational structure is based on the purpose and function of the related jobs and each exercise should be carried out systematically in order to avoid any issues that are not relevant and complicate the situation.

Management should clarify the responsibilities of each position in the quality management system that has been created in the company. Foster (2008) mentioned about the identification of factors such as customer focus, supplier relationship, leadership, quality practices, business results, human resources practices, and safety which should be managed properly when quality management is implemented. This is important especially when traceability of all actions can be done during the work process. It should be noted that the lack of understanding of the problem is more pronounced at higher levels of the hierarchy.

Normally, a managing director will have full authority over the company. After the implementation of quality management, the role and position of each sector, as well as employee responsibilities, will become more apparent in the organizational structure of the company.

Today there are still companies that are against the implementation of quality management, but once quality management is adopted by companies, management will normally ensure that the implementation of quality will be among the most important elements in their organization. According to Yeung (2008), quality management implementation facilitates such an effort (Yeung, 2008). However, in some cases, it is implemented due to fear; in actual fact, management does not want any changes in the work culture of their organization.

When the quality management process is implemented, all the positions involved in each working process will be under the responsibility of the management. Some sectors of the labour and employment have been clearly emphasized to ensure that it runs perfectly.

It can be said that most construction companies, even though still operating under the configuration work, have begun to adopt and have benefited from the impact of the quality implementation process. The improvements explained by Raymond and Bergeron (2008) have affected managerial tasks in terms of improved project planning, monitoring, scheduling, and control.

Studies have also shown that companies established several quality subcommittees to ensure that work is always executed accordingly (Peter Baxter & Cotter, 2009). Examples of such subcommittees are quality teams or quality audit committees. They comprise people who have key positions in the organization (Chandar, Chang, & Zheng, 2012) , responsible for managing the development and implementation of quality systems. These subcommittees are sometimes made up of the management board who will observe the implementation of the procedure. They are also responsible for the development of specific procedures for each process in the system.

Usually, in companies that are owner operated, the management style is more likely to be traditional, and will not change even after implementation of the quality management program. However, with the existence of official positions managing the quality department, the roles will become clearer. Each manager needs to have flexibility in their management style so that they can adapt to new challenges and opportunities that often arise.

The need to delegate the responsibility and initiative to support adaptation to change is a very good approach for a particular project management (Fernandez, 2008). In addition, within each committee, every employee has the opportunity to participate in the work standardization process in which they are a part of. For example, employees who perform well in their job and meet all job standards requirements will have the opportunity to achieve something good in every work process and this will enhance their positions.

A major objective to be achieved with the implementation of quality management is improving organisational communication and information systems. (Ma, Zhou, Lyu & King, 2011) and this is necessary in order to keep up with the rapid growth of information generated by online users. The improvement in the management of communication is very important to ensure that every work process is carried out effectively. This exercise usually involves the use of computer equipment which helps to process information easier and faster.

In order to facilitate planning and effective enhancements, all work processes in today's organizations are conducted by using the latest technology. This is a positive step which would result in having greater impact on the management of communication in an organization. This is supported by Prajogo and Sohal (2006), who stated that with improved work performance, it will give a better impact on the management of quality itself.

2.4.3.2 The impacts observed in the production structures

For decades, the structure in the construction industry has been basically composed of an engineer, a general foreman, foremen and the workers, who can be craftsmen or helpers. In this traditional structure, the foreman conducts the work at the site while the engineer is occupied with administrative work, such as materials and equipment management, people management, etc. As a result, workers develop their careers without any formal training.

At the work site, the foreman and workers determine the way the job should be done and are also responsible for controlling its execution and its quality. In fact, the building firms and engineers do not have real control over a great part of the technological aspects involved in the production processes. This resulted in the inefficiency of the construction process. Quality management may well be applied to improve the effectiveness of a production-maintenance system (Levner, Zuckerman& Meirovich, 1998).

As discussed earlier in this research, companies are aware that their production processes are inefficient and to address this issue, they have adopted quality management as a strategy to change this situation. The most important impact of the quality program in the production systems is that the companies reassume control of its technological aspects. With a focus on increasing revenue, and productivity of workers, Davenport (2011) mentioned that companies will provide them with free access to knowledge through information technology and provide them with the tools. This is a direct result of the formalization of procedures that determine the production steps and its controls for the most important production processes developed on the construction site. Companies tried to find the best engineering solution for each of the processes that is standardized. Once this is achieved, the exact same production techniques should be adopted throughout the project implementation.

Most companies that are still using traditional working procedures face difficulties in implementing quality management. This is partly due to the heads of department who have problems adjusting to the quality system. Prior to this implementation, they are responsible for managing any work done in the usual way. But after the implementation, they are responsible for controlling the work done and ensure the quality of work produced. Quality control as mentioned by Ahire and Dreyfus (2000), has the benefit of base and record to facilitate the movement and management of work processes, in which the organization is able to learn about quality management and to implement both design and process efforts more rigorously and the synergy helps firms to attain better quality outcomes. Thus, with this implementation, some low-skilled workers who use modern technology will either work harder or forced to leave their positions.

In all companies that carry out these processes, there are often concerns about who will bear the responsibility. As an example, warehouse or store keepers before the implementation checked the price and quantity upon receipt of these materials. With the implementation of quality management, companies had to invest in training programs to ensure that all employees understand the original purpose of this implementation. It also provides training to ensure that their own workers and also the workers of subcontractors are essential for the success of standardization and control services. Many procedures are not known or understood at every point of the quality process (Clegg, Rees, & Titchen, 2010), therefore quality awareness training has an important role in raising awareness and ensure it is applied properly.

Manufacturing companies will continue to face many challenges when they implement job quality management in the manufacturing process. The aims of manufacturing are to produce high quality products at the necessary production rates, while at the same time minimizing the use of resources. Quality production aims to go beyond the traditional approach. This new paradigm has its own purpose as in the emerging manufacturing sector by running the quality management in a more strategic manner. In order to achieve the overall quality of the production, a method of quality, logistics and maintenance of production design, management and control as well as enablers of innovative and integrated advanced technologies that were stated by Colledani et al. (2014)will play an important role in ensuring its success.

Even after providing training to workers, there are still other problems that will arise. One of them is related to the on-going changes in workers at a construction site, where companies have difficulty to control employees who have been trained adequately for the job but them still not able to do the required job. Repeated training of staff is also not recommended as it adds cost to companies. Instead ,Smith, Oczkowski, Noble, and Macklin (2003) suggested that the integration of business strategy training which they found to be the most important factor in ensuring the overall success of training provided.

The organizational structure always depends on how the work process and the work description are determined. The availability of skilled labour is a significant aspect in determining the competitiveness and performance of the company. Job description classifications cover all employed persons. Normally, each job is given to one professional at the lowest rank of the classification. The professions are classified based upon education, skills, work performed, training and credentials required for the job. For example, professional supervisors and technical workers usually have a background similar to the workforce that they supervise, therefore their classification will be the same as that of the workers they supervise.

2.4.4 Inspections, Verification, Monitoring Activities and Statistically Process Control (SPC)

2.4.4.1 Inspections

Inspection in the construction industry involves conducting inspection activities during the production process. The purpose is to manage and control the quality of the products by helping to correct the sources of defects after a defective item is detected. According to Gomes, Beck, and Haukaas(2013), inspection can help to manage risks by allocating the best possible resources in inspection and maintenance activities. It is also applied to improve productivity, to reduce the defective rate, and to reduce re-work and waste.

Normally, the inspector or examiner does not have sufficient planning support to prevent any inefficient inspection or overlook undetected defects (Gordon, Akinci& Garrett, 2007). Maintenance strategy based on inspection activities is now considered to be an effective tool. Most of these methods rely on quantitative data from the inspection, rather than the qualitative and subjective data. The development scheme is based on examination results by combining the analysis of the impact of cost and quality to assess the condition of the infrastructure element / network throughout the process. Referring to Sheils, O'Connor, Breysse, Schoefs, and Yotte (2010), each stage of the examination or inspection is being conducted for different purposes with different parameters, used to represent each procedure in the maintenance management model.

As described by Shiau (2002) and statements supported by Al-Ani and Al-Adhmawi (2011), the elements of quality control inspection are shown in the following four elements of classification below, with the number of checkpoints that are limited in each inspection process often considered to be able to solve all the problems faced by each production activity:

1. New Design Control - the design prototypes are controlled, checked, approved and tested and it is being planned primarily according to cost. To eliminate any possibilities of threats to product reliability, the quality standards are specified, the product and process designs are re-evaluated which may be done before the beginning of formal production to improve productivity.
2. Incoming-Material Control - The procedures for actual acceptance and recognition of materials, components and parts that are purchased from other companies or, perhaps, from other operating units of the same company. Rarely, incoming material control applies to parts that are produced in one area of a factory to be used in another area of the same factory.
3. Product Control - This element involves the control of products at the starting place of production. This control tries to find the deliverability of a reliable product that will perform acceptably during its expected life and under the conditions of use. The quality characteristics during the manufacturing operation not only

involve the materials, but also contribute to the control of work processes.

4. Special Product Studies - To detect the causes of defects in the products, QC is well concerned with tests and investigations. Controlling and eliminating these causes will produce a good result in product and process improvement, not only recovering the quality description, but also reducing the cost of fabrication.

According to Wang (2009), the production process may be subject to two types of process changes. The first is to detect defect in product quality caused by small process that can be identified and corrected by regular inspection and repair, and the second is the main defects caused by mechanical or electrical problems that may be considered primary only when the defect had led to the breakdown of the process or defect revealed by examination followed by appropriate remedial action at the time of inspection.

The daily progress inspections during performance of the construction work will focus on the quality of the construction work and continued compliance with the construction work plans. During the inspection, the conformance of the merchandise based on the documentation is checked according to written instructions. This may also be in the form of review of the quality documentation compiled and supplied by the subcontractor or by the supplier.

The nature of work and its product depend on the type of inspection in the construction and manufacturing industry (Wirth, 2014). The benefits and advantages of inspection activities enable assemblers to take responsibility for the quality of their work, reducing production and '*Shelf Wait Time*', improving Quality Ratios and first-time acceptance throughout all manufacturing areas that use visual in-process inspection and providing an instrument for cross training in different manufacturing areas.

Inspection activities are generally dependent on the use of paper-based forms to document the results of the examination. However, with the recent advances in computer technology, information is gathered by the system which helps inspectors during inspections. Computing system is useful and practical in carrying out inspection activities which are often designed to suit a construction process; in other words, it serves as an aid in inspection activities.

Any specific inspection tasks will be carried out in the context of a knowledge-based and physical examination itself (Sunkpho, Garrett, & McNeil, 2005). Unfortunately, the development of such support systems is difficult and time consuming. Efforts to implement different applications to support different field are, therefore, useless because of the resistance from workers.

Each inspection schedule for the production process will not be complete if the displacement of inspection process is 'in control' but actual situation is 'out-of-control'. If it is assumed to follow the probability of failure, the rates and products will be sold with warranty repairs condition. In every production process, it is monitored through the inspection process which checks the 'out-of-control' situation, in which the restoration or repair will be carried out immediately.

According to Giri and Dohi (2007), the inspection model operates under two different policies which are : (i) no action is taken within a period of production unless the system is found in a state of ' out-of-control ' by the inspection and (ii) preventive repair actions are carried out as soon as the ' in control ' condition is detected by the screening process.

Integrated model of production often depends on the size, quality and maintenance. It considers the possibility of inspection error, takes preventive maintenance and ensure just minimal reduction in repair processes to avoid systematic process that does not work. In the production system, all preventive maintenance activities are not perfect which means that they cannot recover current as well as new errors. This may cause the system to switch production due to circumstances beyond the control of the system.

Numerical analysis is used to simulate the impact of changes in various parameters on the optimal solution by which time, the process is still in a state of control. Moreover, Lin, Chen, and Chen (2011) stated that the impact of the error will affect the total cost of the minimum period of optimum inspection, inspection frequency and quantity of production.

Quality control is usually used to check the quality of products / services. But if the checks are just casual inspection, the results cannot be trusted. This situation arises due to lack of skills in carrying out the work. It must be noted that every inspection control is costly and it takes a relatively long time. On the basis of quality control inspection, Mason and Antony (2000) mentioned that it will cause a reactive situation. In other words, if a product is faulty or was made before the discovery of problems, it will cause the product to be disposed or reworked. Indeed, there can be no implementation of continuous improvement if it involves the use of equipment just to check the process.

For the record, the inspection carried out will not tell the operator why the error occurred and subsequently, no corrective actions can be taken to overcome the error. Thus, in order to address these issues, the implementation of preventive measures should be made at the operational level which will ensure that desired product quality is achieved.

2.4.4.2 Verification

Verification or validation refers to a procedure or test manual used to ensure that a product, system or service meets the necessary requirements and specifications. Basic strategy verification or confirmation and validation errors are usually used in computing model in finding a solution. The two types of solutions used for verification are analytical solutions and numerical solution (Oberkampf &Trucano, 2002). In ISO 9000, QMS states that this is the critical component to execute.

According to Gunter and Peled (2005), verification or confirmation is divided into two parts: (i) a search based on behaviour, and (ii) the drafting and negation of a condition. Both will allow a variable constraining conditions of the specification of the program. The difference in definition for these two terms has also been mentioned in the current literature. Validation is defined as the assurance that the product, system or service meets the requirements of the customer and it frequently involves acceptance by and suitability for the customer.

One of the most important aspects in the process of testing is verification / validation of test results. Any work process that is not properly verified can lead to conflict between efficiency and professional services. It is worth noting that manual verification of data is a time-consuming activity. Verification is often made subjectively, and it requires the presence of experts in order to avoid any weaknesses in management and also work process. To overcome this problem,Guidi et al. (2009) suggested the development and implementation of automated systems for validation, verification and transmission of laboratory results.

Verification, which is often an internal process, is defined as the evaluation of whether a product, system or service meets the terms of a regulation, requirement, specification or compulsory condition.

According to Sargent (2000), there are different approaches to determine the validity of the verification model which are: (i) how to model validation and verification with regard to the development process of discussed model, (ii) various authentication techniques defined, (iii) the truth of the concept model, (iv) model verification, (v) the validity of the operation , and the validity of the data set, (vi) ways to document the results given, (vii) the recommended procedure is presented, (viii) and accreditation are discussed briefly.

Methods for verifying the accuracy and usefulness of business process had been invented before, but they were not able to indicate whether the devices actually operated as designed. Meanwhile, user authentication or validation through interviews and surveys have shown that they ran as expected (East, Kirby, & Liu, 2008). However, the methods were not very effective for external use where it would require a more detailed verification of support in terms of time and also the necessary analysis.

Difficulties related to manufacturing will recur if the product- line approach to development has not been done properly (Padmanabhan & Lutz, 2005), for example the difficulty knowing the status of a new product when it is positioned alongside existing product line. There is no standard procedure to verify the completeness and consistency needs for new products, using the existing verification tools.

2.4.4.3 Monitoring

Monitoring activity involves the possibility of measuring or observing and calculating the results of the work pattern and if necessary, forward early warnings; this must be considered as a key survival tool. According to Skyttner (2002), the main purpose of monitoring is to verify whether the activities of the work process flow and its environment follow an expected pattern so that any unpredicted pattern can be identified at an early stage.

Construction monitoring is an independent verification that is provided by the engineering staff to confirm that a certain aspect of the work process has been completely done according to the work process and the procedure. The Institution of Professional Engineers New Zealand (IPENZ) mentions that in construction monitoring service, most construction projects are unique and also complex. The five levels of project construction monitoring are:

1. Monitoring the outputs from another area regarding the quality assurance program and also the requirements of the specifications and work plans. Frequent observations are done to review the importance of critical materials involved in construction work procedures regarding the components or completed plant. The purpose is to give an opinion to the constructor on the technical explanation of the specifications and work plans.
2. Reviewing the model of each important work procedure, representing the compliance of materials for construction and components with the requirements of the specifications and

work plans. Reviewing a representative model of each completed work prior to enclosure or appropriate completion.

3. Reviewing a random model of important work procedures, the requirements of the specifications and work plans for compliance and reviewing the important completed work prior to enclosure or appropriate completion.
4. Reviewing the regular model of work procedures, the requirements of the specifications and work plans for compliance and reviewing the majority of completed work prior to enclosure or appropriate completion.
5. Maintaining the workforce on site to continuously review and recheck all work procedures, materials for construction and components for compliance with the needs of the specifications and work plans and also reviewing completed work prior to enclosure or appropriate completion.

Four important factors in project construction monitoring are:

1. The size of the project
2. The importance of the project
3. The complexity of the construction work
4. The experience and demonstrated skill in quality management

In order to guarantee the most favourable performance of a construction management system, Al-Najjar and Alsyouf (2000) mentioned that many monitoring methods may be used in the construction management. The focus of monitoring methods can be on one or more of following: tools, product features and roughness, tolerances, makings process formation, temperature and energy consumption.

The process monitoring method is based on the importance of ensuring that all production operations are in good shape. Other researchers found that changes in operating conditions can be detected by monitoring the data distribution process, which reflects the state of the same operation (Kano, Hasebe, Hashimoto& Ohno, 2002).

Many industries are now thinking of how to improve product quality and product yield in a short period of time. This issue is critical because every industrial process is completely different in appearance, with different problems to solve.

There are many ways to solve this issue. One of them is to build a reliable model that can assist in monitoring other aspects of the process. Other examples include using the limited data available to analyse and create associate model by using the basic principles, as well as to optimize the operating conditions, and monitor and control the online system and maintain its performance.

This process is not only for monitoring the construction work but according to Wetzstein, Karastoyanova, Kopp, Leymannand Zwink (2010), it is also to monitor business processes across organizational boundaries to enable the detection process and the process of good valuation metrics.

Other researchers also mention about studies which use statistical process monitoring and control methodology, and their effect on work process which are: (1) the development of new methods which can cope with the quality and qualitative information related to operating conditions on the quality of the products (2) the simultaneous analysis of multiple processing units, and (3) the results of successful application in the steel industry (Kano & Nakagawa, 2008).

Kano and Nakagawa (2008) also suggested using Statistical Process Control (SPC) software for process monitoring. Normally, the problem of using SPC is that it often uses the word "existing" without adaptation or a connection that is appropriate for making the software work within the work context.

There are several SPC monitoring software which can be used as a solution to deal with any problems especially in industrial work. Based on their experience, Baldassarre, Boffoli, Bruno, and Caivano (2009) said that SPC can contribute to the practical work methods by resolving any issues that are similar. In addition, it can be monitored with the correct approach, as well as controlling the process.

SPC is also intended to detect any errors in the work process. Errors and mistakes in the work process primarily involves replacing traditional methods. This approach is based on the reconstruction and contribution-based approach, SPC is also to analyse and stimulate the process and make comparative information.

The complementary nature of this approach is based on its reconstruction. By providing an easy way to analyse errors, including errors of reconstruction and identification, it can solve many theoretical issues in the monitoring process (Joe Qin, 2003). An example is a control chart monitoring process whereby each performance is measured by one or more quality characteristics. However, Kang and Albin (2000) mentioned about several different processes which also have the features or functions with the same profile characteristics.

The process of monitoring work is handled by a monitoring agent. This is an approach that lays out a process that can specify the monitoring tasks carried out by a proactive controlling agent. These monitoring tasks are assumed as composite and refer to some measure of progress. According to others researchers, by creating a monitoring agent, it is intended to improve the quality of work of the operator. It is also to provide more space for the supervisory agent. This will indirectly provide the information in the form of measurement data. To regulate the constraints in the monitoring process, several agents are appointed to help smooth the process. It also can perform tasks cooperatively in which this monitoring approach will be illustrated with test scenarios using the measurement data of the industrial process (Seilonen, Pirttioja, Halme, Koskinen, & Pakonen, 2007).

Dickinson and Villeval (2008) mentioned that there is evidence which shows that high level of intensive work will occur when monitoring is carried out not during the normal inspection schedule. According to Ge, Song, and Gao(2013), the monitoring process that has been put into practice has become a key technology initiative for effective monitoring of industrial processes involving safety, quality, and operational efficiency.

Indeed, the nature of different industries with distinctive characteristics are revealed after the data is analysed. The findings will be described in more detail according to the data characteristic. Each of the main characteristics of the data will be displayed in the same manner in which it is defined and described, presented with a more detailed discussion and comparison of different monitoring methods.

These three activities are very important because they are the tools to measure the actual status during the quality management implementation in any company. The method of inspection and the scope of random sampling should be well defined. The inspection, verification and monitoring are closely related to each other. These activities will be the most effective tool in defining the outcome of the implementation.

2.4.4.4 Statistically Process Control (SPC)

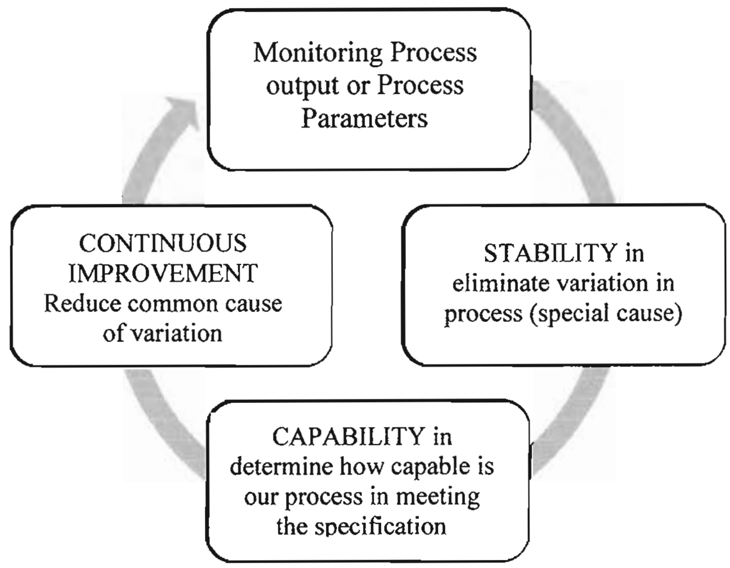
Statistically Process Control (SPC), which is mentioned by many researches, is a method of quality control using statistical methods in the execution of a work-in-process (Mason & Antony, 2000). It aims to help the process of working with the monitor and supervise the quality of a product or the process. Each monitoring and control of a process work to ensure it operates properly and according to prescribed standards. SPC controls chart method, continuous improvement and experiment. It has also become a valuable technology for understanding the process of working to facilitate real-time decision by an organization involved in production.

According to Elg, Olsson, & Dahlgaard (2008) and Poots & Woodcock (2012), the purpose of SPC is to improve the quality of work. SPC provides analytical techniques for understanding any variety of quality measures whose aim is to make an improvement by taking into account of all information received. Indeed, by using graphics such as charts, which form the backbone of the control of SPC, the results of the analysis will be easy to understand.

SPC is also part of monitoring, maintaining, managing, and improving the performance of processes and services. The process is carried out using statistical methods. One of the functions of SPC analysis is to regulate the problems that occur in the process of work-related, such as rework, scrap rates, productivity, customer complaints and cost. It, however, does not work perfectly due to lack of understanding and suitability.

The failure to implement SPC by organisations is due to wrong methodology and miss-interpretation of methods. Misunderstanding of SPC design concept, which involve only displaying workflow with control charts, with the aim to satisfy customers is totally wrong (Antony & Taner, 2003; Mason & Antony, 2000). Sometimes SPC is misinterpreted by the individual's own idea. SPC actually uses control charts to demonstrate the suitability of the process but it does not tell the user what is wrong with the process.

In the implementation of SPC, there are two main causes of change which are "*assignable*" and "*common.*" The cause of variation which does not exist in any process allows the introduction of these variations; this cause is known as assignable or special. This is because a relatively large variation in magnitude usually requires some action in the process / system to eliminate the variation.



Sources : Adapted from Mason and Antony (2000)

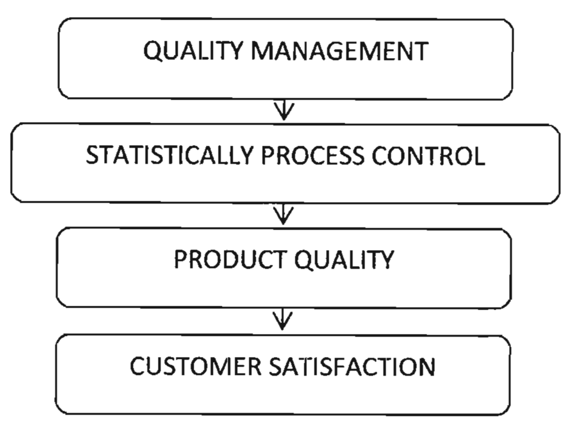
Figure 2.14: SPC Interactivity

Meanwhile, *common* will cause all products / service of process variation to be affected because they are always present in the process. According to Mason and Antony (2000), to distinguish between the reasons for any changes in *assignable* or *common*, the control chart is used and SPC is the most effective method when control charts are used. (See Figure 2.14). Control chart is, indeed, a very important tool to be applied in the "analyse, improve and control" process.

The SPC interactivity includes all four (4) components that will relate which each other to monitor the process, stabilise the variation of the process, determine how the process meet with the specification, and also execute the continuous improvement to avoid and reduce variation cause.

The processes suitable for SPC should be measurable, repetitive, well-defined, and sufficiently critical to justify monitoring (Mahanti & R. Evans, 2012). Mason and Antony (2000) explained about the advantage of implementing SPC in Quality management work process which are: reduces waste, efforts and costs; better process output consistency; greater output because of process improvement; achieving a predictable process; variation reduction; helps distinguish special from common causes of variation; uses a common language on performance of process with all parties; reduces quality cost; reduces need for checking/testing and inspection effort; better understanding in work process; and reduces time spent on quality problems charts.

The implementation of SPC in Quality Management work process will ensure that the product is better in quality and guarantee customer satisfaction. Refer to Figure 2.15.



Sources : Adapted from Mason and Antony (2000)

Figure 2.15: Relationship between QM and SPC in Customer Satisfaction

Figure 2.15 describes the implementation of SPC in ensuring the product meet the quality specifications, before delivery to customers.

This process will provide feedback in customer satisfaction through the product received.

The successful implementation in executing SPC in Quality Management process, especially in construction or any organization, depends on the management skill. All personnel at each level of organization should be aware and understand the benefit of this implementation. The need for training is to fulfil the understanding of SPC itself. The failure in the implementation of SPC usually occurs because of the following reasons: lack of training and education, lack of commitment from management, not understanding the benefit of SPC implementation, failure to interpret control chart which means that no necessary actions taken, confuse as to which should be monitored and measured and finally, necessary system not adequately in place.

One more important factor for the implementation of SPC is focusing on the end user. The view of all users must be kept in mind during the process of development and improvement. For each proposal submitted, it must be listed and analysed in order to improve the strength in solving problems or a variation (Elg et al., 2008).

2.4.5 Record Documentation Management in the Construction Industry

The project documentation approach is to highlight and report the quality activities to top management. Documentation and records used in QA/QC activities will be re-examined and analysed. Data or records will constitute the content of information; its significance is the utilization of the context and the data (Lillrank, 2003). According to Duffner et al.(2001), each development and effective implementation requires a good system , so the implementation of the documentation system should be introduced for the implementation of quality management which enables it to be used properly. Indeed, with the development and implementation of this system, documentation design in quality management can be improved and put to better use.

Management record of process of information has long been introduced in organisations to ensure that all processes are in good working order. However, in the construction industry traditional methods are still being applied. With the emergence of computer technology, all existing work processes have been streamlined and are now used by most organizations in the construction industry. There is thus an increase in awareness among organisations towards the need to record information. Nevertheless, Craig and Sommerville (2007) mentioned that the adjustments and work processes in managing this information is increasingly becoming complicated, at the same time workers have not mastered the skills in how information is collected, stored and recorded

It is important for workers to know how to manage information. Knowledge in managing records and information about the construction process is often based on the work done by an organization. It is also considered as the basis of creating, storing, and retrieving that information.

The information management process depends on the amount of information received and produced. The information received should be recorded to facilitate the analysis process for issuing a work report or analysis report.

Today, there are a few companies that have taken advantage of the situation by changing their performance and work process. Understanding the system of record management should be emphasized by all companies (Craig & Sommerville, 2007; Gregory, 2005).In studies that have been done, it is proposed that information is stored in a centralized database (Duranti, 1999). A centralize database will achieve the following:

1. Encourage all available information to be recorded. This is because it can be stored and re-used as evidence if it is needed.
2. Establish and operate a business in a centralized database.
3. Train talent in discharging their responsibilities in handling information.

Craig and Sommerville (2007) also mentioned about the proposal from studies that have been done before. It is important to remember that from a business point of view, management of record and information is crucial and thus, should be managed properly. The setting up of a quality centralised data system brings with it several advantages such as:

1. Information Processes in information management will grow smoothly and effectively
2. Accelerated solution of the problem
3. Confidence in getting quality information
4. Information received better and steadier
5. Reduction in the administrative burden where all the computing done

6. Provide better performance and more effective analysis

An organization relies heavily on records and information for analysing and reducing any risks. Dang et al. (2014) who looked into medical records management mentioned that it is essential that hospitals manage their information well because easy access to medical records is very important when dealing with patients. Records are the backbone of every organization because without proper record management, various problems will occur.

Records management and data management are also fairly common (McDonald, 2010; McLeod, Childs, & Heaford, 2007), and Egbuji (1999) explained that recording of information will help protect property and legal rights especially when customers file a claim and enquire matters related to the hospital. It is important to ensure the authenticity and reliability of information in determining and identifying which is false and which is true. : With good records management, the level of confidence in making sure all the information is received and managed well is further established in the respective organizations. Duranti (1999) stressed that some organizations have taken the following steps to ensure that all information is safe and secure:

1. Reorganize the records in accordance with a predetermined format.
2. Verify all records
3. Apply special characteristics to ensure that the information is not modified.
4. Restrict access to the information
5. Record travel / out privileges of users who use the information

6. Ensure records are not destroyed, and copied without the written consent.

The difference between records and data information is that the former is defined as information recorded and stored in various media. While others said that the data also means representation of facts, figures and concepts that are easily processed and analysed (McDonald, 2010; McLeod et al., 2007). Battikha (2003) agreed about the relationship between construction quality control and quality assurance. Quality management has been described and publicized as applying to any organizational structure and construction area for the development and management of a quality program and its documentation.

The difficulty of establishing a good report on information management has been the focus of many studies. According to Boisdeffre (2006), the difficulties are due to the following: lack of information being created and received, lost tracking, poorly managed, incorrectly classified, poorly preserved, incomplete and disorganised information. The other concern in preparing a good report is the establishment and organisation of structures and also the crossing point between records management and archiving. In some other cases, the information received is stored and remains in the system without any analysis done. This makes it worthless since the information is not made available to the public.

The following are suggestions on how to have a quality record management system: (i) the background of employees who perform records documentation should be enhanced by means of orientation and training activities;

and (ii) manuals and procedures concerning record management and associated issues must be prepared in order to normalize procedures and prevent mismatched information.

A record preservation program must be implemented and prioritized by all organisations. According to Külcü (2009), an incompatible applications, unnecessary bulk of the records and destruction of important documents will be solved with the implementation of record management.

In information management and analysis process, each organization must have the ability to measure any information to ensure the effective collection of such information. The performance of a piece of information that can only be evaluated or measured with the information that is obtained in accordance with a predetermined benchmark.

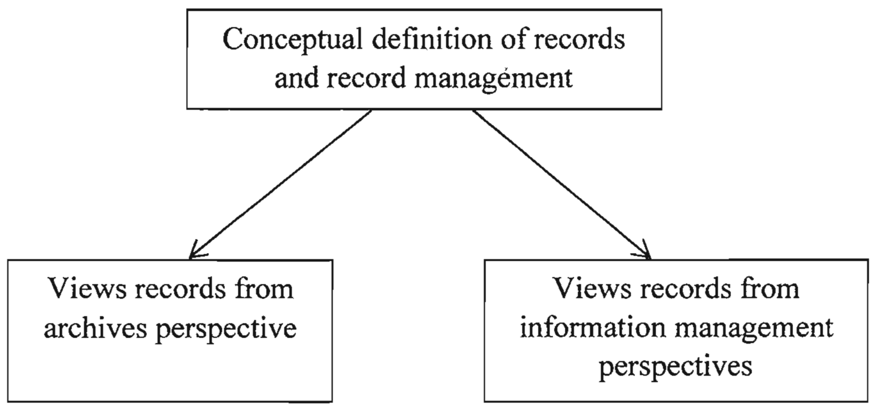
Although it is very complicated to implement a quality system, it is actually based on a straightforward idea. The intention is to produce a figurative representation of certain objects or events; the information must be put into a framework, allocated a pre-defined meaning and sent out to a recipient. According to Lillrank (2003), the expectation in producing a report will define the meaning as intended for the reader. Document what you are going to do and do what you documented (Lillrank, 2003).

Documentation statement refers to the quality standard and allows communication of intent and consistency of all appropriate actions. Gunnlaugsdóttir (2002) explained about the use and contribution of record management which are: the achievement of consistency with customer needs and quality improvement; the provision of appropriate training; repeatability and traceability; the provision of objective confirmation; the evaluation of the effectiveness and continuing appropriateness of the quality management system. These factors should always be considered in order to maintain the effectiveness of the quality management.

Gunnlaugsdóttir (2002) also mentioned that a quality management system requires centralization for proper documentation and record keeping; all records must be identified and recognized with important records kept up to date, reviewed as required and appropriately stored and retained for a pre-determined period. In the areas of information and analysis, Hayati Habibah et al. (2014) mentioned about the obligation of potentiality in the use of measurement and information for purposes such as capacity performance, quality data, and benchmarking.

Record documentation management has confused many people in terms of its definition. According to M.Yusof and W.Chell (1998), there seems to be a basic problem when speaking about records management; it either comes from management or the profession, and also how to define the core component of the subject matter in the field. The line of work has developed and shifted from the traditional function of filing and storage. It is expected to become more complex as technology continues to move forward.

It can be stated that any description of the records is a matter-of-fact and the description will have been altered with the passage of time with more complex issues emerging. Each of these descriptions replicates an existing school of thought, as illustrated in Figure 2.16.



Source: Adapted from M.Yusof and W.Chell (1998).

Figure 2.16: Record Management and its Conceptual Framework

Quality standard refers to the quality records requirement; it means that the function of the quality system does not expand to the quality record. The configuration of the paradigm has changed regularly in the course of its development (Healy, 2010). It has been stated that the text is divided into two documents- a standard document that focuses on the principles and outcomes (the "*what*" and the "*why*") and a Technical Report that gives procedural guidance and assistance, and thereby, gives support to understanding and executing the Standard (the "*how*").

Control of records in quality standard of Quality Management is intended to provide evidence of conformity to requirements and the effective control of the quality management system. The organization shall establish a documented procedure and to define the right information needed for the identification, storage, protection, retrieval, retention and disposition of records. Records shall remain legible, readily identifiable and retrievable.

Quality is one of the important aspects in the completion of construction projects. The fulfilment of the expectations (for example: satisfaction) can be defined as a successful quality project. To achieve a good standard document, the goal is to find a more effective, consistent and uniform system, using the latest information technology.

Specification and implementation of standard documents may take several years which require an in-depth analysis and understanding of document management practices. There is a standard document that does not involve only the documents but also workers, their work, partners, and systems of the future as well. In the modelling process, the document is considered as a resource produced and used in business processes or between international organizations. According to Salminen, Lyytikäinen, and Tiitinen (2000), these types of document are typically generated and used in business processes.

The factors associated with the management of electronic documents and records are: integration of processes and daily work documents; risk analysis; engineering and control needed to manage the records and control data. According to the research done by Bustelo-Ruesta(2011), anyone carrying out works related to the document should be given a significant role in regulating all of the information received and sorted by priority and the right level in order to avoid any complex issue.

In conclusion, to motivate and instil confidence among staff whose role is vital in meeting the quality requirements of companies, companies' control of records have now been given its due attention in all construction projects. The functions of the record have also been transformed from documenting all activities to providing information and evidence for decision making by management. If the recommendation of documentation management were put into coordination, practice and standardization, the inconvenience would be avoided, and any records development would be would be smoother and more effective.

2.4.6 Centralization of data information

The definition of information, as defined in any dictionary, is a fact or detail that has been provided or learned about someone or something. It is also defined as data indicating that something is appropriate and timely, and recommended especially for something or other purposes. The information is also presented in several contexts that give the same meaning or vice versa which would then lead to an increase in the understanding of uncertain decision. There have been several studies conducted, one of which was by McKinner Jr and Yoos II (2010) which is about "information". However, it only describes in general and it only involves related cases.

To determine the dimension of any quality information, it is necessary that the lack of quality information related to any forecasts and customer orders as well as on the various stages of production planning and control, several aspects need to be explained clearly. According to Gustavsson and Wänström (2009), there are two steps in determining information. The first step is to identify any information that is in an easily accessible location with clear adequate information. Second, by providing an overview of the various stages in certain production planning and control.

Many studies have been conducted to identify the lack of quality information in the design and manufacture of quality control processes by relying on certain input information. For example, to perform a quality assessment information model that can explain the truth about the lack of quality information related to production planning and control. Management of this information also affects the related studies in which they can affect the behaviour and results of each analysis.

Information can also be defined as some selected data for a particular purpose. Similarly, according to Zeng et al. (2007), the information on construction projects is often used to communicate to all concerned through various forms in order to meet the objective of quality management and for improvement purposes. Each quality management shall ensure communication, acquisition, generation, preparation, organization and dissemination, evaluation and management of information resources are properly maintained. Each flow of information usually has a number of messages and information processing activities. Uncertainties in any communication of information lead to the hassle to interpret all the information contained in the information flow.

Among all the definitions of information, Detlor (2010) explained about information as related to the management of the control of the information that is created, organized, collected, distributed, stored, and used as a way to promote something; it also to provide efficient and fast access to information which can be used by all people and organizations.

Quality management can be implemented more easily through the adaptation of information technology for the integration of professional resources, according to Liang, Lii, and Liang (2011). It is also necessary to improve the standard of every discipline related to the field of engineering, surveying, design, planning, construction, and inspection.

As human being we are always thinking of ways to better our lives. And for thousands of years we have been organising and using information to solve human problems.

Spink and Cole (2006) also noted that the management of information back then could be seen as a limited attempt to understand the evolution of human behaviour itself which causes them to conduct research about their own life; they recorded all the details of everyday life to get something logical to assist them in providing a more perspective approach to solve any problems. In addition, the lack of a clear understanding of the role of information management can cause a breakdown in the information itself; the nature of this information is often provided with the information and the use of relevant theories and requirements.

According to Tribelsky and Sacks (2010), the consumption theory starts from the notion of psychological understanding of human evolution itself, which allows to adjust to the environment and their survival. In the event of disruptions to any information that would lead to wastage in a significant flow of information.

Although the concept is an entity in the form of qualitative information, it really would have imagined the events that may occur in the history of the concept itself. It also provides a consistent emphasis on quantitative aspects.

In general, information usually comes from a particular concept of the term; it affects a broad concept of social applications. Referring to Yoshimi (2006), after World War II, with the systematic development of information theory and computer transmission within the community, a group that uses the concept of military associations and social applications of information is lost gradually. But with the popularity of the theory of the information society in Japan and the United States show that the needs to review back the concept of social applications.

Today, with the development and adoption of various global and local media, the phenomenon of social information concept is spreading information far and wide. As such the concept of information needs to be closely scrutinized since it is an area that is quite complex, where different definitions enlighten others and will lead to the creation of new practices and alternative concepts.

Now there is a number of very large digital information which can be found everywhere, for example the Internet, digital libraries, and other forms of information systems which are growing quickly. With this system, all information can be easily collected and found in a single location. At the same time, it is also difficult because some information is restricted, regulated and controlled by individual organization. The management can also be more complex and dynamic.

As a result, information retrieval and presentation of results have become more difficult. In addition, discrimination analysis explained by other researchers revealed the presence of the difference between the organization and the level of sharing of information and quality of information lead to failure in a sharing of information and the quality of the information itself (Zhang, 2008; Li & Lin, 2006). If this is not checked, the failure will continue to occur regardless of the interest shown in trying to solve the problem.

Information behaviour and information practices are two key concepts that describe in general how everyone can deal with information that has been analysed. Generally, it comes under a general term known as the "umbrella concept" or "umbrella discourse".

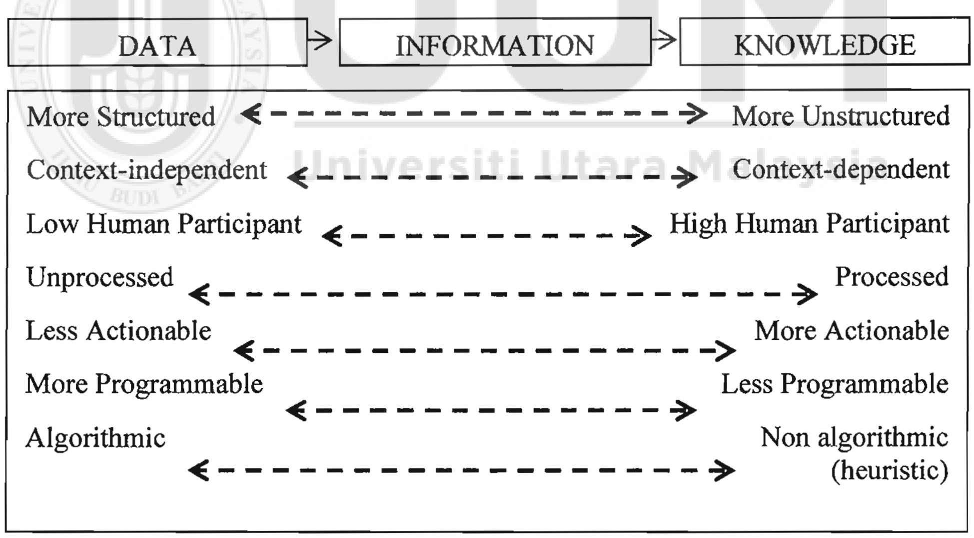
Behaviour information is in accordance with umbrella concept, while the information practices serves as critical alternative information. Behaviour information is attractive to cognitive view and information practices mainly focuses on the ideas of social construction. Savolainen (2007) mentioned that these two type of information often become an important resource for any researcher to construct any information in their study

As a step in regulating all the information available, it has led to the establishment of an information centre where all information obtained will be stored and processed in the same place to facilitate and regulate the management of such information.

To realize the sharing of information resources and enhance the value of the information, Wang and Luo (2008) explained that there are various initiatives in the construction of information resource management centre that is required to regulate the information obtained. Through this partnership, the information will be communicated clearly and effectively.

Based on previous studies, a resource information management, data exchange centre, data centre disaster recovery backup centre and information service platform have been established as the core of the study. In addition, it proposed construction technology systems, including three different stages and two types of collateral in order to complement the quality management system.

Data, information and knowledge have different attributes that can be summarised and illustrated in Figure 2.17.



Source: Adapted from An and Ahmad (2010)

Figure 2.17: Data, Information and Knowledge Attributes

Although the terms data, information and knowledge are similar in meaning, they should not be used interchangeably. However, in the field literature and science, the concepts of information has been used incorrectly (An & Ahmad, 2010). Understanding in terms of data, information and knowledge is very important to ensure that it is not misinterpreted and it is used in accordance with the situation.

Data intent often refers to the original facts without any changes or process or analysis, so that it has meaning and benefits the decision-makers. Data is interpreted directly in which the decision will be based on the facts known to be true or in existence. Normally poor data structure will affect all related data, for example data value quality and data service quality (Ryu, Park, & Park, 2006). According to Laurie et al. (2010), the need for a more precise observations on the quality of data is very important because it is one of the main requirements of a number of strategies for quality control and quality assurance (QC/QA). There is no doubt that the maintenance of data quality is often overlooked, where poor quality of business data is a major cost factor for most companies. In fact, a perfect data quality is not the ultimate goal, but rather the quality of data that needs to be fixed in accordance with certain levels. Haug, Zachariassen, and Van Liempd (2011) agreed that by implementing the optimal data and classification of the costs incurred by low-quality data it allows for effective maintenance. Indeed, the structure and requirements of the observation is to be followed to ensure that data and information do not deviate from the accuracy of the information sought.

Information refers to data that has been processed and moulded into something that is more meaningful to the user. Information usually consists of facts provided by structure. To optimize access to the increasing amount of information, Pinto (2006) mentioned about a classical solution that has been established as a representative of any input data. By exposing any factors involved, it requires each of these issues more directly in the planning and design of information products.

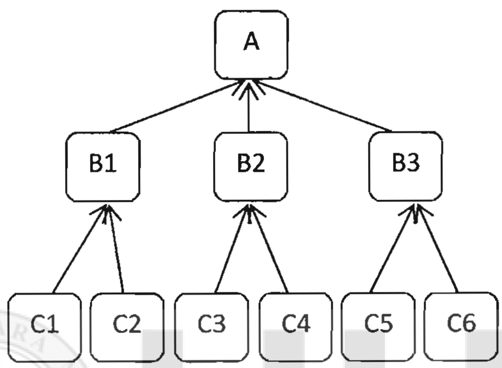
Success in the use of information technology is largely based on the savvy relationship between quality, satisfaction, and usability. Currently, not many studies have been carried out to investigate the relationship between information and quality system Some studies suggest that any information from the overall quality of the system is stored in data warehouses, implementation of theory for development and application of information technology is very effective practice in the implementation quality management (Nelson, Todd, & Wixom, 2005).

Due to the various challenges faced by today's construction industry, construction companies must find new solutions to stay ahead of the competition. Much emphasis is placed on identifying, capturing and sharing knowledge within organizations today. According to Dave and Koskela (2009), valuable knowledge was gathered during on-going construction, because of the nature of the construction industry and also the many challenges that exist in the work environment in finishing the work project.

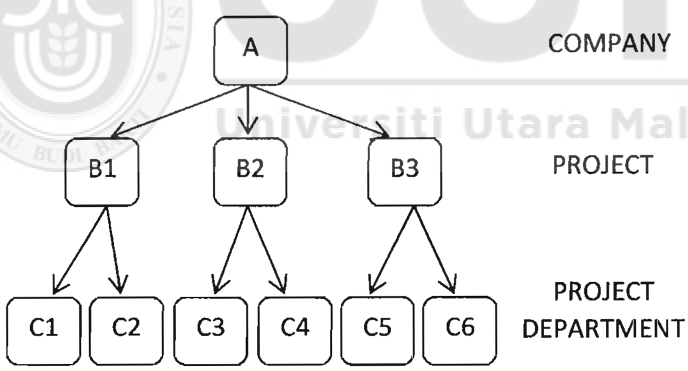
As well as knowledge, information incorporates values, beliefs, perspectives, and reasoning. Knowledge is something that is most useful for each item that is usually used to solve problems and it also has a deeper meaning than that of data and information results. Thus, by combining the three terms, it will show methods and procedures used to solve similar problems in the future.

According to Zeng et al. (2007), generally there are two main types of information flow is in the construction industry and they are always difficult to share. They are: (1) transfer of information from the project to the company; and (2) the exchange of information between the projects. Refer Figure 2.1

a) Information Transfer



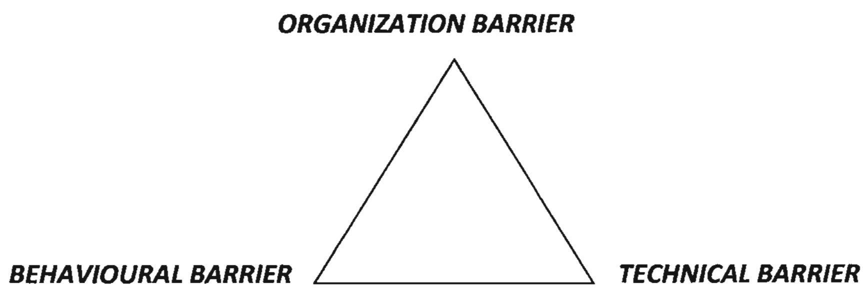
b) Information Exchange of feedback



Source: (Zeng et al., 2007)

Figure 2.18: Information Flow in Quality Management

As someone who has experience in work construction process, it is easy to transfer all information from top management to the ground. However, it is very difficult to get the feedback from low level to top management. Zeng et al. (2007) also mentioned that this situation exists because of barriers created by the management itself. The barriers that exist in Quality Management information flow is shown in Figure 2.19.



Source: Adapted from Zeng et al.(2007)

Figure 2.19: Information Flow Barrier in Quality Management

There are three barriers that affect the flow of information process in organisations: (1) Organizations that have multilevel structure for information to go through and the communication flow is horizontal, (2) Behavioural barriers that turn into liability and mechanism that does not support incentive, and (3) technical barriers including lack of information collaboration and application in different projects.

2.4.7 Project Risk and Quality Management in Construction Industry

Risk management, which started centuries ago, is still being practised by organizations today. Risk management is essential to business, industry and any institutions as it helps them to manage their business. The most significant risk is for companies is the one that involves money (Ahmad, 2012; Ammar, Kayis, & Amornsawadwatana, 2007). Project Risk and Quality Management are interdependent on one another, as quality management focuses on aspects of the work process which should be effective and efficient. In this context, it is an advantage due to the ability to implement effective quality control. It also helps the reduction in costs and waste in the production process. Ultimately, this implementation will also result in companies yielding a good profit.

The processes of identifying, prioritizing a work process, eliminating any possibility of failure in a work process in order to achieve an objective, are known as risk management. By implementing this risk management, it means that a company is more pro-active, prefers to predict and prevent unwanted future events. It is also looking at the probability of thinking either in positive or negative shift of mind. When viewed from the angle of quality, it seeks to ensure that the process is working well, even though there are various risks that companies may face. With the implementation of the risk management, it would ensure that the risk gap would be much less exposed.

According to Kululanga and Kuotcha (2010), the objective of measuring the risk management processes in a construction project aims to identify and understand that performance is linked to the uncertainty that continues to undermine the objectives of the construction project. In addition, it suggests a more effective way to stimulate capacity building organizations in the construction industry and to encourage the measurement of business processes.

Risk management is normally a concern for all companies, and its function is to evaluate threats that may arise during the work process. Although risk management principles are common to all types of companies, the perception of risk is something that a company itself measures. The general view of risk management principles are: focus on the uncertainty of the future, a manifestation possible, discuss the risks and effects , and how to handle risks and reduce or eliminate any risk that may occur (Briner, Kessler, Pfeiffer, Wehner, & Manser, 2010; Smit & Watkins, 2012). One of the skills that is required in every entrepreneur is the ability to identify and analyse the risks before embarking on a business venture.

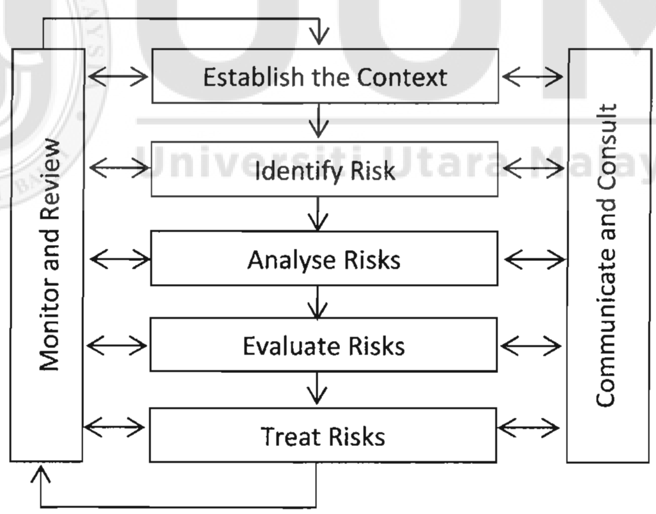
The construction industry has always faced a lot of risks which it cannot deal with effectively. This leads to poor work performance in the face of high costs and construction projects which are becoming longer and more complex.

Risk should be applied in the identification of acquisition methods and to rethink how these risks are treated in the project and in their organization (Adnan, Rahmat, Fatanah, & Mazali, 1985). Risk functions by interacting in uncertainties and it can make the company loss or gain profit. Compared to other industries, construction works operate at a higher risk because of the complexity and uncertainty which always exists in the construction process. According to Ammar et al. (2007), such unforeseen events occur in any kind of projects and it can have adverse effects on the project, either positive or negative; the latter due to deviation from the original plan. Indeed, these risks should be managed in order to avoid losses from unexpected events.

Risk is usually defined as the probability of the occurrence of the loss or the loss itself (Chua, Mosley, Wright, & Zaman, 2000). The risk management process is done by defining any information that will identify the objectives, goals and determine criteria of impact. The identification, analysis and assessment of threats and vulnerabilities are among the ways to handle problems faced by organizations.

Baccarini, Salm, and Love (2004) suggested that by identifying the threats and risk, this will eliminate the threats that may affect the original objectives. This is followed by conducting a risk analysis, estimation and evaluation of the problem. All these are done to determine the appropriate techniques for handling and treatment of these risks.

A Risk Management plan is presented in Figure 2.20. It can be used for any risk management plan. Each organisation will manage its own Risk Management Plan according to their scope of work process.



Source: Adapted from Barateiro, Antunes, Freitas, and Borbinha, (2010); Cleveland and Soleri (2005)

Figure 2.20: Risk Management plan

The key to success in any field is dependent on a company having an efficient risk management strategy. Ahmad (2012) explained that in each risk management strategy, it is often associated with the use of the original design of the derivative itself. Any hazards should be managed efficiently because it can lead to increased levels of costs, decline in profit rates, decline in the rate of return, and sometimes lead to losses. Threats like these can be dangerous to the parties involved and they must make precautionary measures.

The risk can also be seen as a numerical variable which is the easiest format to use, in which the probability and consequences are usually valued or divided by group or class. The risk that occurs is invented and used to compare the different effects and risks (Zalk et al., 2010). Sometimes assessing the probability of this can be difficult to analyse; one example is assessing the frequency of exposure to danger, with the probability of occurring expressed by the condition given. Risk level is presented in Figure 2.21:

		PROBABILITY			
		Extremely Unlikely	Less Likely	Likely	Probable
SEVERITY	Very High (serious injury or illness)	Risk Level 3	Risk Level 3	Risk Level 4	Risk Level 4
	High (lost work time)	Risk Level 2	Risk Level 2	Risk Level 3	Risk Level 4
	Medium (recordable)	Risk Level 1	Risk Level 1	Risk Level 2	Risk Level 3
	Low (up to first aid)	Risk Level 1	Risk Level 1	Risk Level 1	Risk Level 2

Source: (Zalk et al., 2010)

Figure 2.21: Risk level Matrix Mapping

In order to determine the scope and establish the context and goals, the need to make observation is important. Barateiro et al. (2010) mentioned that it is impossible to determine all the purposes that apply to the implementation of maintenance; it depends on the type, size and amount of data. It also depends on the goals of each organization and also on the use of all the acquired data.

To identify any risk that may occur, every organization needs to conduct a brainstorming session because it is the most appropriate techniques that is used in identifying the risk besides, being flexible. By listing all the risks that are likely to occur and record all the information, each risk information should be distributed to the relevant parties responsible for providing appropriate solutions (Chihuri & Pretorius, 2010). Each evaluation involves comparing the estimated risks against criteria and level of risks. The weakness in identification of the risk is the main criterion for measuring the damage and problems related to the work project. Thus, each recorded list of risks is to be managed actively as stated in the risk register.

Normally, Risk Assessment consists of the following stages: (1) Context Establishment, (2) Risk Identification, (3) Risk Analysis, and (4) Risk Evaluation. All these stages are related to the Risk Management Plan (Evangelidis, 2005). Context establishment, which is the first stage is to create a risk assessment in a broad context. It is not limited to the acquisition of knowledge that ultimately will define the impact of various measures of risk. Risk identification will be responsible for identifying any risks that occurred, and how, what or why events occur. Each of them has its own advantages and disadvantages to achieve risk identification, so various methods can be used in this stage. Here are examples for a selection of factors influencing scientific risk assessment prepared by Stirling and Scoones (2009), Refer to Table 2.6:

Table 2.6
List of selection factors influencing the framing of risk assessment

Setting Agendas	Defining Problems	Characterizing Option
Posing Questions	Prioritizing Issues	Formulating Criteria
Deciding Context	Setting Baselines	Drawing Boundaries
Discounting Time	Choosing Methods	Including Disciplines
Handling Uncertainties	Recruiting Expertise	Commissioning Research
Constituting proof	Exploring Sensitivities	Interpreting Results

Risk analysis is a level where budgets of both probability of risks occurring and the magnitude of the effect of risk are accepted. The next stage is giving the evaluation of the risks that is responsible for the expression of their status after the impact occurred.

Management of risk is an important practice in ensuring the success of a project. There are four main strategies which can be applied in response to handling possible risks associated with a project: (i) avoidance- not to engage in activities that pose a risk; (ii) reduction- reducing the probability of risk occurrence and / or impact of such events. Risk reduction is the most common of all risk control strategy; (iii) moving- risk transfer in whole or in part to others; and (iv) detention- received as a result of risks and therefore, it should turn out (Baccarini et al., 2004; Besner & Hobbs, 2012).

2.4.8 Cost of Quality Management in the Construction Industry

According to Harrington (1999) and Omar and Murgan (2014), most organizations believe that the implementation of quality in their work processes will further increase the cost, which then add to their workload. But this attitude is slowly changing after they see the positive effect of the implementation.

Companies that implement quality control are now enjoying high returns and no longer see it as a burden. As a result, the focus now is on producing better quality products and this is achieved by giving more training and exposure to all staff.

Today most organizations have realised that in order to produce high quality products and services, they must implement quality control. The implementation does not involve additional cost to the organizations. The real objective of implementing quality cost system is to identify any areas that can be improved by implementing a quality system in order to achieve cost-saving measures (Chopra & Gargr, 2011).

Acceptance in implementing a quality management strategy is very important for any company; many organizations invest in this endeavour yearly to ensure that the implementation of quality management is running efficiently because it results in cost savings. According to Eldridge, Balubaid, and Barber (2006), the cost of quality is seen as one of the most important concepts to help companies control and reduce manufacturing costs by identifying the source of excessive costs.

It is important to understand that the process of work being done in an organization or company will often involve cost, be it big or small. Barber, Graves, Hall, Sheath, and Tomkins (2000) mentioned that each work process is always closely linked with the cost of use and it is difficult to separate the preventive action and cost evaluation in a construction company. For example, the improvement in the quality of work which will give high returns to the company is the result of companies investing in such undertaking.

Most companies place the quality of customer value as one of the factors behind the success of their organizations. The focus is not just to meet the needs of customers, but it is also to improve the quality of work of the company itself. This implementation should be done carefully and thoughtfully to avoid adding any unnecessary costs. Each exercises should be identified and measured to ensure that the original purpose of its implementation is not lost (Chopra & Gargr, 2011; Schiffauerova & Thomson, 2006).

It turned out that the cost of quality can be used to increase the productivity of a company or work processes of any organization. What is necessary is a brief description of the analytical framework that describes the relationship between the components of quality cost and quality; it includes an assessment of the costs, prevention costs and costs of failure (Omachonu, Suthummanon & Einspruch, 2004; Chopra & Gargr, 2011).

There are four categories of quality costs that may be used: (1) it involves the promotion of quality as work process, (2) it establishes measures to improve work performance, (3) it ensures no excess through quality control and cost planning and (4) it raises the motivation level of a company.

Although there is an increase in the awareness of the importance and benefits of quality improvement and implementation of quality costs, the efforts to improve the quality and reduce the cost of quality do not always go smoothly.

According to Eldridge et al. (2006) and, Schiffauerova and Thomson (2006), there are several problems and difficulties associated with quality implementation. It is not just specific to any sector or size but involves all aspects of organizations. The five issues associated with the implementation are: (1) lack of understanding and awareness of the concept and principles of quality management; (2) the corporate culture that inhibits the implementation of work effectively; (3) the lack of information and data; (4) the confusion between all parts of the organization on the importance of quality implementation; and (5) inefficiencies in handling accounting information systems, which prevents the company from providing quality cost data.

Meanwhile, for companies that have adopted quality implementation, the advantages are: (i) the gathering of quality information and data analysis which are easily accessed and used (ii) an evaluation system that can assist with the implementation process easily and effectively, monitoring and planning of prevention activities and execute the reduction of costs by organizing and helping to ensure improved quality in terms of investment; with the help of the cost of the quality system, companies are also able to develop a method of measuring current performance to ensure customer satisfaction, production and design, leading to better target and in directly, and (iii) this implementation also gives a good return on investment while reducing manufacturing cost(Roden & Dale, 2000; Barber et al., 2000; Chopra & Gargr, 2011; Schiffauerova & Thomson, 2006).

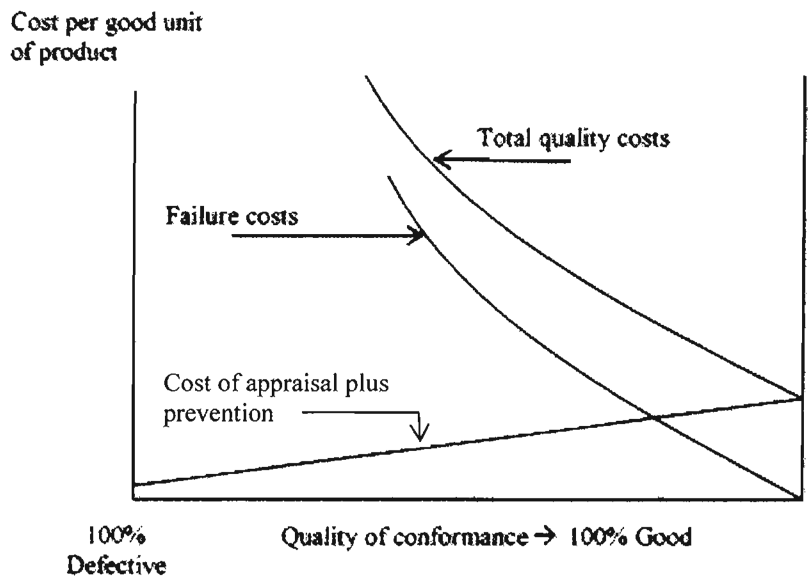
Many organizations, especially those in the industrial sector have stated that by implementing quality, it will directly improve customer satisfaction, reduce production costs and increase productivity

There are many factors that hinder the implementation of quality control in an organization, especially when it is seen from the definition, collection and measurement, as well as uniformity. Definition of quality costs can be so common and not so accurate. Collection and measurement of information can also become an issue because they are done by the not so efficient staff.

According to Freeman (2008), the involvement of the cost information should provide a good system in carrying out the following tasks: collecting accounting data, operating systems, procedures, standards and specifications. Meanwhile, uniformity refers to collecting and analysing cost of quality according to the elements which correspond to the cost of industrial, commercial or service.

Meanwhile, Omachonu et al. (2004) stated that cost quality is relevant with these elements: the size of the assessment, prevention and the cost of failure to achieve the quality of the product that has been designed. This means that compliance with the requirements is important to ensure the implementation of the quality cost. The cost of quality is related to:

1. The ability to comply with the requirements in terms of design and specifications of the market that will provide cost effective assessment.
2. The cost of failure resulting from the work process that is not perfect and in need of improvement in terms of design reuse and others. The cost is passed to the customers.
3. The ability to process and review the design and research that need to be done.



Source: Adapted from Omachonu et al. (2004).

Figure 2.22: Model of optimum quality cost

Fig. 2.22 presents a model that explains in more detail the impact of cost involved and prevention. The increased in costs in terms of assessment and prevention may lead to failure in the implementation of quality costs which then affects quality cost and productivity. This situation will give a bad impression on the company.

There are three line graphs in the model: the cost of failure, total quality cost and cost of appraisal plus prevention. Each line has its own definition. If the cost of failure is at the level of zero then the product is 100% good, and if the cost of failure is at the level of a particular value mean then the product is damaged, according to the level of uncompleted product.

This means that the cost of failure is increased if non-compliance occurs. When 100% of the products are damaged, the cost of appraisal plus prevention will be zero. To ensure compliance with the implementation of improvements in quality, cost assessment and prevention should be approached to the implementation of compliance. The total cost of quality involves the aggregation of failure; appraisal and prevention costs will represent each of the total cost of quality per unit of a good.

In an effort to ensure quality improvements are carried out according to the standards that have been set. The result of the implementation according to Omachonu et al. (2004) consist of three different elements:

(1) Cost assessment will be different, including the cost of failures and the cost of prevention,

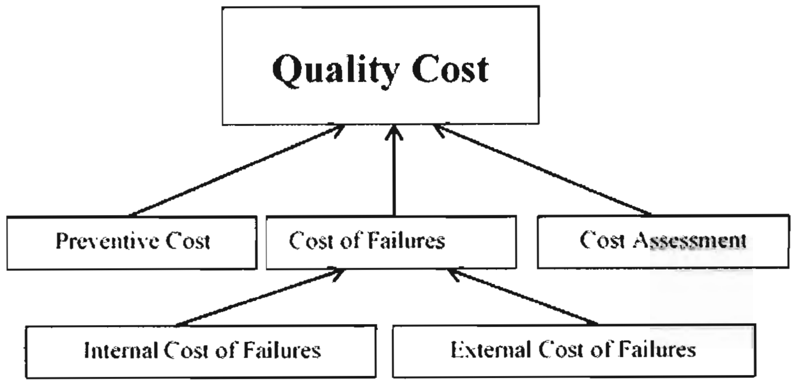
(2) There are costs directly, including the assessment of prevention costs and quality, and also

(3) The inverting relationship between quality and costs of failure.

All three of these decisions will impact differently on the implementation.

In order to achieve a breakthrough in the production of quality products and efficient service, a special line that states the cost of quality can be measured effectively. This is because it will give the difference between the actual cost and the reduced cost of a product or service.

According to Chopra and Gargr (2011), applying will identify weaknesses in service, failure to produce a good product and the occurrence of defects in the manufacture of a product. The various types of quality cost are shown in Figure 2.23 (Chopra & Gargr, 2011; Omar & Murgan, 2014).



Source: Adapted from Chopra and Gargr (2011); Omar and Murgan (2014)

Figure 2.23: Quality Cost Framework

As seen in Figure 2.23, preventive costs is applied to prevent defects in products which are produced not according to specification, bad raw material , and things that can result in damage to the manufacturing of a product. It involves many parties, such as the ability of suppliers to provide quality goods, carry out manufacturing assessment of each work process and assess the ability and skills of workers.

Next, Cost assessment is related to how the measurement process, evaluation and auditing are done. This is to ensure that components or ingredients to produce a product comply with the standards and specifications. Cost assessment is conducted to evaluate each costs including the work process, test, audit, calibration and others.

Meanwhile, the cost of failure is divided into two categories; internal failure costs and external failure costs. The cost of internal failure refers to product or related materials that do not meet the specifications and quality standards. This process, which include repair work, re-examination, and others, occur before the product is released to customers. While the cost of external failures are discovered when the product fails to function according to specification. It happens after the product is marketed to customers. Examples of external failure costs are warranty costs, cost as a result of complaints, cost of customer returns and others.

Quality cost also can be described as: Total quality costs = (Prevention costs) + (Appraisal costs) + (Internal failure costs) + (External failure costs). According to Chopra and Garg (2012), the process of calculating Quality cost is as follows:

1. Constitute "cost of quality" team
2. Defining its scope of work
3. Creating awareness among employees
4. Identify the quality related activities
5. Formulate methodology for assigning money cost to quality-related activities.
6. Assign money cost to all such quality activities
7. Place these activities under different categories (such as prevention costs, appraisal costs, internal failure costs and external failure costs)

The aim of this work flow is to make sure the quality cost is being managed properly and this system is one of the most effective measurement of performance evaluation. The quality cost provides the opportunity to identify any wasted cost, suggest improvement and also to reduce any costs.

2.5 Initial Conceptual Framework

Over the years, the application of quality frameworks has been on the increase and this has helped many companies (including suppliers of software services) to produce better products. (Antony & Taner, 2003; McManus & Wood-Harper, 2007).

The proposed conceptual framework for this study has been developed based on the implementation of quality management in a naval ship construction company. The framework is the guideline for the development of the research (Friedman, 2003).

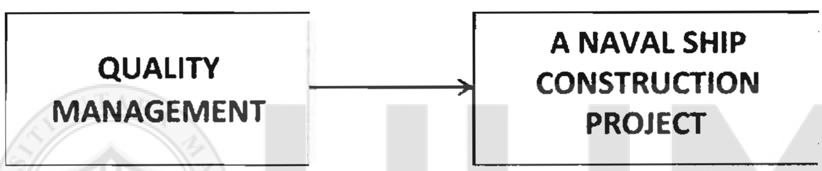


Figure 2.24: The proposed conceptual framework

The purpose of the proposed conceptual framework is to act as a starting point in identifying weaknesses in the execution for implementation of quality management in the ship building and maintenance work process with regard to the project completion.

This conceptual framework has been explained briefly in this chapter. As stated before the relation between quality management and construction of ship is very important and they connected with each other. The important of implementing quality management in construction of ship is always be a part of the successful of ship construction project completion.

Some organizations implement and execute quality management concepts without any problems; they execute and integrate them as standard procedures. Other organizations are unsuccessful , while some have had well-substantiated success, depending on the application of the concept itself (Gremyr & Elg, 2014).

The framework analysis in this research is flexible during the analysis process and allows to collect all the data and then analyse it or do data analysis during the collection process. In the analysis stage the gathered data is sifted, charted and sorted in accordance with key issues and themes. It gives the importance of looking at variables in the natural setting in which they are found. In the process of qualitative research interaction between variables is important.

2.6 Summary

This chapter presents in detail important signification of this research. The terms, definitions and also the discussion by other researchers have helped to better understand all elements of the research study. These eight key terms; (a) quality management, (b) construction, (c) inspection, (d) monitoring, (e) record management, (f) data information and (g) cost of quality are used in this research. The details of the term have been explained in various combinations of this literature review chapter.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This research is to conduct a study on the current implementation of quality management in the ship construction and maintenance industry, specifically upon completion of projects related to naval vessel designs.

This research explains the methodology and research design method as a guideline which includes, design research, information gathering, sample selection and management methods, reliability and validity issues, principal reasoning and data analysis strategies.

Consequently, this research uses the Qualitative Method approach in executing data collection and analysis whereby the research design is comprised of interview sessions with selected employees from the Quality Department and direct observation of work activities by the QC team including inspection work monitoring and inspection documentations.

The qualitative research method is used in order to understand the method of data collection and data analysis using a strict method procedure (Seaman, 2008; Cohanier, 2014). In the design research method, the involvement of the focus group is in the Quality Department with the participants selected according to the job description that they had been appointed. It also includes direct observation of activities carried out by QC teams which includes monitoring and inspection reports.

The interview sessions involved 19 participants from different backgrounds and status in the Quality Department and from various sections and job scopes. The survey design also covered public documents involved in the current QC procedures including Inspection Records, Operations, work Instructions and reports relating to the non-conformities record. Upon collection of data from the above-mentioned information gathering methods, triangulating data information process is utilized to implement further research queries.

3.2 Case study methodology

The research focussed observation on a small sample in which the Quality Department has a manpower strength of 25. In the gathering of data for this case study the qualitative approach was used.

Responding to the "how" question in this research, it will try to broaden a complex phenomenon that cannot be read outside the context in which it took place. The objectives are to find relevant issues for theory and to capture process, time related to the data (Yin, 2014).

Therefore, it allows one to understand why things happened the way they did, and to make changes based on past examples, rather than our own actions. The case study is an in-depth examination of a single case, an individual or an event and the case study is more of an intellectual process, where people examine past examples to learn (Crowe et al., 2011). The selection of this research for the case study method is based on the problems that occur in this company that requires to be analysed and improved.

Some misunderstanding case study approach, in general the theoretical knowledge is more valuable than the concrete and practical knowledge. It cannot generally evaluate on the basis of individual cases and it cannot contribute to scientific development.

The case study is most useful for generating hypotheses, while other methods are more suitable for hypotheses testing and theory development. Normally, a case study contains a bias towards verification, the tendency to confirm preconceived notions, some aspects of the case studies used as a method of design research and case studies which category each of these studies can usually be achieved (Zainal, 2007). It is difficult to formulate and develop recommendations based on the theory of general and specific case studies (Study & Flyvbjerg, 2011; Flyvbjerg, 2006).

There are two types of cases: single-instance and multiple-instance. In this research work, the multiple-case plan has been selected because it is anticipating answering the three research questions. The primary reason is to infer the influence of the variability of context and to acquire more general research results. Within-case analysis: individual cases are studied to apply a deep familiarity with each instance, which accelerates cross-case comparison. Cross case analysis: the results of multiple cases are compared and merged.

The purpose of the use in case study method, this method is often practiced but little to understand. A case study is defined as an intensive study and a single unit for the purpose of announcing to the whole set is greater. These case studies are often dependent on a few things that have conversational same evidence, and it is not used in the case study research (Gerring, 2004). Therefore, the case study method must be properly understood in a particular way, it is also not a way to analyse the case or how the causal relationship model. This perception needs to be explained in greater detail.

That is why any study research can give an advantage to one another where some people who do not have an effective theoretical knowledge in action (especially if they are inexperienced) compared with others who do not have the experience (Bent Flyvbjerg, 2011).

In case study research, the collecting of data sources for documentation (existing measures and evaluations), statistics, interviews, and surveys. Direct involvement or participant-observation (e.g. Work, meetings, activities, and discussion) and the physically manufactured article (testing the resulting product) are likewise included in data sources. For this case study research, the thematic process of gathering up data is using three sources: interview, observation and document inspection. All these will be explained throughout this chapter.

To determine the research questions for the theoretical approach, it will implement a more effective analysis of this case study. It is clear about sampling, validate/test the instruments, identify natural controls, use multiple sources of data for triangulation, search for alternative explanations and report your data collection process, threats to reliability, method bias. The utilization of all information, including field notes, field protocol, and methods to map data to construct, and also to use quotations or other line of business data. A qualitative case study methodology usually provides a tool for researchers studying complex phenomena in the context of their studies. When the approach is used properly, it becomes a valuable method to develop a theory, evaluate and develop intervention programs (Pamela Baxter, Susan Jack, & Jack, 2008).

3.3 Overview of Research Methodology

One of the most common misconceptions about Qualitative Research is that Qualitative Research does not involve the use of numbers and statistics and as such cannot contribute significantly to the research results and findings as a whole. Although it may not seem straightforward, Qualitative Research is a methodology that plays a key role in all research studies, supplementing further understanding of the experiences of the people involved, and determining the root cause of problems and issues that might have arisen (Bogdan, R. C., & Biklen, 2003; Dodge, 2011).

Through this methodology, qualitative information is gathered from interview sessions and relevant documentations (Yu, Chan, Chan, Lam, & Tang, 2010). The development of the qualitative research study was defining as it may indicate very different things to different individuals, as a means of gathering data in conformity with an interpretivism posture, the semi-structured and open-ended interviews with selected participants were conducted individually (Cassell et al., 2006; Qu & Dumay, 2011).

In a particular situation where the researcher conducts the study by qualitative research normally involving collecting, analysing, and interpreting data by observing what people do and say, it also includes the definitions, meanings, concepts, metaphors, characteristics, symbols and description of possessions which may be more subjective than quantitative research (Yang & Lê, 2008; Guercini, 2014).

Qualitative method in this research will be characterized by the objective, which is related to understanding some aspects of the academic tradition in sociology, anthropology, history and geography, and their methods, which generate words, rather than numbers, as data for analysis. The normal objective of using qualitative research can be referred to the quest for "*more insight or a deeper understanding of the phenomenon under investigation*", "*exploration of experiences*", and "*development of meaning*" (Kapoulas, 2012). To fully acquire an in-depth understanding of complex factors the researcher is authorized to use qualitative methods of data collection and analysis (Amedy, 1999).

Yin (2002) mentioned in his book for triangulating multiple sources of evidence. Convergence of evidence (single study) in Figure 3.1 will be used in triangulating the data (Jepsen & Rodwell, 2008). As a result of the research understanding the research requirement and the obstacles access must also reflect in the qualitative researcher, making it visible and be overcome in a continuing process towards a holistic access (Stenbacka, 2001).

A qualitative element is usually included in the research design: it is also to discover relationships between important issues, to discover main key issues and to ensure that appropriate data are collected (Jepsen & Rodwell, 2008).

There are several methods of using interviews as a source for data collection because qualitative interviewing is appropriate when studying human beings and their habits, what is inside their minds, and how they interact or communicate with all the questions put to them. It is quite difficult on a level of experience a researcher, but the most popular method in qualitative research design is the interview protocol (Turner, 2010).

3.4 Research plan

This qualitative case study sought to investigate the work process normally used in quality management. The qualitative research plan includes interview, work observation, and document review. Although qualitative research is characterized as an emerging and flexible design, a basic research plan was necessary to guide this research exploration (Alexander, 2004).

The case studies combining different methods to understand and to explore more of the situation, for example, each individual's experience and involvement in the organization. The interview was conducted using semi-structured questionnaires to open-ended discussions. The observation was conducted directly and transparently including all participant and non-participant monitoring. The qualitative data and the interview transcripts used in the study were re-evaluated and categorized for relevant findings according to the research study requirement (Xia & Gong, 2014); and also reviewed all related documents: procedures, work instructions, quality inspection record and quality monthly reports to understand the situation.

3.5 Population

The research study is focussed on a small group of the population that is directly familiar with the quality work process. The focus of this research study was taken from a sample population in the Quality Department. The research interview involved 19 QC personnel, with the session being conducted according to the interview plan. Normally, the respondents are those involved within the related discipline as specified in the research study (Raich, Mu, & Abfalter, 2014). The participants were chosen based on the availability and agreement of each section to be involved in this case study research. During this period only 19 out of 25 QC staff were available.

3.6 Sampling procedures

The purpose of using theoretical sampling is to know the experience of the phenomenon of interest. An in-depth study of an individual's work experience is regarded as being an important part of the information. This helps to understand participants' perception of their experiences in quality management work process.

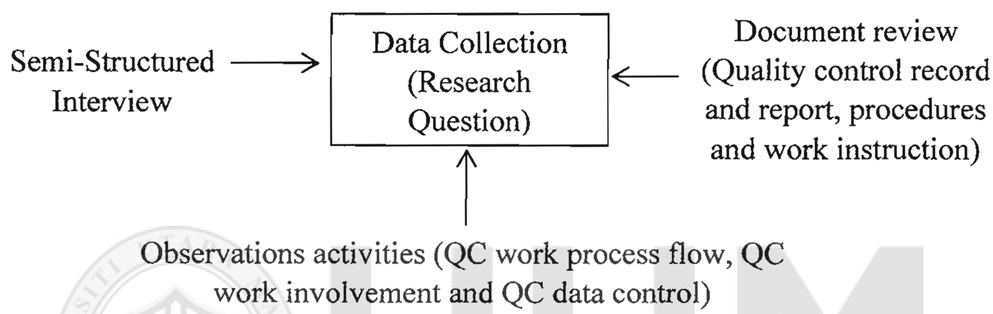
The targeted sample participants, who met the following stated criteria is work in the QC Department. Consistency sampling plan is a statistical tool used in decision making based on information obtained from an existing experiment on whether to accept or reject based on the sample data (Appaia et al., 2014; Srivastava & Sharma, 2015).

3.7 Data Collection Strategies

The triangulation data can be defined as the combination of the similarity of the same phenomenon in the methodologies, a methodological metaphor can also be described as triangulation overview. Triangulation speaks about the methods of convergence and will generally produce valid information with more objective results.

However, it is not fundamentally different on the subjectivism and it was explained in detail in the discussion section on the important subject of more open and stirring approaches (Jonsen & Jehn, 2009). The use of more than one approach in finding information is very effective in increasing confidence of its findings, and it can provide confidence in the prospects of all information received (Bryman, 2004).

With the data triangulated, the evidence will be supported by more than one source; where multiple sources were used but which the data have not really been triangulated, typically each source of evidence is analysed independently and the comparison of the different analysis will be supported in the conclusions (Yin, 2002). There are three components in a research design; interview, observation, and document review to form the data collection strategy in order to answer the research questions.



Source: Compiled by author

Figure 3.1: Research question adaptation for convergence of evidence

The convergence of evidence can be explained as in Figure 3.1, where all inputs of data information given from these three sources; by conducting semi structured interview, observation of work process flow and document review. The observation activities would involve the participation of the whole Quality Department work process.

With the research design of this research study, it is advantageous for the researcher to obtain all the necessary information. Each question should be about the goals of this research study. The data collection strategies are related to each research question in Table 3.1.

Table 3.1:
Research question and data collection strategies

Research Question	Data Collection Strategies		
	Interview	Observation	Document review
RQ1: How effective is the work planning done by the Quality Department in the inspection planning activities during the work process in ship construction projects?	✓	✓	✓
RQ2: How to overcome the problems of work monitoring activities including internal work inspection, work observation and surveillance in the work process of the project completion, especially in ship construction project?	✓	✓	✓
RQ3: How to improve the work information management process in preparing a good quality work report?	✓	✓	✓

3.7.1 Interview approach

The interviews were carried out using semi-structured questions. By choosing semi-structured interviews, the interview process was not very strict, unlike structured interviews. In semi-structured interviews, the objective is to discover a subject matter in free mode situation and to allow interviewees to put across their opinions and ideas in their own words regarding what they have experienced. The researcher needs to pay attention carefully to the participant's replies and to follow their direction while using the semi-structured interviews (Dagbjartsdottir, 2012; Dodge, 2011).

In addition, phrasing of questions can be changed, explanations given and for some interviewees, where applicable, some questions can either be omitted or added to the interview. Robson (2002) has mentioned and supported by Dodge (2011), that the interviews should choose suitable participants as well as the sample size for the interviewing session, this is one of the rules that needs to be conducted carefully. The questions were based upon the understanding of the QC work process and job description that had been developed. Open-ended discussion and questions will be used during the interview session to persuade the participants to act and respond freely and honestly to the entire question (Bogdan & Biklen, 2003; Dagbjartsdottir, 2012; Dodge, 2011).

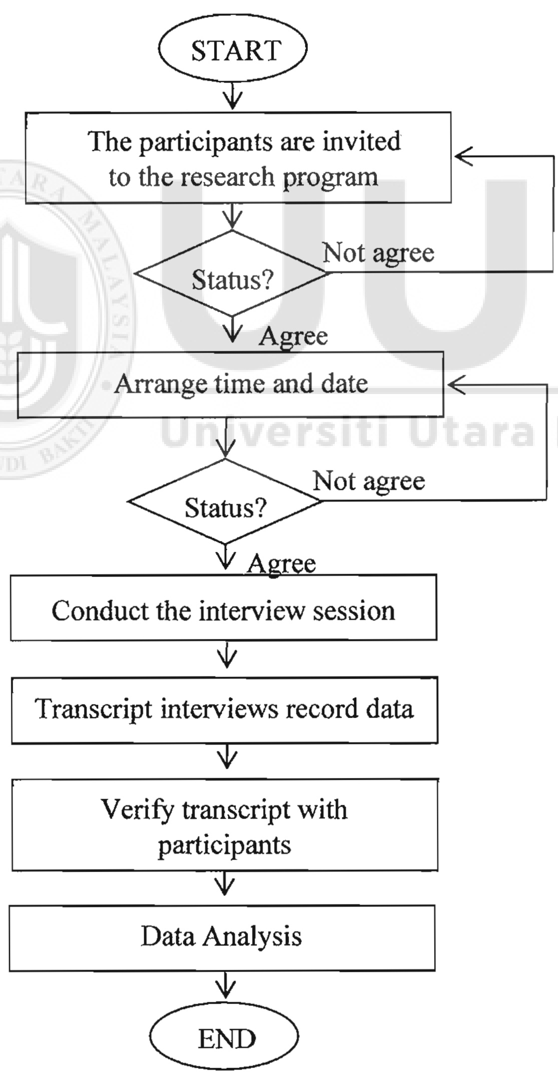
The interviewing process is as follows: the interviewees were first contacted by email to arrange an appointment and the researcher briefly explained to the participants about the purpose of the research, research procedure, and the expected benefits from this research. The interviewee can withdraw from continuing to participate in the interview session at any time and is ensured protection of confidentiality.

As an addition, all participants were informed about the risks involved in the research study (Phua & Rowlinson, 2004). Jepsen and Rodwell (2008) mentioned that a good interview practice is always carried out in private, usually in an office room within the respondent's general work area.

Next, the interview was conducted through direct face to face communication. The process of the interviews were recorded in order to ensure that no information were lost; with the interviews then transcribed on paper and verified by the respondent. The main topics were always kept in mind as guidance for the interviews while allowing any questions that might originate from the main questions.

A sample uniform procedure was conducted in Figure 3.2. All the QC Staff were invited to this research program. When the participants agreed, they were sent an invitation email to do the interview session with the detailed arrangement of time and date.

The semi-structured interviews were conducted during the interview session. The interview sessions were audio-recorded and written out within a day of the completion of the interview sessions.



Source: Compiled by author

Figure 3.2: Process flow for interview session

The information contained in the transcriptions were verified with all the respective participants. All confidential information gathered were only used in this research study. Copies of the written transcription of the interviews were then given to all the interviewees. Interviewees were guaranteed complete secrecy whereby their responses were kept completely confidential (Jepsen & Rodwell, 2008; Phua & Rowlinson, 2004).

All the data were reviewed and coded for emerging themes and categories. In NVIVO, coding is the suitable way of assigning detail of information to a section of data, by using a word or short phrase taken from that section. In addition, NVIVO 8, a software program for qualitative data analysis, was utilized to assist with the organization of content, coding, and theme identification. This entry describes this practice and some applications and problems associated with it.

The coding of the data is the heart of the analysis (Raich et al., 2014). Supported by Rowley (2012), he mentions that the coding information is created to ensure that the result stay as close as possible and also to obtain a key factor on the interview participants' own words or their own terms.

To ensure provable research steps throughout the research study normally the research trail record will be documented (Dodge, 2011). Table 3.2 is a part of this research trail record; for details refer to Appendix A - The research trail record.

Table 3.2:
A part of Research Trail Record

Date	Description of activities	Remark
27/9/2013	- UUM Registration of Doctor of Management	
28/9/2013	- Class of Methodology at UUM Sintok, Kedah	

The semi-structured interviews were divided into five parts; each part of the question is representative as the key that should be asked in the interview session. The objective of the sequence of interviews was to identify the key subject believed to have a significant impact on their work performance and decision making (Jepsen & Rodwell, 2008).

The details of the interview guideline are as follows: Part 1, the introduction, and demographic information are related to the work requirement in any interview process. In a research study of undergraduate students for individual information management behaviours, such a personal profile may explain in detail the year of study, sexual category, age, and level of knowledge and subject. This is necessary to demonstrate that the interviewees have the "authority" or the information to offer for the research topic (Jepsen & Rodwell, 2008).

Indirect questions are used to develop more precise descriptions from general statements especially in related topics of discussion (Qu & Dumay, 2011). The questions that have been considered as being an important key of getting the information regarding the main topic of discussion for this research are stated in part 2, part 3 and part 4 of the interview guidelines.

Part 2: Research Question No.1, the intention is to search any information regarding the work planning, work inspection process, and the problems of work inspection activities especially any critical incidents during the work construction activities.

Example:

1. *How do you plan your work activities?*
2. *What do you think about the work process in this company especially in Quality Inspection activities?*
3. *How often have inspection activities been postponed or cancelled and for what reasons?*
4. *How do you measure the work effectiveness of your daily activities?*
5. *Have you been involved with any critical incident or problem during your work?*
6. *What are your suggestions and expectations to improve work planning for inspection activities?*

Section 3: Research Question No.2, the intention is to search for any information regarding work preventing activities, including corrective action. This part is also to identify any work observation activities during the work construction process. This section is really significant because the respondents were given the understanding of work inspection monitoring in the project structure.

Example:

1. *What do you do to prevent problems from occurring? Or what are the measures you take to avoid problems from happening?*

2. *Are you familiar with corrective and preventive maintenance? or what do you know about corrective and preventive maintenance? or how much do you know about corrective and preventive maintenance.?*

3. *How often do you do observations and survey in a day's work?*

4. *Are you willing to do your observation or survey without any instruction from your superior? If not, why?*

5. *What is your opinion about work inspection monitoring in the ship construction project procedure?*

Section 4: Research Question No.3 is a set of questionnaires designed to gather details on the tasks of managing, assembling and compiling all related information with regards to Work Inspection Activities, and setting up of Quality Control (QC) Report

Example:

1. *How do you manage your inspection records and activities?*

2. *How do you record your work activities?*

3. *What problems do you encounter when preparing reports?*

4. *Do you report your work status to your superior and how do you do it?*

5. *How often do you discuss your work activities with your superior?*

6. *When a problem arises, how do you handle the situation and how do you prepare the supporting documents?*

7. *What is your suggestion to improve the work process in managing the inspection information record?*

8. *In your opinion, who should be responsible in managing information and preparing reports?*

Section 5: Closing the interview session and expressing appreciation to the participants. In order to establish effective research findings, it is imperative that accurate information were gathered during the interview sessions and that questionnaires were answered honestly by participants. Additional questions to instigate open suggestions by participants to improve or change certain aspects of the current situation or procedures will also provide vital information to formulate recommendations for improvement upon conclusion of the research study.

For the purpose of this research, interview sessions were ended with a kind reminder to the participants with the following statement: "*If you happen to come across further ideas on the issues we just discussed, you are welcome to call me" or "Is there anything else that you would like to offer that I did not specifically asked for?*"

All resolutions of the interviews were recorded and composed during the interview sessions. View details of interview questions in Appendix B. Meanwhile, see Appendix C in the template form for composing all the recording of the recording interview.

3.7.2 Observation and monitoring of QC daily work inspection activities

For information, observation and monitoring activities are commonly used in the construction process (Derek H.T. Walker & Keniger, 2002). The observation of daily inspection activities is to understand more about the work process that was performed by QC personnel. The participative work observation activities had been implemented during the research.

The observation and monitoring involved multiple perspectives, these are:

a. The work process flow of individual and inspection team.

b. The work communication flow.

c. The problems were solved by inspection activities.

d. Record management in meeting all the information regarding the inspection activities.

The work observation process flow activities are as follow:

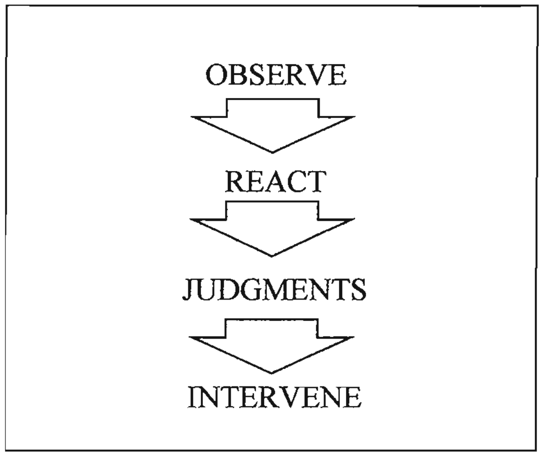
a. Request on work join with the QC Team.

b. Then, reschedule all work activities according to the availability of the QC Inspectors.

c. Record all result finding during the observation.

One of the useful framework from action research that had been mentioned by Coghlan and Brannick (2014) can also be used in this case study research, which is called the ORJI (Observation, Reaction, Judgment, and Intervention) model. This model will be carried out in the reflection activities of this case study. In addition, ORJI focuses on what is in our heads and its effects on hidden behaviour.

Figure 3.3 mentioned the flow of this model. According to Coghlan and Brannick (2014), the observation activity is important. This observation activity is a method that can provide a definition based on research in cultural anthropology , and also common in other qualitative research - the discipline of sociology and education (DeWalt & DeWalt, 2010).



Source: Adapted from Coghlan and Brannick (2014)

Figure 3.3: ORJI Model (Action Research framework)

Through this model, observe means to observe whatever you find during any work activity, React means to participate to any work process especially in daily work activities. Judgement means to do analysis based on the result of the observation. And the last one is intervene, which means to try to give an idea or suggestion in order to make something happen.

Taking all notes and information during the observation activity will provide a true understanding of the process itself, the outcome of the observation is recorded in the same method as the interview process, with the details of the observation listed as follows:

Table 3.3:
List of observation for QC Inspection Activities

No	Description
1	Date of Inspection
2	Name of the Project
3	Section of Quality Department
4	Subject / Item / Detail Inspection

5	Type of Inspection
6	Meeting Point / Location
7	Time of Inspection
8	Representative (Production / QC / Client / Classification Body)
9	QC Person In charge
10	Duration of Inspection
11	Inspection Status
11	Other Remarks

Inspection workflow was reviewed during the notice and monitoring activities with cross reference to the routine and work instruction that's being used. Each operation in a workflow was summarized, studied and explained in the subsequent chapter.

The reflection and monitoring were done in 6 months, from January until June 2014. The activities were entered into one record database and summarized in the following chapter. A tilt of the observation is referred to the actual activity that's been put down in the quality inspection form. The researcher normally followed and participated in all work activities with the QC team. The observation and monitoring activities were not informed by the QC team in order to get pure and actual work information.

3.7.3 Document Review

Procedures of work inspection process, work instruction for each study, quality inspection record (QIR) and non-conformance record (NCR) were surveyed. Each part of the information was taken as an instrument to produce information regarding the quality inspection activities in production and the acceptance of inspection for the culmination of the task.

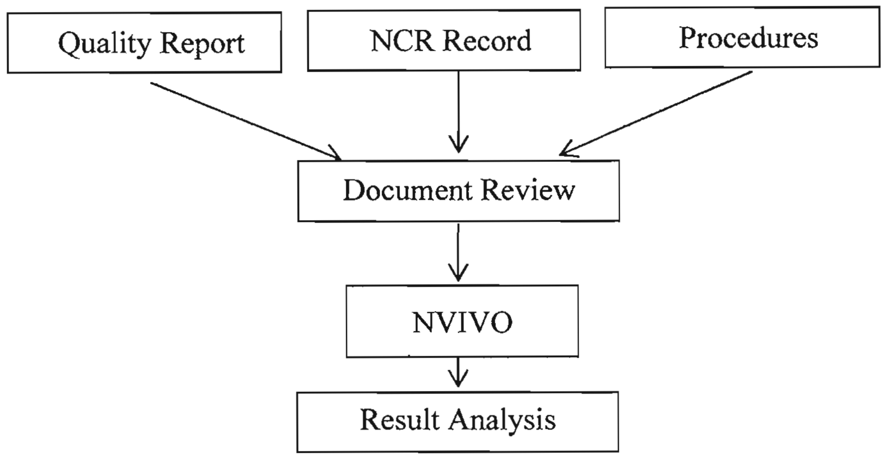
The details of work demarcation for each QC personnel will be included in the reviewing procedure. The comparison between written documentation and actual process will be verified in this arena. This role will make the data analysis in triangulate data more accurate.

The importance of examining written texts and any artefacts are that they are real evidence and exist in such a manner and unlike the spoken word, are physically enduring and thus can be separated in space and time (Ahuja, 2007).

Document clustering technique is widely recognized as a useful information tool, to restructure the document, mining and collection of data and information (Kishida, 2003). There are various ways to compile and review all the information especially the information that has been recorded, as stated by the previous researchers.

There are also tools that combine machine technology that not only handle the cost, time and accuracy issues in the study of learning documents, it also facilitates the work of the review team by making use of intelligent commentators , and enable collaborative work (Privault, Oapos; Neill, Ciriza, & Renders, 2010).

In this research study, using a simple process flow from gathering all related documents and then reviewing it one by one and summarizing all the information in one folder. Subsequently, the process of analysing all the information that has been collected in one folder will be facilitated by using NVIVO software. Refer Figure 3.4.



Sources: Compiled by author

Figure 3.4: Process flow for document review

The analytical process is dependent on the information that has been collected from these three sources: quality report, non-conformities report, and procedures. This information is very important to support the findings of this case study.

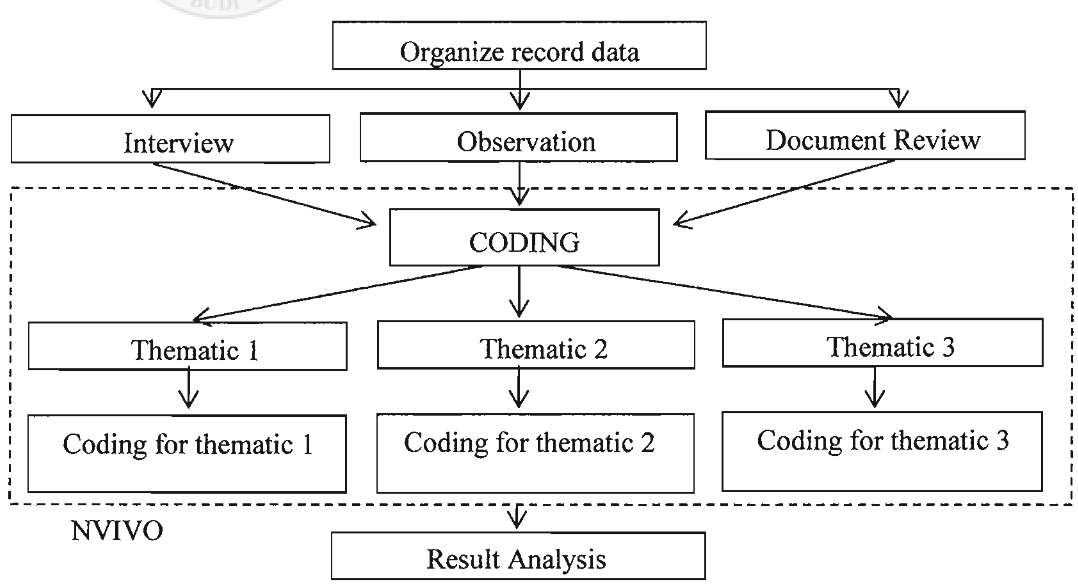
3.8 Data analysis procedure

Four themes were created: participant profile, work inspection planning, and the problems that occur in work inspection monitoring and quality record management. Data analysis procedures begin once the collected data from various sources were converted into transcribed form. This includes interview information from audio tapes, notes, etc. Thereafter, the data reduction process begins with the reading and re-reading of the transcribed data.

Next, identifying the emerging themes was done upon reading of each transcript during the reduction process. The files were placed in the same folder for ease of process analysis. Subsequently the "open coding procedure" was initiated to identify the emerging themes. Upon identification, the theme was separated accordingly in order to avoid any misplacing of information in the system.

There are six steps in the data analysis (Creswell, 2009). The analysis is in linear order as the cognitive operation is not simply static; organize and set up the data for analysis, read through the data, detailed analysis with coding process, the coding process to get a description of the scene or people as well as categories of the data for analysis, advance how the description of the compositions will be interpreted in the qualitative narrative and interpret the significance of the data (Creswell, 2009).

For the first step, organize and prepare the data for analysis. For this step, gather and review all information from audio records and interview documents, then transfer all the information into a single transcript document. Then, read through the data. The next step is to analyse the overall meaning in the information to achieve a general sense of the ideas and information given by the participants.

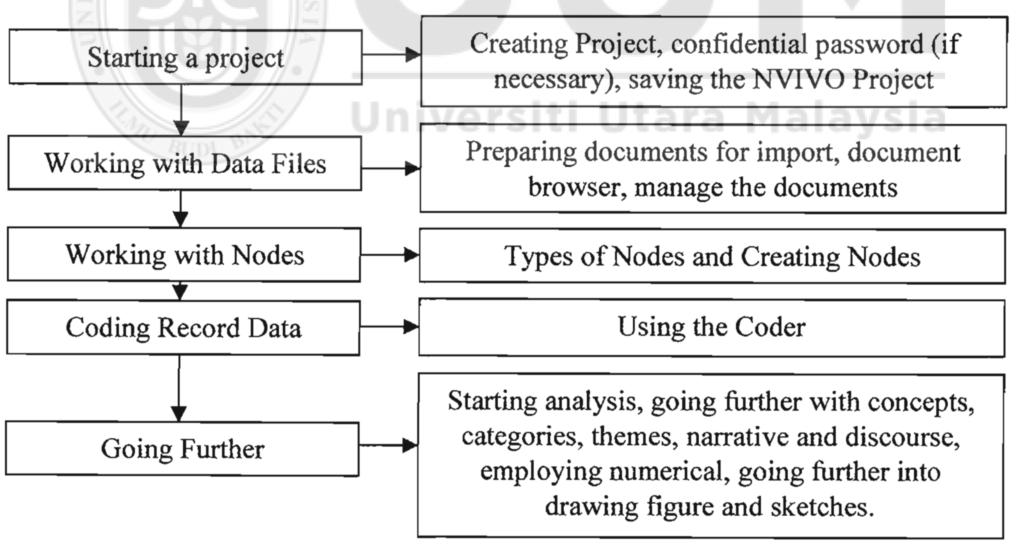


Sources: Compiled by author

Figure 3.5: Process flow for data analysis

A detailed analysis begins with the coding process. The next step is to organize all the information into categories and labelling all the information with conditions by referring to the information given in the interview sessions. The coding process will describe the categories for analysis.

In this research analysis, codes will be generated for all the information and all categories will be analysed in a general description in NVIVO. As a Qualitative Data Analysis (QDA) application, NVIVO requires knowledgeable skills to attain maximum accuracy out of the research findings. However, learning how to leverage from NVIVO was made easy with the tutorials that were packaged with the software while workshops and trainings were readily provided for a more impressive outcome through using special techniques.



Sources: Compiled by author

Figure 3.6: NVIVO software program procedure

The tutorials packaged in the NVIVO software offers a step-by-step animated guide whereby researchers can commence employing the QSR software straight away.

The procedures employing NVIVO software program are illustrated in Figure 3.7. Eventually, a total number of nodes were created and they were clustered into categories or groupings in this case research study.

The description of the themes was represented in the qualitative narrative. This action combined all the findings that emerged logically from the interview responses, i.e. by incorporating them into a narrative. From there the significance of the information is then translated. By exploring and observing the activities of the quality work process, reviewing the documentation and understanding the participants' stories during the interviewing process a full comprehension of all the information gathered during the school terms was achieved.

The qualitative research study is a creative and innovative process and it is not an unchangeable/rigid standard (Denzin & Lincoln, 2006). Data analysis for Qualitative research gives a meaning to first impression and final compilation (Dodge, 2011). Describe the main objective at immersing oneself in interview transcript to "*load up your memory*" with all collected data (Esterbeg, 2002).

After getting to know all the data, the results were generated by themes or categories or identifiable patterns. It is presenting a themed issue in describing qualitative research, it is not a straightforward process. However, it seems both compulsory and appropriate that we consider some of the limitations of qualitative research (Cassell et al., 2006). The results of the analysis are explained in detail to reach the goals of research objectives.

The function of data is to sustain or support the theory, the function should be emphasised in the construction of the theories that has elements in the data collection (Johnston, 2014). In addition, Creswell (2009) and Esterbeg (2000) suggested the research study must follow the coding procedure and data analysis, especially the open coding where the process of your work rigorously with your information data, categorizing the information and themes, and checking line by line. Qualitative researcher coding is more than simply organizing the data and the principle of coding is to arrange the data to make them easier to understand (Catterall, 1996).

Not all data analysis will fit precisely into one group or category. The writing up of all the findings will require the need to often cut across the different categories in both understanding and interpreting (Cassell et al., 2006). It is very important to know what's available in data analysis processes and tools in the industry and also the future needs of these processes and tools.

3.8.1 Data reduction

Data reduction is the first phase of qualitative data analysis. Data reduction involves the process of selecting, simplifying, and extracting themes and patterns from written field notes, transcripts, and other available resources.

The objective of data reduction is to reduce a data set. Lin, Tsai and Ke (2014) mentioned that the data reduction will result in the data itself becoming less important, but the reliability of the original data set is strongly preserved. The result will keep fewer data count and more amount of the information, for example, the result of interview transcripts while searching for similarities and differences in themes.

Code names were assigned to those themes that were detected and then organized into categories of related topics, patterns, concepts, and ideas that emerged from participants' perspectives.

3.8.2 Data Display

The following phase of data analysis is data displays, tools in showing all the solutions. The data displays are used to submit all the data into an accessible summary in order to arrive to the resulting conclusion. There are several number of methods that can be used for arrangement and classification (Xia & Gong, 2014). The final decision for the techniques used in the field was determined according to the outcomes of data reduction. Once the appropriate technique was identified, data displays were created depending on each individual information, as well as in each case, to demonstrate findings across all available sources of information.

3.8.3 Data drawing and verification

The final phase of data analysis consists of drawing initial conclusions based on cross-case information displays and then subjecting these initial conclusions to verification procedures.

Conclusions were drawn reliably according to the methods and findings of this study (Xia & Gong, 2014). These routines were meant to affirm that the findings were appropriate before they were labelled as conclusive. In qualitative research, the results were verified and deemed appropriate by evaluating their trustworthiness.

In general, the data analysis for this research work are shown in these three categories: the work process flow of the quality department involving the work inspection planning, the weaknesses in the implementing of quality management during the inspection monitoring activities and the details of report requirements needed by the top management. These three categories are trying to find all the details that can be utilized to accomplish the objective of the research. Data analysis is good for the data forecasting and development analysis, which represents the core products of the company (Xia & Gong, 2014; Jirwe, 2011; Pope, Ziebland, & Mays, 2007).

3.9 Chapter Summary

In summary, this chapter elaborates the methodology of the research study, initially adopting the Qualitative Research approach to complement the Research Questions and objectives. Research procedures, surveys and questionnaires for interview sessions were prepared thoroughly prior to conducting the research at site. Upon accumulating useful data through information gathering, the most contributing factor in the Research Design is the involvement of employees from the Quality Department selected according to their appointed job description that were most relevant to this research. These participants play a vital role in providing useful feedbacks with regards to the current procedures through these research interview sessions. Research information is also gathered through other means of data accumulation including observation of work activities, inspection work monitoring, scrutinizing of inspection work records and reports and various other modes of information gathering that would be used as qualitative data for further research analysis.

CHAPTER FOUR
RESEARCH FINDINGS

4.1 Introduction

This chapter elaborates further the results and findings of the qualitative study in which the interview process including procedures and observations are reviewed based on these categories and identified patterns for the entire research. The primary method carried out was the face-to-face in-depth interview, with the objective to get participants answer all the research questions with the utmost accuracy.

Interviews were conducted at the participants' work premises at their convenience and comfort. Part of the interview sessions included formulating questionnaires from which the participant's profile can be derived and developed. Also included in the interview process is a summary of the group characteristics of the participants.

In the final section of this chapter, a presentation of the research findings was derived from the interview sessions with the aid of NVIVO to summarize the following; examples of raw data collected, discussion of the themes generated from the data and how the results relate to the key construct of the overall research.

4.2 Research work process

Before starting a certain process analysis, the necessary information must be obtained from all sources such as information from the project documentation, information from the interviews that was compiled, as well as information obtained during work observation.

4.2.1 Working with data files

Any information received was grouped according to the classified equation information, of which the same information must be kept in any "node" that has been prepared. For this study, all information gathered were achieved from three different sources: interviews, observation and review of activity documents.

Each source was used in accordance with the method that had been set out in the previous chapter, in which all information on the methods were arranged to suit the required needs of this research.

The important consideration in the work process of classifying information is to collect and collate all information received in accordance with the resources available. The complete list of each collection and classification process that were used in Nvivo applications are as follows:

Table 4.1
Nodes derived from all sources

No	Sources	Nodes
1	Document review	Procedure of inspection and testing
		Quality inspection record (QIR)
		Non-conformity report
2	Interview Transcription	Age of the participants
		Educational background
		Work Experience
		Work Expertise
		Quality understanding
		Record management
		Work planning
		Work process flow
		Observation activity
		Problems
		Improvement
3	Observation	Work process flow
		Record management

All the information gathered was required to be uploaded in this application for analysis processing. The important process in work information management was prepared and placed in locations or sources that were listed. To help analyse and compile the work process, all similar information that was found in different sources must be stored in the same node.

NVivo compiled all the information according to sources and nodes provided. Each information that was uploaded was relocated into the available nodes; the researcher was able to review all stored information from the existing node.

The documentation browser was also found in this application, where analysts could easily identify any information that was uploaded and also revised the information obtained.

4.2.2 Working with nodes

On each of the existing nodes, the researcher was able to access all the information easily. Analysts were also able to revise any encoded information on the findings and passing of each category or classification that was provided. Each of the information analysed was prepared according to the research questions for this study.

The node also helped in the analysis by exploring all the data and the important information that was contained in the listed nodes. Furthermore, all the selected stored information could be modified according to the needs of the analysts. With regards to additional information, the analysts were also able to provide and create new coded information for each category.

A node classification is required because the information recorded is sometimes used as guidance for any analysis, for example the provision of summary information for statistical diagrams.

4.2.3 Coding Recorded Data

The classification and encoding information process were also done using this application. The classification process was purposely created to gather and review all similar information in which each resource was associated with the topic and also the result of the study.

The encoding information process should also provide an insight into the same information where it is being coded by the provided nodes. It makes the analyst's job easier to do any reviewing process of the information. In addition, some of the encoded information can be associated with other sources of information. Therefore, by identifying the similarity of the information, the analyst should apply and use the same work process for the resources and existing nodes.

4.2.4 Analysis option

For the next stage, the analyst can analyse the information directly. Such as a statistical analysis and prepare any work flow that was used in the work report. The researcher can also make any work analysis of the information on a regular basis according to the work reporting requirements. By reviewing all the available information thoroughly, it can give a better analysis in producing a good and comprehensive report.

A good work analysis normally uses all the gathered information and useful method, and it usually follows the objective of the report itself. A good analysis method is necessary to make sure all analytical work reports that were produced would be easily understood and interpreted by others.

The process of this analysis can be used as a guideline for the researcher to launch any systematic way for analysis work. By reviewing the transcribed interview, the researcher can create any nodes that are relevant with the theme that has been set in the research study. The researcher can use a 'drag and drop', where all the tools to copy and paste all relevant answers uploaded into the relevant node.

The researcher can create a new node if needed when it is discovered that some important information needs to be raised or highlighted in this study. It was also placed and stored in the same node when several answers or information were found. Similar information will be grouped and given the right node. The data collected and each created node are labelled according to specific research themes.

The answers given by the respondents revealed that the responses were almost the same for all the questions asked. The similarity of the answers were seen in each node. All this information was important to maintain the authenticity of the information that was obtained from the research resource.

4.3 Profile of Participants

A brief background of each respondent was made available to enable the researcher to know a little about who the participants were. By understanding the background of the participants, the researcher was able to understand and get the best answer from them.

The session was conducted and analysed by methods that have been discussed in previous chapters. The interviews were conducted starting from January 2015. The interview sessions involved 19 participants out of a total of 25 employees from the Quality Department.

The total number of participants involved was only 19 as many of them were having problems that could not be avoided. The normal reasons given were tight work inspection schedules, time-consuming and meetings. However, in the end the interviews were conducted as all the participants' had willingly agreed to in their replies via email and telephone calls.

The results of the interviews revealed some crucial information on the strengths and weaknesses of each participant in the Quality Department. The participants came from several sections of the department where every section contributes to the shipbuilding work process.

All these sections were created with the purpose to carry out the inspection and monitoring of each work process in the ship construction in order to maintain a good quality level. The participants' involvement by sections in the study is shown in Table 4.2.

Table 4.2:
Total No. of participants by sections

No	Section	Number of participants	Total staff in Quality Department
1	Accuracy Section	2	3
2	Electrical Section	2	4
3	Electronic Section	3	3
4	Hull Section	6	13
5	Mechanical Section	6	12

This information of the details of each participant was taken from the findings of the interview sessions. The need to know about the background of the QC staff was intended to determine the level of understanding of the work that has been commissioned by work assignments or tasks provided by the quality department. All of these information were created to give a better understanding on the implementation of quality management in the quality work process, especially in the shipbuilding inspection work activities.

To compile the information that was obtained from the results of the interview sessions, all the transcribed information was uploaded into Nvivo applications. In NVIVO application, information was classified and structured according to the following;

1. Age of participants,
2. Educational background,
3. Work experience and
4. Work expertise.

The process flow was taken from exploring each case that included these four classifications. This is not a cross case analysis. This is more to know about the participant profile in order to understand in more detail about the research focus group.

To make sure all information was obtained to suit the original purpose of the study, a copy of work task and job description given to the participants were obtained to ensure that all required information for this research was collected.

Almost all the participants interviewed gave their full cooperation. They wanted to be seen as being important contributors and influence the outcome of the study. The participants wanted this r study to be one way of describing what is actually happening in their company.

With all the information obtained, the study can be described according to the following categories: the number of participants, number of participants by age, the number of participants by qualification, the number of participants by experience, and also the number of participants by skill.

4.3.1 Result of Participants Profile

The profile of participants using the Nvivo applications are presented in Table 4.3 below:

Table 4.3:
Profile of participants

No	Category	Description	Total
1	Age of Participants	20 – 29 years	3
		30 – 39 years	10
		40 – 49 years	2
		+50 years	4

2	Educational Background	Certificate	10
		Diploma	6
		Degree	3
3	Years of Experience	< 1Year	0
		2 – 5 Years	5
		6 – 10 Years	12
		11 – 15 Years	0
		16 – 20 Years	1
		> 20 Years	1
4	Work Expertise	Painting	2
		Welding	4
		Accuracy	2
		Piping	2
		Electrical	4
		Propulsion	2
		Electronic	1
		Air Conditioning	1
		Mechanical	1

1) Age of Participants

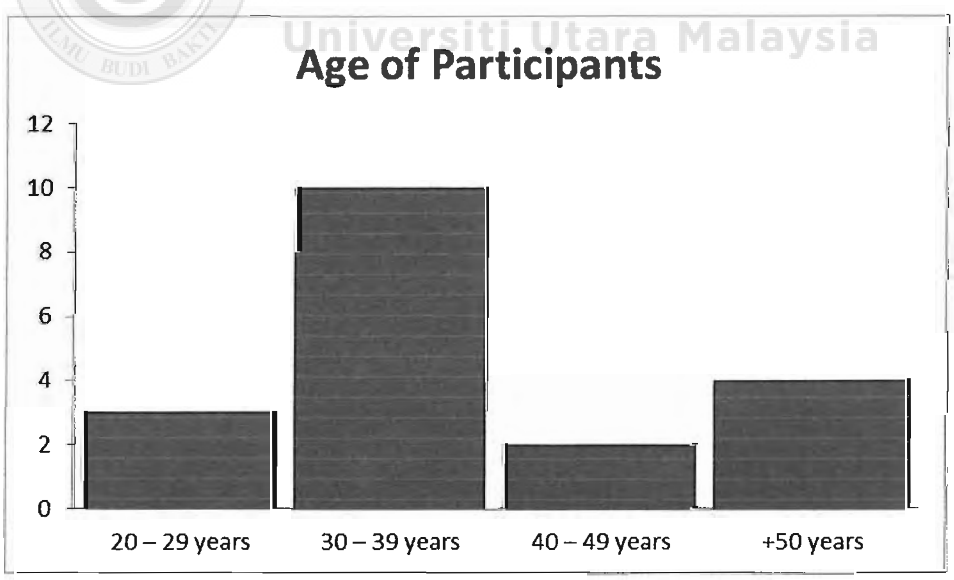


Figure 4.1: Age of Participants

During the interview sessions, it was noted that all 19 participants had given their full cooperation and had provided good responses. Referring to Figure

4.1, from the results of the data analysis in participant profile, we could clearly conclude that because 52.63% of the employees aged between 30 – 39 years were attached to the Quality Department we can consider this to be over-crowded. On the other hand, 21.05% of the employees were over 50 years old, 15.79% of the employees were between 20-29 years and 10.53% of the employees aged between 40-49 years were in the last ranking of the list because only 2 workers were still in this position. Many of them had left this company due to the other work opportunities and retirements.

2) Educational Background of Participants

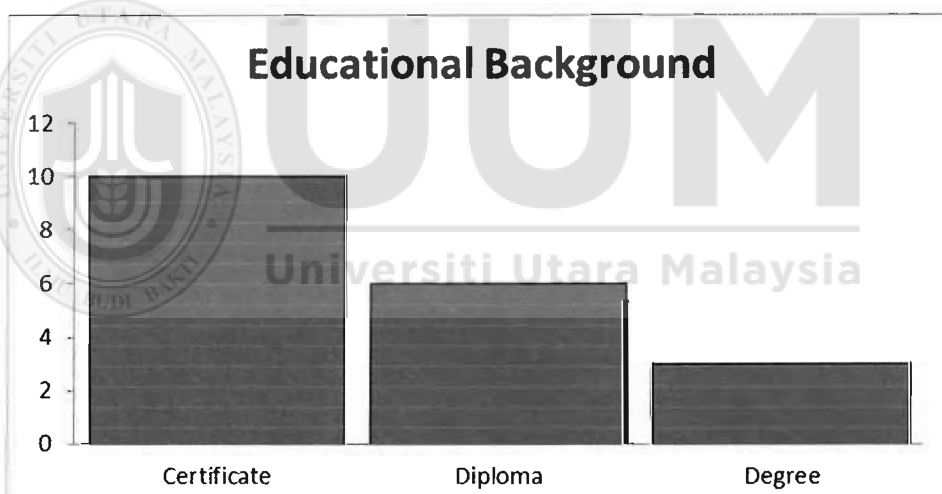


Figure 4.2: Educational Background of Participants

Referring to Figure 4.2, it shows that the participants had different levels of technical education in various fields. The levels of technical educational background comprises of 52.63% of the employees holding a certificate of proficiency as compared to 31.58% being diploma holders and 15.79% having a degree qualification.

It can be concluded that educational background plays a vital role in producing high productivity environment, resulting in high quality work being achieved in the end products. Educational background also determines the effective implementation of a work-process and ensures a smooth process flow through proper Standard Operating Procedures (SOP).This research found that technical knowledge of workers was important in ensuring a smooth production process of the highest quality.

3) Work Experience of Participants

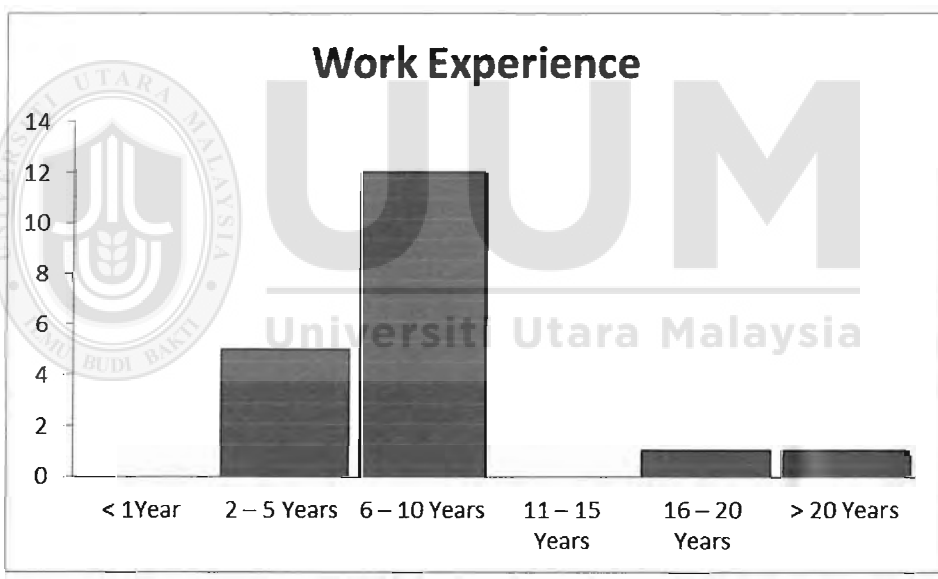


Figure 4.3: Work Experience of Participants

Figure 4.3 shows the number of years of work experience among staff. In general, work experience is a key contributor to the success of an organization as it helps the work process to become more robust and efficient.

Based on the above statistics, 63% of the employees in the Quality Department possessed 6 – 10 years of experience working in the company under study as compared to employees who had worked for less than 6 years and new employees combined.

Based on the results of this analysis, it was found that all employees in this department had plentiful of experience in the field of shipbuilding. This is shown in the quality of the execution of construction work activities for this department which can be said to be at a good level.

4) Work Expertise of Participants

The following graph depicts the distribution of employees in the Quality Department based on Level of Expertise and Job Scope:

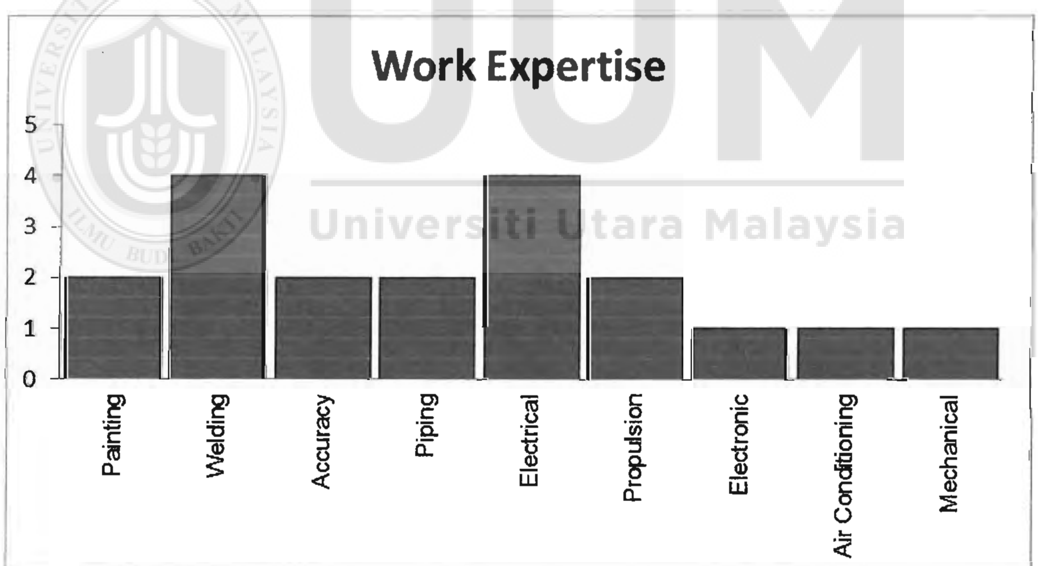


Figure 4.4: Work Expertise of Participants

Based on this overall profile of the participants, it can be described that each participant or employee in the quality department has the required skills. As with the level of work experience, the higher level of work expertise can give them the advantage in carrying out their work inspection activities, especially in the field of shipbuilding.

Indeed, experience in the shipbuilding industry is important for every employee here. This is because the work process is a bit different from other sectors of manufacturing or construction.

4.4 Problems Encountered during Research

This is a compilation list of problems encountered during the research finding using the three research designs (interview, document review and research observation) for this case study. Refer to table 4.4 below:

Table 4.4
List of problems encountered during the research

Interview Session	Document Review	Research Observation
• Customer not available. • Employee work attitude • Items are not ready • Miscommunication • No internal inspection • Not enough manpower • Not enough tools and equipment • On-called request • Work redundancy • Preparation of work was not done • Products purchased are not linked to the QC • Quality is not satisfactory • No centralized document storage • No centralized work information and planning • Incomplete work reference • Runs of time delivery • Tools and equipment do not follow the specification	• Procedures are too general • QC not enough document associated to the work process • Work process does not follow the procedure • No centralized document storage • Incomplete work reference • No record data and Incomplete inspection record • Unsynchronized work report • Individual work record and report • No softcopy and backup record • Difficult to trace any inspection record • Incomplete non-conformance record	• Work process does not follow the procedure • The work normally is not ready as planned by the production planning • Not enough manpower during the work • Work redundance • No centralized work information and planning • Representative not available especially production • Received verbal or on-called request • Not enough time to do internal inspection, surveillance and observation activity • High workload • Individual work record and report • Preparation of work was not done

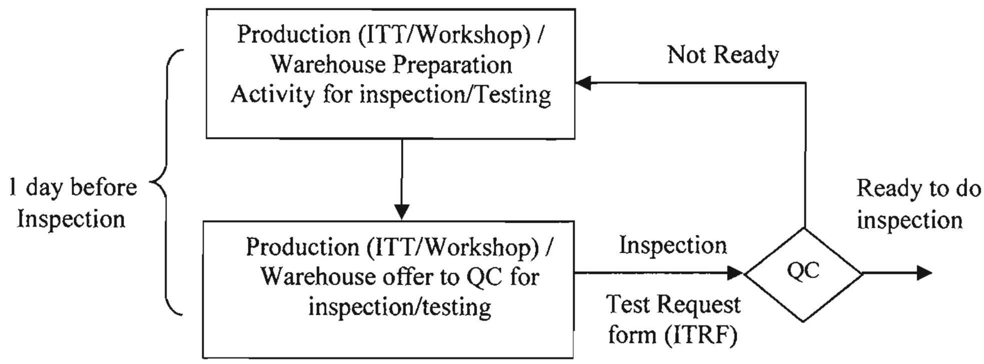
• Representative from production not available • Urgent issue • Weather condition • On-called request • Unorganized work planning	

4.4.1 Theme No.1: Work inspection planning of ship construction project

Theme No.1 relates directly to Question 1 as stated in Chapter 1 as part of the research which addresses the problems and issues currently encountered in the Work Inspection Planning of ship construction projects. Useful information acquired through interview sessions, observations and document reviews were taken into account as evidence and input for data analysis.

The work inspection plan was pre-arranged by the Production Planning unit based on the readiness of items to be installed by the production workers, as stipulated in the standard operating procedure of the inspection and testing job scopes.

In the procedure, all relevant personnel from various sections in the Production Department shall liaise with their production planning side to make a request on Work Inspection in the Quality Department. The partial Work Inspection standard operating procedure is summarized in the process flow depicted in Figure 4.5 below:



Sources: Compiled by author

Figure 4.5: Partial work inspection process flow in procedure of inspection and testing

Based on the flow chart above, the Production Department including theITT/ Workshop and Warehouse can raise a work inspection request for the QualityDepartment through an Inspection Test Request Form (ITRF). Based on the work request and as part of the company's internal inspection procedure, the Quality Department will make an evaluation of the work requested to see whether the work activity was actually ready for inspection.

This information can be obtained from the work analysis and reviewing of the inspection procedures and testing in the quality department. It is important to identify any quality work flow that has been created by this department.

The Quality Department would give an approval to the work inspection request if the works or items are fully ready for inspection. This process usually takes one day before the actual inspection activity can be conducted,so as to give ample time to complete any outstanding works and remaining items, upon evaluation of the request before approval.

This work flow is called the internal inspection, where the QC is required to do this activity before doing the final inspection with the client. This is done to make sure that there are no non-compliance issues and to avoid any repeat work after the actual inspection has been performed.

The actual inspection is considered done if all the requirements have been properly completed by the production. By doing the internal inspection, the QC is able to verify whether the production is ready or not. This activity usually takes a day before the actual inspection activities are to be carried out.

Therefore, the production will make sure that any work that is still not properly done including any outstanding items must be completed before requesting for inspection. If this procedure is not adhered to properly and accordingly, it can cause problems such as delays in completing the preparatory work for the shipbuilding project.

4.4.1.1 Problems Encountered : Theme No.1

Based on the participants' profile, it can be concluded that the Quality Department was not facing any issues with regards to the employees' expertise and work experience in executing quality inspection work.

However, based on the observations conducted during the information gathering process, it was found that the Quality Department did not practise a centralized filing system of managing documentations closely associated with the work inspection activities. Apparently, each personnel in each section was practicing an individual filing system of their documentation records on inspection works which were all correlated.

On the other hand, 17 out of the 19 participants or 89.5% complained that at times, the QC staff were forced to cancel or postpone the pre-scheduled work inspection activities.

The following quotes serve as evidence from 17 respondents during the interview sessions with regards to the work inspection planning practice, indicating the problems and difficulties faced during the work inspection process.

A quote from QC Staff No.1:

"Saya terpaksa membatalkan kerja pemeriksaan ini kerana pihak pengeluaran tidak bersedia dengan sepenuhnya dalam memastikan barangan ataupun kerja tersebut siap mengikut perancangan, kadang-kadang mereka hanya membuat permohonan pemeriksaan secara lisan tanpa memberitahu maklumat tersebut secara terperinci. Begitu juga tentang isu kehadiran pihak pengeluaran di mana mereka tidak dapat hadir dalam pemeriksaan tersebut, ini akan menyusahkan pihak QC untuk meneruskan pemeriksaan tanpa kehadiran mereka."

QC Staff No.1 mentioned that inspections were requested by the representative from the production staff even though they were not fully prepared as the work to be investigated had not been completed according to plan. The inspection request was usually done verbally without detailing any of the work information. The non-attendance of the representative from the production side during the work inspection had also caused difficulties for the QC personnel.

A quote from QC Staff No.2:

"Saya biasanya akan membatalkan kerja pemeriksaan sekiranya tiada wakil yang hadir dalam aktiviti tersebut, walaupun hanya sekadar pihak kontraktor sahaja yang hadir. Mengikutproseskerja-kerja pembinaan kapal, pihak pengeluaran akan memantau semua kerja-kerja pembinaan yang dijalankan oleh pihak kontraktor, jadi oleh yang demikian pihak QC hanya menjalankan semua aktivititersebut dengan kehadiran pihakjabatan pengeluarandan bukan pihak kontraktor. Isu kerja tidak lengkap atau tidak sempurna memang biasa, bila pihak pengeluaran menghantar permohonan pemeriksaan biasanya saya akan buat pemeriksaan dalaman terlebih dahulu. Namun apabila tibadi tempat tersebut didapati masih banyak lagi kerja-kerja yang perlu disiapkan."

QC Staff No.2 mentioned that he/she will cancel all work inspection activities if there is no representative from the Production Department. She/he mentioned that all ship construction works executed by the contractors were to be supervised by the Production Department. QC is not directly involved with the contractors. QC will only conduct the work inspection activities if the representative of the Production Department is present. The issue of items not ready or incomplete is a normal occurrence. QC Staff No.2 also mentioned that he/she always has to do some initial internal inspection, and will usually discover that the work was not finished and needed to be completed before the actual inspection activity.

The issue of the non-attendance of the production staff during the work inspection activity is considered a serious issue whereby every ship construction work activity done by the contractor is to be fully monitored by the production staff. To support the results of this interview, an analysis from the inspection and test procedures in the quality department mentioned that the QC was dealing with the production to avoid any deviation of work, especially in any acceptance work process.

The issue regarding incompletion of work normally occur when applications for inspection were received. The participant also mentioned that every requested inspection that was received was followed by some initial internal inspection. This is important because the QC needs to make sure that all work activity that needs to be done was duly completed to avoid any non-conformity by the production side.

All participants mentioned that most of the work that was being applied in any inspection activity was not completed entirely according to the production plan. And the participants were also faced with the problem of absenteeism by the production staff during those activities. Both these problems were considered critical, and the production staff were required to be more familiar in what they were doing. Every procedure in the shipbuilding work processes is disclosed in detail in each of the work that had been created before.

According to another respondent, apart from these two issues there were also other problems such as the size of work areas, labour shortages, weather conditions, unauthorized and un-calibrated equipment and insufficient tools, all these were due to improper work planning on the production side. As explained by QC staff no.3:

A quote from QC Staff No.3:

"Skop tugasan saya adalah berkaitan dengan aktiviti pengukuran kapal, di mana setiap aktiviti yang memerlukan sekurang-kurangnya dua orang untuk menjalankan tugasan tersebut. Kadang-kadang saya perlu membatalkan kerja ini kerana tenaga kerja yang tidak mencukupi. Walaubagimanapun, kadangkala saya terpaksa meminta bantuan daripada kakitangan pengeluaran untuk membantu saya dalam menjalankan aktiviti pengukuran tersebut. Proses kerja ini memerlukan masa untuk menyediakan kawasan kerja yang sesuai; ini adalah kerana setiap tugasan pengukuran ini memerlukan kawasan yang telah ditetapkan dan disediakan oleh bahagian lukisan kejuruteraan. Pihak QC seperti kami perlu mencadangkan kawasan yang akan diukur, tetapi ia bergantung kepada skop kerja yang dipersetujui oleh pihak pasukan projek, bahagian pengeluaran ataupun pihak kejuruteraan reka bentuk. Jika kawasan yang perlu diukur masih menjalankan sebarang aktiviti atau kerja panas, pembatalan itu perlu dilakukan bagi mengelakkan sebarang masalah. Begitu juga dengan keadaan cuaca di mana ianya juga menjadi sebab dalam menjalankan tugasan tersebut, seperti hujan dan waktu malam. Selain itu, kami mempunyai peralatan yang tidak mencukupi yang mana ianya akan menghalang kami daripada melakukan tugasan, di mana kami hanya mempunyai satu set peralatan pada satu masa sahaja. Jika alat-alat yang telah luput tarikh sah penggunaannya, kami terpaksa menghantar peralatan tersebut untuk ditentukur bagi mengelakkan ketidaktepatan ukuran."

QC Staff No.3 mentioned that he/she needed at least two persons to help him/her carry out any measurement work involved in the ship construction process. He/she normally had to cancel the task if there was not enough manpower available. Sometimes the production representative was required to help do the work measurement activities. The work process involved is both time consuming and meticulous. All the work details are prepared by the Engineering Department. QC responsibility is confined within the measurement work task prescribed by the work detail. If there is any on-going hot work, all measurement activity needs to be stopped. Weather condition like rain and nightfall are considered unsuitable for any measurement work. The proper condition and calibration of all equipment were also mentioned as measures to avoid any inaccuracies in measurement.

There were also other issues mentioned by other participants such as unsatisfactory work done by the production side especially the contractors' work output, emergency work, weaknesses in communication, poor work attitudes, high work load, incomplete information, goods purchased without going through any goods delivery inspection and incomplete documentation. As quoted by several participants below:

A quote from QC No.8:

"Bagi saya, kebanyakkan kerja yang dilakukan oleh mereka sangat tidak memuaskan"

A quote from QC No.14:

"Mereka selalu buat alasan tentang "urgent", bila kerja-kerja mengejut ini berlaku banyak infomasi yang tidak lengkap dan kadangkala mereka sendiri telah salah faham tentang kerja yang perlu disiapkan."

A quote from QC No.17:

"Saya sukar nak bekerja dengan mereka yang hanya mementingkan diri sendiri, apabila kami kata tak boleh nak buat mereka tetap hendak jalankan kerja tersebut. Walaupun mereka tahu akibatnya jika menjalankan kerja tersebut tanpa kehadiran pihak QC"

A quote from QC No.18:

"Kerja-kerja yang diperolehi kadangkala terlampau banyak dan mereka mahu disiapkan dengan segera. Walhal peralatan dan kakitangan tidak mencukupi menghalang kami untuk melakukan kerja-kerja tersebut."

A quote from QC Staff No.9:

"Pihak pembekal menghantar terus peralatan yang telah ditempah tanpa melalui pemeriksaan penerimaan, ini menyebabkan kebarangkalian peralatan tersebut tidak memenuhi spesifikasi yang telah ditetapkan. Begitu juga dengan maklumat serta dokumen yang tidak mencukupi bagi memastikan barangan atau peralatan tersebut dibeli mengikut apa yang dirancang."

A quote from QC Staff No.10:

"Bagi saya, saya batalkan sahaja kerja-kerja tersebut apabila info yang saya terima tidak lengkap. Mereka juga kadangkala tidak memahami apa sebenarnya yang diperlukan dalam setiap kerja-kerja pemeriksaan itu. Hal ini berlaku apabila pekerja baru yang melakukan kerja-kerja tersebut. Kemungkinan mereka tidak diberitahu dengan terperinci tentang proses kerja yang perlu dilakukan dalam pembinaan kapal. Mereka juga kadangkala membatalkan kerja-kerja pemeriksaan itu tanpa memberitahu semula kepada pihak QC, ini menyebabkan berlakunya salah faham di antara pihak QC dan pihak pengeluaran."

All the answers given by all the participants during the interview sessions were similar to the results found in the quality documentation such as the inspection application form (ITRF), certificates and the quality inspection report (QIR). Several shortcomings in the information that was submitted were also found together with a list of non-compliances being recorded.

4.4.1.2 Summary of Problems for Theme No.1

The responses given by all the participants, document review and observation can be summarized and listed as below- these are the list of problems which occurred during the work inspection process by the Quality Department:

1. The non-attendance of the work representative: the problem occurs when the work representative is required to attend all the work inspection activities. The work representative comes from the Production Department, Engineering (if required) and Client (External Acceptance).

2. Problem of the employee's work attitude together with their lack of work responsibility especially those from the Production Department.

3. Issue of work preparedness. The problem occurs when items were not ready to be inspected and preparation of work was not done according to what was required by the production department.

4. Miscommunication usually arises out of issues on work inspection detail, attending to some urgent requirement or matters that were brought up through verbal and not written communication.

5. No internal inspection was conducted. QC was required to conduct as many internal inspection and work observation as possible. This is important to avoid mistakes or rejection during work construction activities.

6. Inadequate manpower, tools and equipment to carry out the work inspection activities.

7. Quality of work from the contractors were unsatisfactory and not up to mark. This usually happens when urgent work needed to be completed or when the project timeline runs out.

8. Work process did not follow procedure. The lack of awareness in reading and understanding the work procedure and work instruction would adversely affect the work construction process.

9. Tools and equipment procured were not according to the work specifications.

10. Weather condition (bad weather and dark).

11. Unorganized work planning. Work plans being prepared by other departments and also workshops. Each work plan was not placed in centralized planning.

12. Work plans become redundant because there is no coordination from other departments.

13. No centralized work information and planning

14. High workload

The importance and awareness in developing on work inspection planning was done according to the project completion period and the total projects awarded. To avoid any duplication of work and to restructure the process, the existing staff should carry out the assignment, and also the production must look into all aspects before requesting any work inspection activities. It means that the effectiveness in carrying out inspection work is dependent on the work planned by the production planning. The irregular work plan must follow the time of work preparation, total personnel and the work requirement in doing the inspection with corporate clients or classification body according to the contract that has been provided for the quality department.

4.4.2 Theme No.2: Problems which occurred during work inspection monitoring.

Theme no.2 is to answer research question no.2 that is issues that occur during the monitoring activity of the construction work. Based on the research findings of the document review activity, work observation or surveillance work was clearly described in the procedures of inspection and testing.

This is supported by the work process flow that has been made before. It is important for all employees of the quality department to be clear about their responsibilities as QC inspectors in carrying out their duties in the shipbuilding project. The details of QC work responsibilities mentioned in the procedure are as follows:

- To ensure that all inspection and testing activities for the project are in accordance with the requirements of Inspection and Test Plans and also the approved contract;

- to coordinate with relevant departments about non-compliances that were identified during the inspection and / or testing and make corrective actions to accelerate the work process;

- to conduct inspections and witnessing of the tests, and provide quality inspection records (QIR), making sure that all inspection and testing activities are conducted in accordance with the procedures and the extent of the agreed contract specifications;

- QC staff should meet with the production side for inspection activity before the actual work is offered to the customer;

- After reviewing the inspection or audit activity, the QC is obliged to inform the customer to carry out a formal inspection based on a time schedule that had been agreed by all parties;

- QC should inform the inspection status to all parties as well as updating the status of the inspection that has been completed.

All work activities are also covered by a certificate of employment that have been awarded and signed by all employees when applying for the work position. This means that every work that is done by the employees has been described in detail.

4.4.2.1 Problems Encountered: Theme No.2

Based to the results of the interviews conducted, it was found that almost all of the QC staff were performing the tasks that they had been assigned. But something obviously happened during the interview session where the QC staff overseeing the important work observation monitoring especially in internal work inspection, observation and surveillance activity. This was mentioned by several participants below:

A quote from QC No.1:

"Saya selalu memaklumkan kepada pelanggan tentang pemeriksaan secara formal berdasarkan jadual masaseperti yang dipersetujui oleh pihak pengeluaran selepa smembuat pemeriksaan dalaman. Kebiasaanya pemeriksaan atau pemantau dalam ini dilakukan dalam dua kali sehari, bergantung kepada masa yang ada. Masalahnya kerja agak padat untuk menjalankan kerja-kerja pemantauan"

A quote from QC No.2:

"Bagi saya, memang kena buat pemantauan serta pemeriksaan dalaman sebelum membuat pemeriksaan secara rasmi, bagi mengelakkan ulang kerja. Biasanya dua kali sehari, itupun kalau kerja tidak banyak. Kebiasaanya kerja saya agak padat."

A quote from QC No.4:

"Saya akan rekodkan semua hasil pemeriksaan dengan cara saya sendiri, setiap aktiviti termasuklah pemeriksaan dan pemantauan akan dilakukan ketika mempunyai masa yang terluang."

A quote from QC No.5:

"Saya buat pemantau sebanyak dua kali sehari tapi saya tidak buat sebarang rekod pemantauan. Saya lebih gemar memberitahu secara terus kepada pihak pengeluar tentang ketidakpatuhan kerja yang saya jumpa ketika membuat pemantauan tersebut.Aktiviti kerja saya padat, ada masa boleh la jalankan aktiviti tersebut."

A quote from QC No.6:

"Saya lakukan sekurang-kurangnya sekali sehari dalam kerja pemantauan, itupun kalau ada masa terluang"

A quote from QC No.7:

"Saya akan laporkan semua aktiviti pemantauan kepada ketua saya, saya tidak merekodkan aktiviti tersebut."

A quote from QC No.10:

"Saya hanya menurut arahan yang diberikan oleh ketua saya. Selalunya beliau yang merancang aktiviti pemantau.Kalau disuruh buat pemantauan, saya akan pergi buat kerja tersebut."

A quote from QC No.11:

"Setakat ini saya belum lagi berkesempatan untuk sebarang kerja-kerja pemantauan. Hanya menumpukan kerja kepada laporan kerja tentang hasil pemeriksaan yang telah dihantar kepada saya. Kerja saya agak padat untuk membuat kerja-kerja pemantauan."

Based on the responses gathered from the interview sessions, the total number of work monitoring activities especially in internal work inspection, observation and surveillance work is less than normal work. The result also found that almost all participants have faced difficulties when carrying out the monitoring work activities.

Overall the respondents mentioned that the observation activity was normally dependant on time available. This meant that problems in monitoring work activity normally arose from the limitation of time, and work overload caused by the planning uncertainties of the production side. The research also showed that QC was not aware of the importance of work monitoring especially in internal inspection, observation and surveillance activity for ship construction project.

According to the research observation work activity, it was found that the quality department was occupied with activities that were planned by the production unit. The observation also found that sometimes the production representative was not present during the work inspection activity. The researcher also discovered that all construction work that needed to be inspected was incomplete and did not meet quality work specifications.

Another observation made by the researcher was that some of the work activities were not completely done after QC received the inspection requisition. The total number of reports on work cancellation and non-compliance was increasing progressively as seen in the quality work management records.

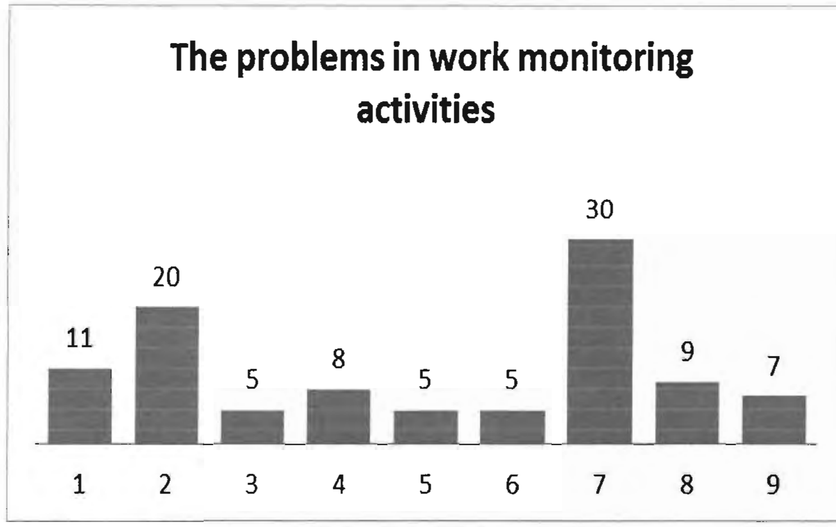
4.4.2.2 Summary of Problems for Theme No.2

Based on the triangulating information from the three research designs, the summary of work monitoring activities are as follow:

Table 4.5
List of the problems related to work monitoring activities.

No	Description	Total Percentage
1	High workload received from the production side.	11%
2	The work is normally not fully completed as specified in the production plan.	20%
3	Work redundance.	5%
4	No centralized work information and planning	8%
5	Representative not presentespecially from production side.	5%
6	Received verbal or on-called request.	5%
7	Limited time available to do internal inspection, observation and surveillance.	30%
8	No specific record data on internal work inspection, work observation and surveillance.	9%
9	Work process does not follow the procedure.	7%

The total percentage given by the NVIVO software based on the triangulating information, the detail graph as Figure 4.6.



Sources: Compiled by author

Figure 4.6: Problems in work monitoring activities

Based on this result, it was found that the weakness in work monitoring activities including the internal work, observation and surveillance have contributed to these problems.

The limited time available to carry out the internal inspection, observation and surveillance is one of the main issues. All these problems are related to each other. For example, the limited time issue occurs due to work not fully completed according to production plan and also to the high work load given

The importance in conducting work monitoring activities including internal inspection, work observation and surveillance is seen in the impact it had on the quality of work of the ship construction project. It depends on how far the implementation of work monitoring to either result in the negative or positive, which will give an impression to the clients especially in the performance of work efficiency in this company.

4.4.3 Theme No.3: Work Information Management

Theme no.3 refers to research question no.3, in which the issues raised were with the weaknesses in the work information management system required to prepare a good quality work report.

Based on the result analysis that was conducted through the reviewing of all relevant documents, it was found that the quality management was mentioned in the procedure of inspection and testing. But a few gaps was noted during the actual observation done by the researcher. It was found that the implementation of quality management in work inspection activity, especially in information or record management was not being done appropriately. For example, the results of the inspection records were not properly managed including work monitoring and observation activities.

4.4.3.1 Results of finding for Theme No.3

Using the triangulating result of the NVIVO software, the summary of the results are shown in Table 4.6 below:

Table 4.6
List of the problems related to work information management.

No	Description
1	Procedures are too general
2	QC not enough document associated to the work process
3	No centralized document storage

4	Incomplete work reference
5	No record data and Incomplete inspection record
6	Unsynchronized work report
7	Individual work record and report
8	No softcopy and backup record
9	Difficulty in tracing any inspection record
10	Incomplete non-conformance record

In the procedures of the Quality Department, there was only a mere mention of the importance of recording all the information that had been generated in each work inspection activity. The procedure did not specify how to manage the information management process. ISO standards simply states that every information shall be dealt with in an orderly manner in which each information is considered important.

As mentioned in the quality management system requirement, all work related to the inspection activity must also be recorded. The top management requires that they be provided with quality reports on all daily tasks conducted by the quality department. This is to enable management to find out the status of the inspection that was carried out in the shipbuilding process. The reports of non-compliance of work must also be submitted to them for work progress monitoring.

Diligence in preparing and managing the work report is emphasized to ensure the delivery of accurate information. The results of monitoring that was carried out by the researcher found that most of the section heads of the quality department just manage and regulate information in their own division. It was found that usually the head of department would reorganize all the information that had been received from every section of the department. Some of the issues included the difficulty in analysing incomplete information, each section submitting different information and lastly, the limited time available in preparing the final report that resulted in an inadequate or unsatisfactory report.

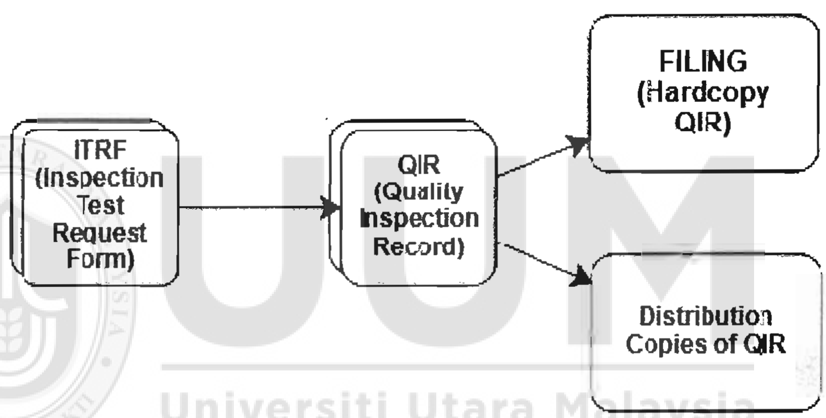
In addition, if the section head did not submit any report to head of department, chaos would ensue within the department. It was also found that the quality department staff did not implement any systematic record management prior to this.

Based on the interviews, document review and research observation, it was found that the Quality Department did not practise good centralized work information and planning. Although each employee keeps his or her own filing and book-keeping on a daily basis, consolidation of records proved to be a tedious exercise when conducting the annual auditing exercise. Besides, tracking of work records can be time consuming, especially whenever there was a need to rectify certain issues under certain circumstances.

4.4.3.2 Analysis of Theme No.3

After analysing all the relevant information with regard to the information management record, drastic action needs to be taken. Information management record is required in any work process especially in quality management. Based on Figure 4.7, the observation found that the work flow was normally carried out in the Quality Department.

Based on the work flow, QC first receives a work order from the production side and then prepares to set up an inspection. After completing the inspection, QC then prepares the quality inspection report using QIR form as proof of inspection. Each copy of QIR will then be distributed to those involved and stored in the QC file.



Sources: Compiled by author

Figure 4.7: The result of work inspection process for record management.

Improvements were made on the work process flow in the Quality Department. The improvement flow process will be described in detail in the next chapter.

4.5 Chapter summary

In summary, this chapter discusses in detail about the processes and procedures that was carried out on the collective raw records data in the form of gathered information from the preceding process through interview sessions, document review and research observations. The raw data was then converted into transcripts to serve as inputs to a Qualitative Data Analysis application software system called the Nvivo; a useful data analysis tool for studies and researches. The functionality of Nvivo was also highlighted in this chapter in a step by step manner.

The results and findings from this research indicate that there exist a slack in performance from the aspect of Quality Assurance resulting from poor quality management. The issues raised that needed to be addressed could be summarised as follows; the problems on work inspection planning, the importance of work monitoring activities including internal work inspection, observation and surveillance and improper information management on work inspection records particularly in the preparation of good quality work reports.

A detailed discussion and recommendation to tackle these issues is addressed in the next chapter, chapter 5 in which suggestions of improvements in certain areas are also included.

CHAPTER FIVE

DISCUSSIONS, RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

This section sets forward ideas for further discussions, recommendations and conclusions. The recommendations and suggestions on action plans to be considered for execution in order to improve the work process under study is meant to accommodate the main objectives of this whole study.

5.2 Discussions

In brief, the purpose of this research was to conduct a study on the current work process in the Quality Department specifically in quality management. Through this research, the knowledge capacity of the employees on quality management in the ship construction and maintenance procedures of the Quality Department was identified as the root cause which contributed to the quality management issues that arose.

This research provided the analysis and consolidates the areas of improvements through recommendations and action plans, hence accomplishing the company's mission "*to provide excellence in quality and timely delivery of products and services and to maximize stakeholders' return on investment*".

This research adopted the empirical investigation method to study a company's production performance within its Quality Department. With the cooperation of its employees, information in various forms was collated and analysed to help the employees understand the importance of their roles and functions in quality management.

The empirical investigation conducted in this research however, was rather limited to the internal parties of the company under study. Qualitative data was collected in several ways and the focal point was the interview sessions with selected participants in the section of interest, i.e. the Quality Department.

For better results of the findings, participants from different sections directly or indirectly involved in quality management were also included as sources of data. The objective of this research is to provide solutions to overcome the shortcomings and difficulties in the Quality Department of a ship construction and maintenance company, particularly in the implementation of quality management in the following areas:

- Work inspection planning
- Monitoring
- Reporting and documentation

The elaboration of the research outcomes in this chapter is strictly based on and refers to the problem statement of the research as identified in Chapter 1. In ship construction and maintenance, weaknesses in the implementation of quality management can have a major impact on the work process, especially in the project completion section and this could be caused by various factors which normally could be narrowed down to the company management itself.

By applying the qualitative data analysis method, this research managed to derive the recommendations on plans of actions to remedy the weaknesses and enhance the operation of the department under study. Findings from the study also revealed the importance of proper management of information from the work inspection planning stage to the preparation of a good final report on quality.

This research shows that it is important that continuous improvement be conducted in the quality management work process, especially in the construction work activity process by the Quality Department. In addition, the proposed improvements for a new work inspection process have also been implemented. The new work process flow will be introduced and explained in this chapter.

A new information management work process was designed to manage and regulate every work flow, especially in the activities of inspection work planning and preparation of a quality report. This new work process implementation should be able to help the work process activity in the Quality Department to be more efficient and systematic. In this chapter, the description on the implementation of the new work process will be described in detail.

5.3 Recommendation

Based on the results of the analysis described in chapter 4, the Quality Department has failed to regulate the work flow processes effectively. However, with the establishment of a new method of regulating the work process flow, it has helped to solve the problems faced by the Quality Department. It was stated that QC was involved in carrying out the work inspection activities in accordance with the work plan that was prepared by the Production Department. This new work flow can help to manage the work inspection activities planned by the Quality Department.

Therefore, any work plan from production must be described in more detail to make sure that all completed information was received by the relevant authorities. Each work requisition from the production was verified and checked by the Quality

Department. The information on the procedure of the project quality of the plan was clearly explained to all relevant parties, such as the project construction team, production, contractors and shipyard management.

The production planning should be able to ensure that each of the work orders for the inspection activities was clearly provided. Therefore, discussions and detailed explanations were done with all the relevant parties to avoid confusion and duplication of work in ship construction activities.

Work process before improvement:

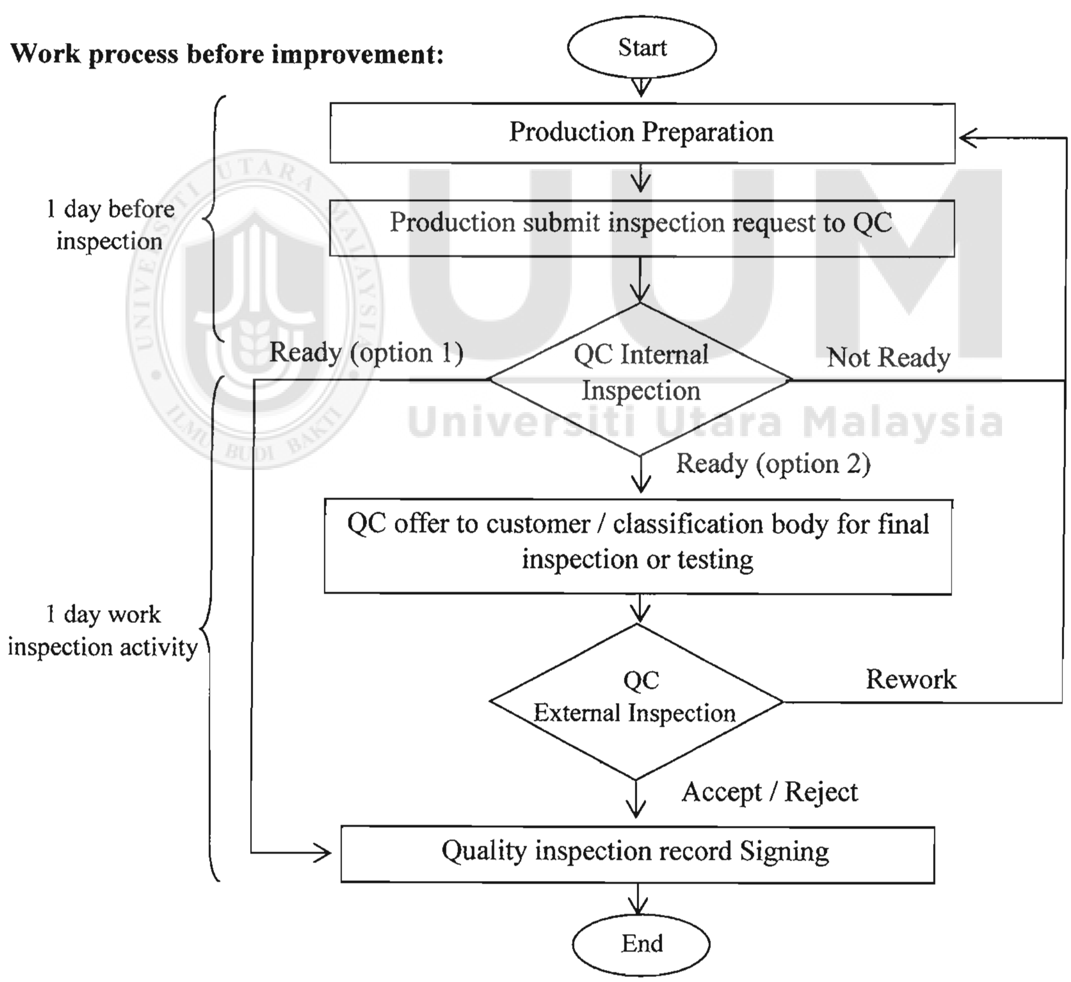


Figure 5.1: Previous work inspection process flow before improvement

The inspection work process flow shown in Figure 5.1 should be able to be improve the current situation. The new proposed improvement is shown in Figure 5.2 based on the findings of the previous work process flow.

Work process after improvement:

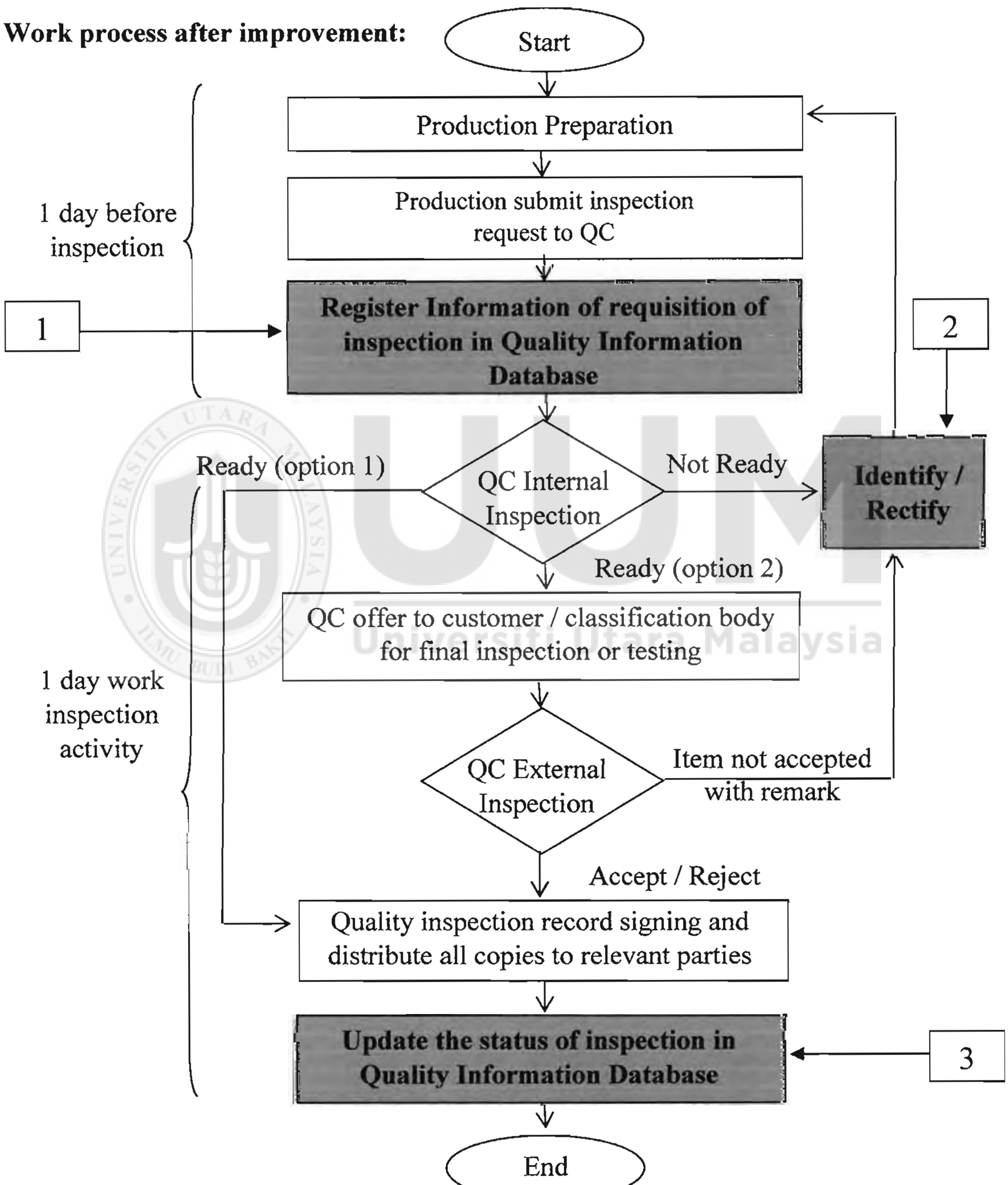


Figure 5.2: New improvement work inspection process flow

The three proposed improvement flows are described below:

1. Register the information of requisition inspection in the Quality Information Database, which in effect will establish a new database system that will record every work activity which will then assist in the preparation of a quality work report. The database must be able to gather all the information that had been filled up by the QC according to the work requisition information from production.

2. Identify and verify the work process. This additional work is on verification for each incomplete work. This process is essential to make sure that each QC does the verification to meet the specifications and to register it in order to avoid any repetition of the problem.

3. Updating the status of work inspection activity in the database system, by using the database system each work inspection activity can be recorded and updated. This process can help QC do the work inspection monitoring and prepare a quality work report.

The internal work inspection process was carried out regularly to reduce any remarks of non-compliance work during any official inspection by the relevant authorities. This is important to make sure that clients were satisfied with the work done by the company.

The production team should also seriously supervise all work construction activity to avoid mistakes and failures and to make sure that each work has been done according to the established specifications before submitting the application form requesting to do the inspection work.

The quality department team needs to collaborate more with the production team to finalize the requirements that are needed to be put in place during the work and inspection activity. In addition, each QC inspector should be meticulous and detailed in their observation in order to avoid unwanted errors during the acceptance work.

It was found that the QC submitted an application to the client or classification bodies to carry out an inspection and final acceptance according to the contractual agreement between the company and the customer.

After doing the inspection activities, the QC is required to prepare a quality inspection report in which every statement and status of the inspection must be written in QIR form. If the activity is not in compliance with the construction standards, the production side should then make the repair works in accordance with the set procedures.

QC is advised to give a full explanation in the event of unsatisfactory results as well as violation of specification to the production. The detailed explanation must be given to the customer if the customer was not satisfied with the results produced by the Production Department.

All representatives involved in the inspection are authorized to sign the inspection form record. This process is important because it provides evidence to all parties who agree with the work inspection activity prepared by the production team. Each copy of this form is distributed and delivered to the parties involved.

With the implementation of this new workflow, there is then a need to create a new unit within the Department of Quality. The new unit will be responsible to coordinate all matters involving the planning of inspection work, handling all reports and documentation including drawings and certification. This is another work recommendation proposed for the company especially the Quality Department.

This section will report to the Head of QAQC which would result in a better flow in work reporting and also distributing the information to others. With the improvement of this work process, the Quality Department should be able to manage the work process flow in a more efficient and seamless manner.

This section is known as the Project Documentation Section. The main responsibility for this section is to manage all work requisitions by the production according to the discipline in Quality Department, including project documentation and quality preparation. This new section also manages the database system in the Quality Department. Refer to Figure 5.3, for the new organizational chart of the Quality Department

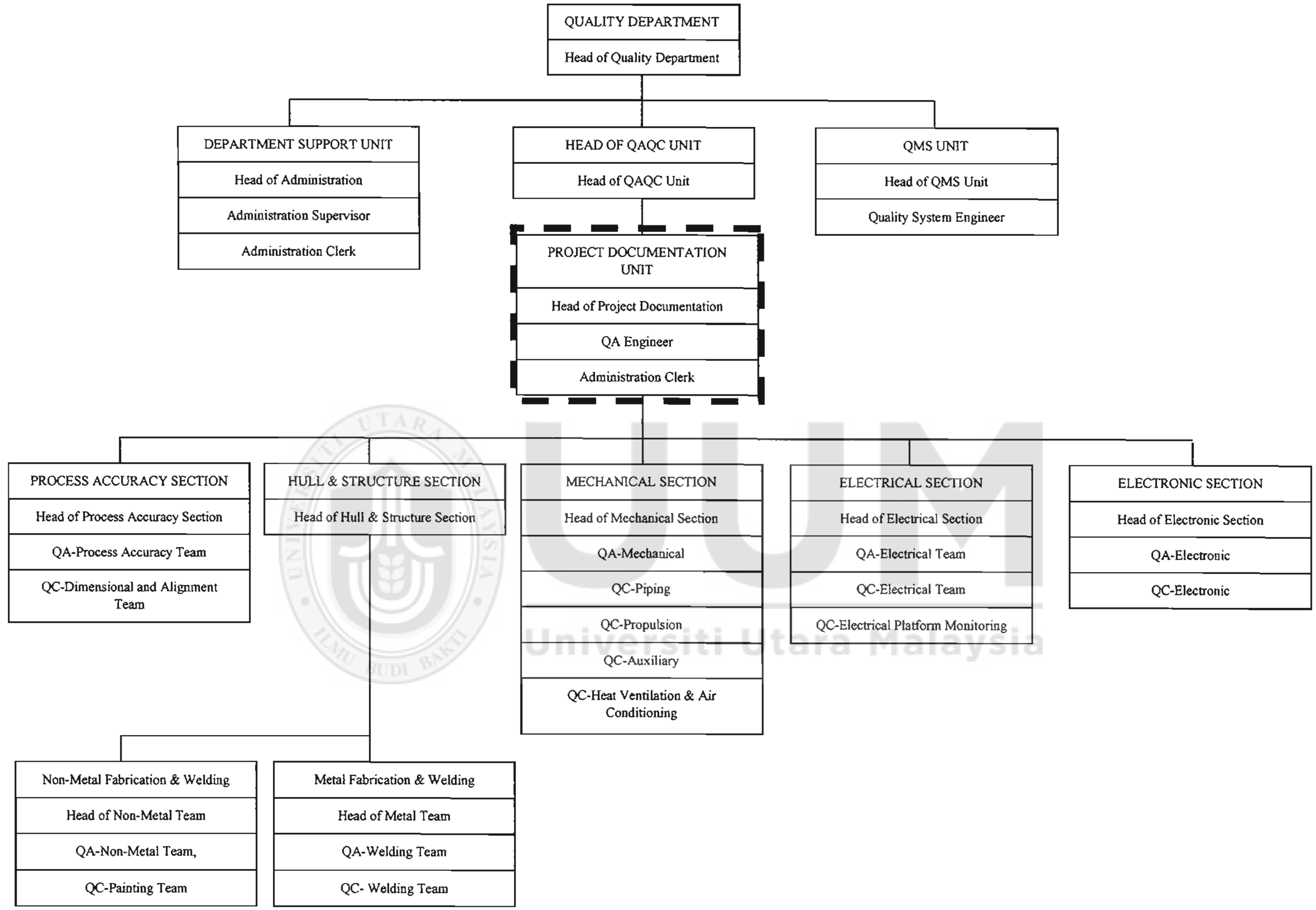


Figure 5.3: The new organization chart for the Quality Department.

Job description for project documentation in the Quality Department are as follows:

1. Managing work inspection planning, receiving all the job tickets and inspection test requests from production and registering them in the system database and to then inform the QC inspector related to the respective field.

2. Updating the status of work inspection activities accordingly.

3. Managing non-conformity issues, especially in work inspection process activities.

4. Conducting work observation and monitoring activities for the Quality Department including audit and workshop survey

5. Managing the preparation of quality report including daily inspection report, monthly, yearly, non-conformities report, progress report and project quality report.

6. Managing the documentation and filing system for all project and quality inspection records for easy traceability and quality audit. Documentation management such as drawing, QIR, certification including material, equipment and calibration, and document protocol for all projects.

7. Liaising with all quality section and support head of QA/QC for any related issue in Quality Department

5.3.1 Work inspection planning

Based on the result of the analysis of Theme No.1, the work inspection planning will be able to manage and oversee properly and accordingly. All work inspection plans prepared by the production will be constantly monitored and continually discussed according to the work construction activity process done by them; this is to ensure the precision of the work construction process, and to reduce or eliminate work redundancy and non-compliance work activity in the production line.

Each inspection that is carried out must be ascertained correctly and in accordance with what was planned. Without any good work planning process, a good quality product cannot be created, and can only result in what is called, *"Designing a plan for failure"*.

Each internal inspection and work monitoring was managed properly by the Quality Department, and the percentage of the good acceptance of inspection work activities was increased as planned.

Improvement in work monitoring must also be implemented in the work process, making sure that the preparation of work in the production line was completed and to also help coordinate the work inspection plan with good quality results. Each work order received was restructured to avoid overlapping with other activities. By ensuring the correct sequence of work inspection activities, the direction of the work planning stayed in line with all the relevant parties.

Communication with the production staff must always be maintained for each activity, with production alerting any matter or activity that is ready for inspection or testing. By submitting a complete application form to the Quality Department, it should help the work inspection process go smoothly. The QC will be able to support with all the relevant documents to make sure that work is done according to specifications.

The obligation for a member of the production to be present during the execution of inspection must always be highlighted and emphasized, with the main reason being that production must not miss any findings or results of the inspections. Production is responsible to make sure that all corrective and repair works be undertaken, as soon as possible according to the agreement with QC and Production.

The closing activity status is important to avoid confusion and to make sure that the results issued is in accordance with the work specifications. QC should always alert and remind the production department in the closing work inspection activity if they have exceeded the specified closing date of the action to be done. This review process was also included in a new procedure for inspection and testing activities.

While the recommendations for improvement were well implemented it did faced some difficulties such as bad feedback and the time taken for the staff to adapt to the new work process. Nevertheless, it was still executed as it was necessary to make sure that the work process runs smoothly as planned

The other important aspect is to make improvements in the production stage. According to the research observation, the work improvement was also implemented in another department. But in this study, the improvement is focused on the Quality Department. The need for improvement on the production work process was added in the future study.

The next step is added to make sure the improvements are going as planned; the Quality Department needs to discuss and inform the production planning in implementing the rules that have been agreed in the inspection and testing procedures. This cooperation is essential to make sure that any improvements made were always clearly understood by all parties.

5.3.2 Work inspection monitoring activities

Based on the results of the research finding for analysis Theme No.2, implementation of the internal inspection as well as work monitoring done by the QC was able to ascertain whether any of the work done by the production was according to the work processes and specifications. QC inspectors were required to prepare all supporting documents and to make sure all notifications submitted to the customer were well prepared according to the quality standard.

The intention for this part is to make sure that all work monitoring activities involving internal inspection, work observation and surveillance are carried out frequently. It implies that, the Quality Department needs to take seriously the work inspection monitoring activities in its ship construction projects.

All QC inspectors must take responsibility in conducting the inspection and / or witnessing the functional test of any items in ship construction activities. QC is also required to make sure that the inspection and / or testing is carried out in accordance with customer requirements as specified in the contract and ITP unless otherwise stated. QC inspectors must hold back any inconsistent and non-compliance work activities done by the production side until corrective action is taken. The production can do the correction work that was mentioned by the QC.

There are few exceptional cases where equipment is supplied by the customer itself, which then will not require the compliance nor approval and subsequent corrective actions by this company. It is totally the customer's responsibility, and this must clearly be defined in the contractual agreement to avoid any future misunderstandings.

To recap, production is required to ensure that all work is fully completed and ready before applying for any inspection requisition. The representative for production must also be present during the work inspection. The cooperation between all departments must be maintained to avoid any complications during the work inspection process especially in the ship construction project.

In discussing the monitoring of the non-conformities record or NCR, it is normally defined as a way to avoid any non-conformities being investigated and suggesting the solution. In the ISO standard, non-conformities normally meant that something had gone wrong and needed to be addressed. A non-conformity could be identified through any complaints received by anyone, normally surfacing out of internal and external audits. QC normally prepares the NCR for any issues that crop up during incoming material inspection and other normal inspection activities.

Without the commitment and involvement of everyone in this company, the execution of the new work process, will not be easy. The difficulties of the new implementation would normally come from the people involved. It is not easy to change any habitual work activities that were done previously. However, with the proper explanation of the new work process, all employees were able to adapt to this process smoothly.

Indeed, Van Der Aalst (2011) mentioned that in each compliance inspection, it should associate with the alignment of business and audit of the goodness; it is also referred as compliance analysis by Rozinat and Van Der Aalst (2008). The non-compliance report is normally to detect inconsistent work process implementations.

5.3.3 Work information management in preparing of work quality report

The next issue is the preparation of a good work quality report. The finding revealed that the Quality Department had failed to prepare a good quality report within the time given.

The crux of this issue is to ensure that the QC staff understand the need to prepare useful information with regard to the work inspection activity that was done. This is to ensure that all information related to the work will not be lost. All information has to be compiled and stored in one place.

The obligation for each QC to submit their work progress and work inspection status should enable all important information be included in the department management report.

Based on the results found in the previous chapter, it was mentioned that QC inspectors had managed their own result of the inspection activities within their circle; each section head had prepared the quality report and submitted it to the Head of Quality Department.

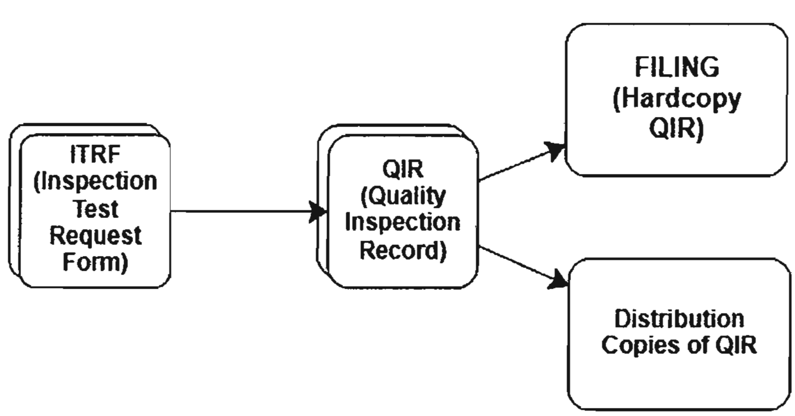
Based on the new work process implementation, QC staff had prepared all the inspection report by updating the inspection status and scan all related documents. This is required as evidence to certify every inspection activity conducted during ship construction process.

With the centralized database system, Quality Department can manage the work planning, work inspection status and preparation of work quality report. A new database was developed based on the requirements and references about the progress and current status of work inspection activities in the Quality Department and also details of the non-compliance record. All generated reports were submitted on a daily or regular basis to senior management for their reference.

With reference to Figure 5.4, the new improved work process is clearly explained. The database system was purposely created to help in the gathering and compiling of all work inspection status and preparation of quality work report activities.

The main purpose of this database is to help the Quality Department in managing and preparing all inspection work process, including the work inspection planning, gathering and compiling all inspection records, and also in preparing quality work report activities.

Previous Work Process Flow



Improved Work Process Flow

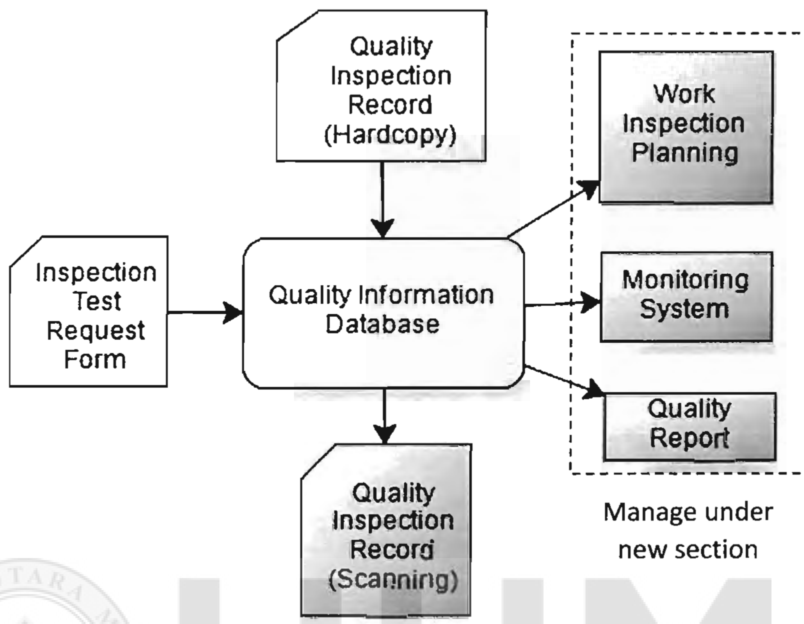


Figure 5.4: Improved quality inspection management system main process

The advantages of this implementation are as follows:

- Work inspection planning is more organized;
- Each work planning and work inspection status are shown in the database. QC staff is able to know the details of the activity according to the date and time of the inspection;
- Work monitoring can be managed properly, including internal inspection and work surveillances;
- Preparation of the quality work report is made on time, including the work analysis and presentation;

- The quality management report is produced in a systematic way with the same format and detail as much as possible;
- Information about work inspection activities can also be gathered in a proper way; and
- Record traceability is more efficient using search record in the database.

In addition, this company is serious about non-conforming work that needed to be repaired, reworked and improved. All the activities involved relatively high expenses. The detailed quality report was able to assist top management to see the real work that was issued by the production. It would give an idea about the work in the company, and to avoid any failure of producing a good quality product to the customer.

5.3.4 Implementation of the new work process

The implementation of the new work process has made a substantial impact on the management of inspection work activities in the Quality Department. It involves the planning, monitoring and preparation of a quality work report. By using a simple database program, it has helped to provide a complete work requirement process in this department.

5.3.4.1 New database model for quality inspection database

A new model was created for this study in order to make improvements for the Quality Department, where a system of quality work inspection database was established to organize an inspection plan, which included work monitoring and analyzing of information in order to prepare a good quality work report. This database program is being fully managed by the Quality Department's Project Documentation Section. This is a prototype database based on the work requirement of this department. The final database system program was created by the Information System Department, based on the template of the previous database.

This prototype model can be used to see the clarity of the work inspection flow process of the Quality Department. By looking at an overall view of this database program, it becomes simple and easy to execute. This program is able to keep all the information, including the soft copy of all the inspection work reports. It is also easy to manage and it can also track back all required information easily.

The database compiled and stored all the work inspection information that has been filled by the project documentation and QC staff. The program had been designed to make the relevant analysis in which it was able to generate quality work reports required by the top management.

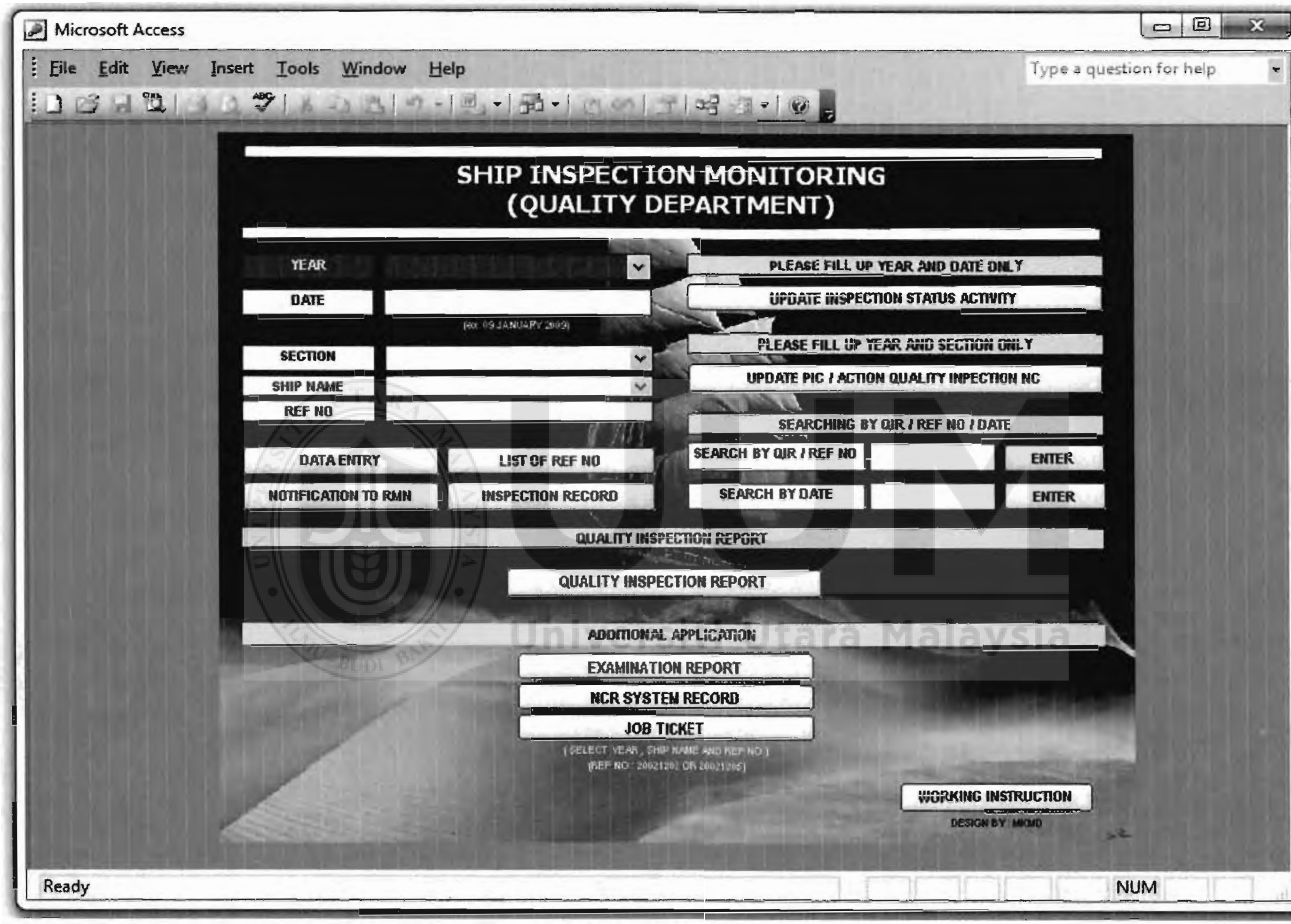


Figure 5.5: A system database model for quality inspection database

Figure 5.5 is the main menu for the database model that was created for the Quality Department. The database is divided into three parts:

(1) Quality Inspection Record,

(2) Quality Inspection Report, and

(3) Additional Application.

Quality Inspection record is the main part of this database program. The project documentation section is required to key in all the related information with regards to the work requisition that had been received from the production planning.

This section needs to inform all QC inspectors in each section related to the work requisition to carry out the work inspection activities. After completing the work inspection, QC inspector is required to update the work inspection status and upload a copy of the relevant documents (QIR or any test record) matching the work activity.

All information record has reference to the date of the work inspection. This helps to facilitate the traceability of the work process if the need for any supporting evidence is required for a certain time period.

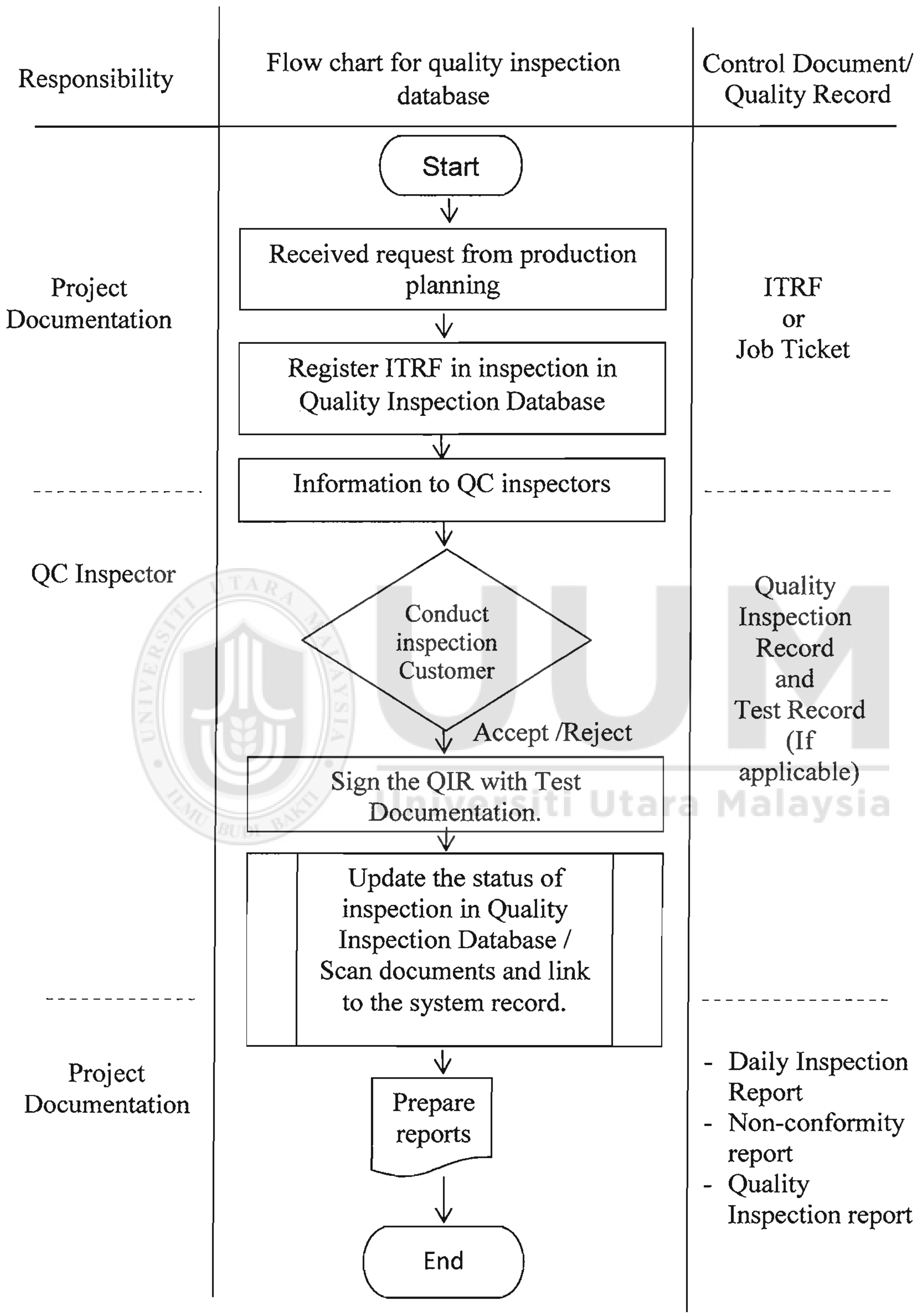


Figure 5.6: A system database model process flow for quality inspection database

The main process work flow for the database program is described in detail as illustrated in Figure 5.6. The work flow that has been implemented in the Quality Department is able to assist in understanding the work process in regulating the database program. It is important to understand the function and how the database program work properly. The database program can be described as follows:

Quality Inspection Record

As mentioned before, the team at the Project Documentation Section is required to key in all the information received from Production Department. The information to be keyed in can be referred to the work requisition form (ITRF). The details in the work requisition form are as follows. Refer APPENDIX E.

- Project
- Order No.
- Reference No
- Activity No.
- Subject or Title of Inspection
- Work No.
- Requester Name
- Receiver Name or section
- Additional information
- Component or Equipment list
- Job Description
- Date of Inspection
- Time of Inspection

- Job Done by or Contractor Name (if available)
- Comment or remark
- Signatures (Requester / Prepared by and Approved by)

The database program has been created based on the information in the work requisition form (ITRF). These inputs are important; each part of the information in the database is able to give the analysis required by the management.

Quality Inspection Report

The quality inspection reports are the responsibility of the Project Documentation Section. The team normally focusses on work management activities, especially in work monitoring and reporting. The team also prepares any relevant quality inspection report in accordance to the requirements of the project, especially on quality work inspection report for the Head of the Quality Department.

The Quality Inspection Report is divided into 5 areas:

1. Quality Inspection Report according to Year and Date selected
2. Quality Inspection Report according to Year and Section selected
3. Quality Inspection Report according to Year and Ship selected
4. Quality Inspection Report according to Year Only
5. Quality Inspection Report according to Year, Section and Ship selected

This quality work report is designed based on the report requirement requested by the management. Each of this report is well explained, including the statistical data and graph. In addition, all reports are created using a standard format and registered in the QMS work procedure.

Additional Application

The part of the program is created according to the work requirement needed to be controlled by the Project Documentation Team. Each of these programs is linked to other management software's. This is just an extra application required by this section; created by just adding a shortcut for each application in order to assist the team to manage the work reporting properly.

This is a model or prototype that was created for this study purposely for the Quality Department. With the improvement of the work process flow, the Head of Quality Department has agreed to use the database program in managing the quality inspection work activities.

It has also been recommended by the management for the quality department to make full use of the system and integrate it with the main server which is operated by the Department of Information Systems; this database program was redesigned to suit the company main server as an official work management process for the Quality Department.

The new data is now being used according to plan and managed by the Project Documentation Section, assisted by the Department of Information Systems. It is also integrated with the previous model, so it was easy to manage and monitor all the work inspection activity using both programs.

5.3.4.2 Total inspection record and record monitoring

From the previous inspection record, it was difficult to get the actual figure of the total number of inspection activities. With the new system information management database, it is now easier to monitor and summarize the total inspection.

This new record monitoring covers the daily inspection record and records of statistic required for quality management report. This process is easy to maintain and monitor. Below is the illustration and cost benefit of this new work process.

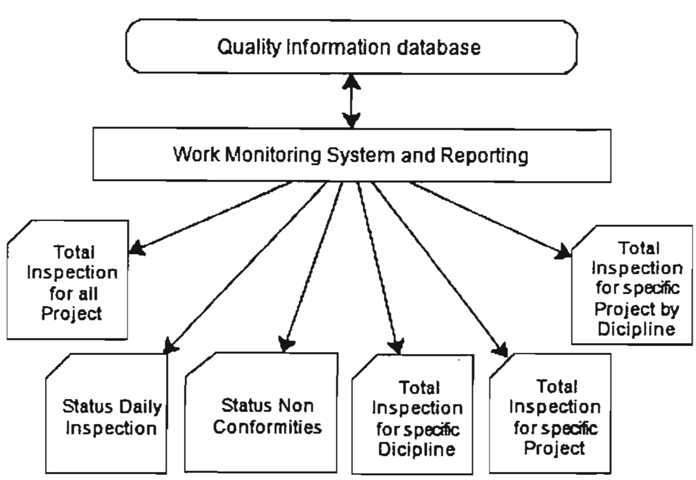


Figure 5.7: New quality report monitoring system

The new system has helped the Quality Department to prepare a good quality work report with actual and accurate measurement. The improvement of the work process has been verified by Head of Quality Department. Refer to Appendix F.

As a result of the implementation of the new work process, the calculation of quality improvement cost is as follow:

1. Information working hour in this company:

Monday - Tuesday				
	8:00 am - 1:00 pm	:	5	hours
	2:30 pm - 5:30 pm	:	3	hours
Friday				
	8:00 am - 12:15 pm	:	4	hours
	2:30 pm - 5:30 pm	:	3	hours

1. Salary for Executive : RM 5000.00 a month
2. Salary for Non-Executive : RM 3000.00 a month

2. Calculation for work hour in normal working day:

Monday to Thursday	:	8.25	hours
Friday	:	7.00	hours

If the previous work process is taken 7 days of normal working day from Monday until next week on Tuesday, the total hour for the flow as follow:

Monday to Thursday :					
	8.25	hours	x	4 =	33.00hours
Friday :					
	7.00	hours	x	1 =	7.00 hours
Monday to Tuesday :					
	8.25	hours	x	2 =	16.5 hours
				Total	56.50 hours

3. Calculation for work payment per day:

   If the executive was paid RM5000.00 per month, and in a month he or she worked for 160 hours, the total payment for an hour's work is RM31.25. Meanwhile the non-executive was paid RM3000.00 per month, and he or she worked for 160 hours in a month, the total payment for an hour is RM18.75.

4. Calculation for previous work process:

   Executive :
   (total hours for 7 days) x (payment per hour)
   = (56.50 hours) x (RM31.25)
   = RM 1765.60

   Non Exec :
   (total hours for 7 days) x (payment per hour)
   = (56.50 hours) x (RM18.75)
   = RM 1059.40

   ** All calculation are rounded up for easy calculation*

5. Calculation for new work improvement work process:

   Based on total work day after improvement from 7 days to 2 days, refer to Figure 5.8, for example the total hour is 16.50 hours.

   Executive :
   (total hours for 2 days) x (payment per hour)
   = (16.50 hours) x (RM31.25)
   = RM 515.60

   Non Exec :
   (total hours for 2 days) x (payment per hour)
   = (16.50 hours) x (RM18.75)
   = RM 309.40

6. Calculation for cost reduction from previous work process to new work implementation:

    a) Executive : RM1765.60 – RM515.60

    = **RM 1093.75**

    b) Non Executive : RM1059.40 – RM309.40

    = **RM 753.00**

Based on the calculation of cost quality improvement, the summarized results of cost reduction can be expressed in percentage terms. The company can save more than 62% for executive and 71% for non-executive for work payment. The gap is big and this is a good result for the work improvement that was implemented in Quality Department. The purpose of this calculation is not to cut down the payment of salary for the staff but to cut down the recruitment for new staff as the workload can be minimized.

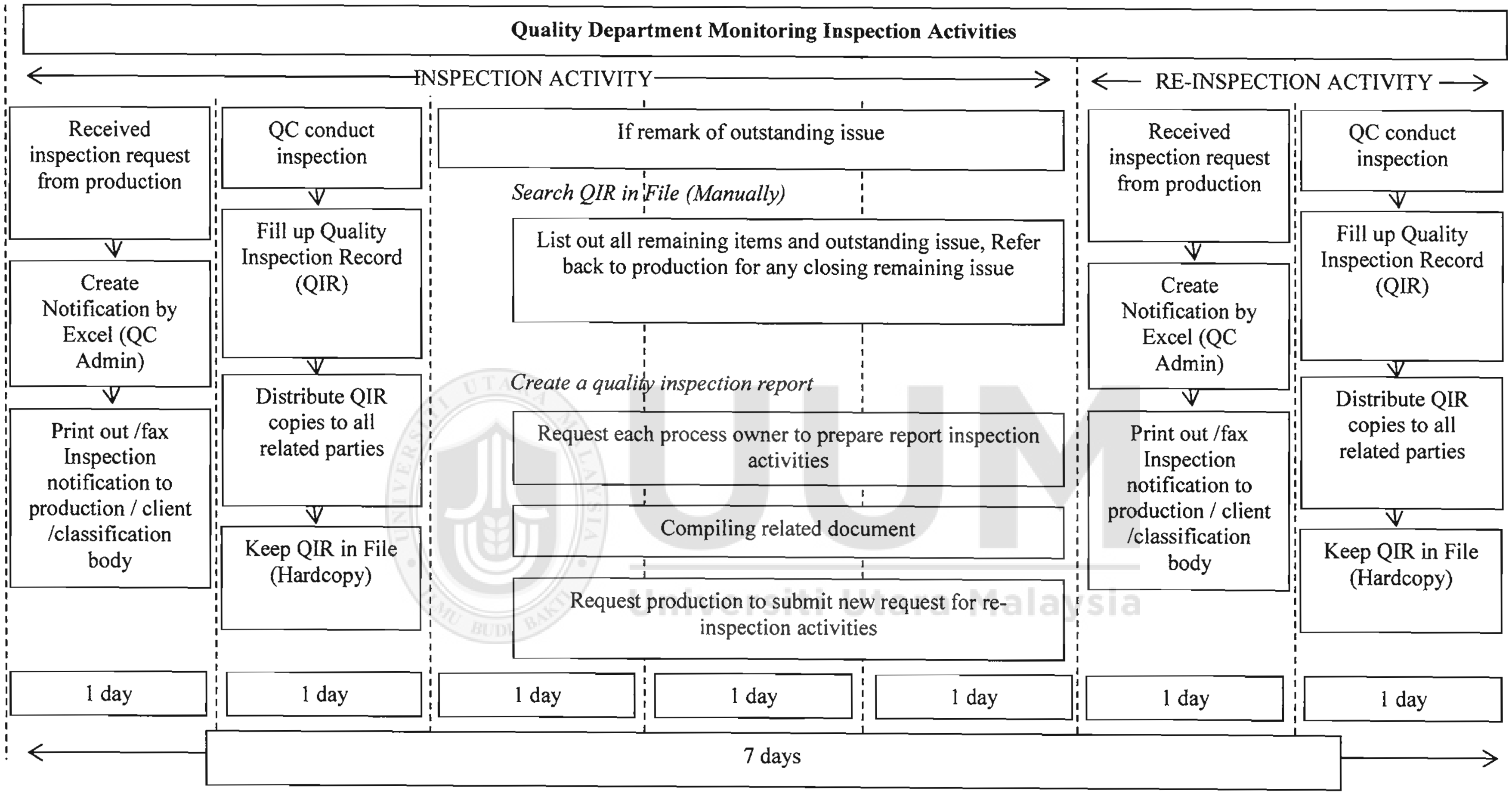


Figure 5.8: Previous system traceability and report preparation

Based on Figure 5.8, the workflow process had taken too long with lots of repetition in the work process, especially in solving and closing any non-conformity records.

Based on the work observation in this study, it was found that the process of closing any non-compliance work had taken at least a week in accordance with the level of non-compliance cases.

The work process flow shown was based on the work activity that was done from the beginning of the inspection until the closing date of the non-conformity issues.

The delay in closing the issue of non-compliance will jeopardize the work completion of the project. In this company, the delay in the completion of a ship will result in a late payment penalty to the customer.

In order to avoid any issues related to failure and delay in completion of projects, the company will scrutinize and analyze the work planning.

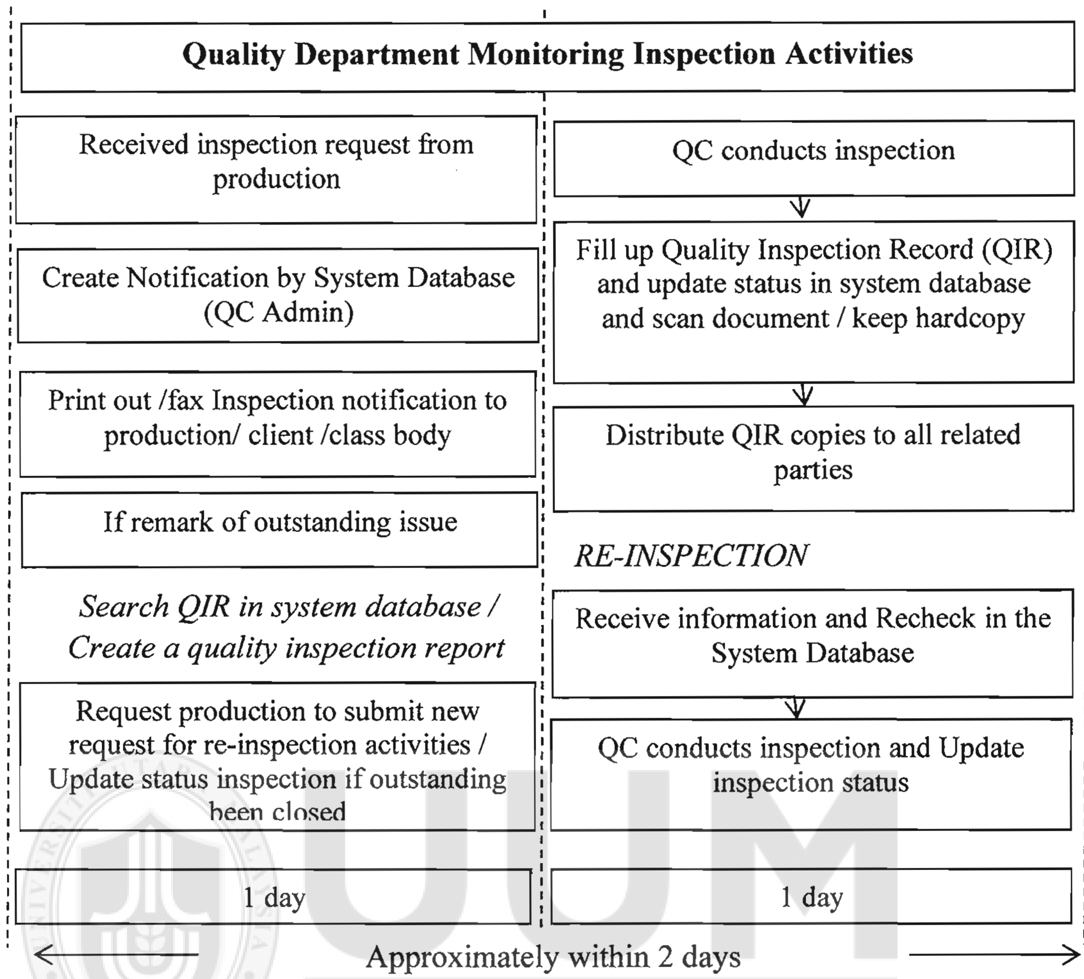


Figure 5.9: New system traceability and report preparation

Based on Figure 5.9, the implementation of the new work process was able to reduce the time in preparing and closing the non-conformities issue.

The work process was reduced approximately to within two (2) days compared to the previous workflow. The monitoring work was done through the database system, while the repetition of recording information that needed to be filled up in the database was avoided because all non-conformity issues had been registered during the inspection activities done by QC.

5.3.4.3 Traceability of documentation record and time report preparation

Documentation of information must be well kept by the company; this is important in order to track and search for information needed to show as work evidence when required. The previous work process only focused on controlling the hard copy records that was managed manually. The new work implementation work is being executed by the Quality Department.

By improving the information systems in the quality management work process, it proves that the previous studies such as Zeng et al. (2007), Detlor (2010), Liang, Lii, and Liang (2011), Zhang (2008), Li and Lin (2006), Wang and Luo (2008), and others are right. The work process in the implementation of quality management in the Quality Department is more efficient than before.

5.3.5 Recommendations for future studies

For future research proposals, it is suggested that researchers identify other ways of collecting information which could be applied to other approaches where possible, and the use other than qualitative case study

By using another approach it might result in a new perspective that is more comprehensive. The study can also be conducted by using mixed methods or action research.

The importance of the research is purposely to achieve the objective and to bring the advantages, especially to the company and academicians. The following are some other areas quality management, especially in ship construction work, which could be carried out in the future:

(1) Recognition of quality in production processes, particularly in reducing rework activities,

(2) Research studies on the process of quality management in controlling the efficiency of the staff,

(3) The relationship gaps between quality management and organization management level.

In this study, it was found that the centralized information management was able to give a good impression of the work process flow in the Quality Department. This process can be duplicated in other departments; the opportunity to use this study as a guideline and as an impetus to produce other research can also be achieved.

Finally, the discussion process in quality management should be taken into account in future studies, especially in naval ship construction. This research study can also be discussed in fields other than shipbuilding management.

5.4 Conclusion

In conclusion, the study has achieved the main objective of finding ways to overcome the difficulties and problems that occur in the implementation of Quality Management especially in the naval ship construction company. Furthermore, it has fulfilled the requirements of an Industrial PhD in accordance with the company's objective, namely identifying the use of quality management knowledge in the quality department of ship construction projects. It has identified the issues that had occurred in during the research, provided an analysis that can benefit the company and contributed to academic knowledge and also enhance the company's vision and mission. Recommendations for future studies have also been proposed which will provide opportunities for others to continue research on quality management, especially in the naval ship construction industry.

Reference

Antony, J. & Taner , T. (2003). A conceptual framework for the effective implementation of statistical process control. *Business Process Management Journal*, *9*(4), 473–489.

Abd. Manaf, N. H. (2005). Quality management in Malaysian public health care. *International Journal of Health Care Quality Assurance*, *18*(3), 204–216.

Azizan Abdullah, (2010). Measuring TQM implementation: a case study of Malaysian SMEs. *Measuring Business Excellence.* 14(3), 3 – 15.

Abdul Rahman, H. (1997). Some observations on the issues of quality cost in construction. *International Journal of Quality & Reliability Management*, *14*(5), 464–481.

Abdul Rashid Abdul Aziz (2002). The realities of applying total quality management in the construction industry. *Structural Survey*, *20*(2), 88–96.

Abusa, F.M. & Gibson, P. (2013). TQM implementation in developing countries: A case study of the Libyan industrial sector. *Benchmarking: An International Journal*, *20*(5), 693–711.

Adnan, H., Rahmat, M.N., Fatanah, N. & Mazali, N. (1985). Risk Management Assessment for Partnering Projects in the Malaysian Construction Industry. *Journal of Politics and Law*, *1*, 76–81.

Ahire, S.L. & Dreyfus, P. (2000). The impact of design management and process management on quality: an empirical investigation. *Journal of Operations Management*. 18, 549-575.

Ahmad, A.A. (2012). The principle of risk management: Sharia perspectives. *Journal of Applied Sciences Research*, *8*, 3335–3343.

Ahuja, R. (2007). Towards an Understanding of Excellence in Urban Pedagogy : A Portrait of a High School, *12*(1), 1–19.

Al-Ani, R., & Al-Adhmawi, F.I. (2011). Implementation of Quality Management Concepts in Managing Engineering Project Site. *Jordan Journal of Civil Engineering*, *5*(1), 89–106.

Alexander, A. (2004). A Qualitative Exploration of Students' Experiences With Tutorial Learning, *Ph.D. Dissertation.*

Ali, A.S., Kamaruzzaman, S.N., Sulaiman, R., & Peng, Y. C. (2010). Factors affecting housing maintenance cost in Malaysia. *Journal of Facilities Management*. 8(4), 285-298

Ali, M. C., Zin, R., Hamid, Z.A. & Ayub, A.R. (2010). Quality Cost In The Construction Industry – Preliminary Findings In Malaysia. *Journal of Design and Build Environment*, *6*, 29–43.

Al-Najjar, B. & Alsyouf, I. (2000). Improving effectiveness of manufacturing systems using total quality maintenance. *Integrated Manufacturing Systems*, *11*(4), 267–276.

Al-Saket, A. (2003). A Case Study of Total Quality Management in a Manufacturing and Construction Firm. *Ph.D. Dissertation*.

Amedy, L. (1999). *A Qualitative Study of Female Superintendents: Leadership Behaviors in Context*. Doctoral dissertation,Virginia Polytechnic Institute and State University.

Ammar, A., Kayis, B. & Amornsawadwatana, S. (2007). A review of techniques for risk management in projects. *Benchmarking: An International Journal*, *14*(1), 22–36.

An, M. & Ahmad, H. S. (2010). Knowledge Management in Construction Projects: A Way Forward in Dealing with Tacit Knowledge. *International Journal of Information Technology Project Management*, *1*(2), 16–42.

Anderson, C.A., Pettersson, F.H., Clarke, G.M., Cardon, L.R., Morris, A.P. & Zondervan, K.T. (2010). Data quality control in genetic case-control association studies. *Nature Protocols*, *5*(9), 1564–1573.

Antony, J. & Taner, T. (2003). A conceptual framework for the effective implementation of statistical process control. *Business Process Management Journal*, *9*(4), 473–489.

Appaia, L., Muthu, P., Sankaran, K., Appaia, L., Muthu, P., Sankaran, K.R. (2014). Article information : *International Journal of Quality & Reliability Management*, *31*(8), 950–962.

Arditi, D. & Gunaydin, H. M. (1997). Total quality management in the construction process. *International Journal of Project Management*. *15*(4), 235-243.

Arshida, M.M. (2012). Critical Success Factors (CSFs) for TQM Implementation: Current Status and Challenges in Libyan Manufacturing Companies. *GSTF Journal on Business Review*, *2*(1).

Arumugam, V., Ooi, K.B. & Fong, T.C. (2008). TQM practices and quality management performance: An investigation of their relationship using data from ISO 9001:2000 firms in Malaysia. *The TQM Journal*, *20*(6), 636–650.

Azaran, M. (2008). Programme management as a framework for the whole quality management life cycle - a case study of esc lille. *Management*, 309.

Baccarini , D., Salm , G. & Love , P. E. D. (2004). Management of risks in information technology projects. *Industrial Management & Data Systems*, *104*(4), 286–295.

Badrick, T. (2003). Quality leadership and quality control. *The Clinical Biochemist. Reviews / Australian Association of Clinical Biochemists*, *24*(3), 81–93.

Baldassarre, M.T., Boffoli, N., Bruno, G. & Caivano, D. (2009). Statistically based process monitoring: Lessons from the trench. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, 5543, 11–23.

Barateiro, J., Antunes, G., Freitas, F. & Borbinha, J. (2010). Designing Digital Preservation Solutions: A Risk Management Based Approach. *International Journal of Digital Curation*. 5 (1), 4-17

Barber, P., Graves, A., Hall, M., Sheath, D. & Tomkins, C. (2000). Quality failure costs in civil engineering projects Patrick. *International Journal of Quality & Reliability Management*, *17*(4/5), 479–492.

Batson, R.G. & McGough, K.D. (2006). Quality Planning for the Manufacturing Supply Chain. *The Quality Management Journal*, *13*, 33–42.

Battikha, M.G. (2003). Quality management practice in highway construction. *International Journal of Quality & Reliability Management*.

Baxter, P. & Cotter, J. (2009). Audit committees and earnings quality. *Accounting & Finance*, *49*(2), 267–290.

Baxter, P. & Jack, S. (2008). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *The Qualitative Report Volume*, *13*(4), 544–559.

Bayazit, O. & Karpak, B. (2007). An analytical network process-based framework for successful total quality management (TQM): An assessment of Turkish manufacturing industry readiness. *International Journal of Production Economics*, *105*(1), 79–96.

Bednarek-Michalska, B. (2002). Creating a job description for an electronic resources librarian. *Library Management*, *23*(8/9), 378–383.

Besner, C. & Hobbs, B. (2012). The paradox of risk management; a project management practice perspective. *International Journal of Managing Projects in Business*, *5*(2), 230–247.

Bettayeb, B., Bassetto, S. J. & Sahnoun, M. (2014). Quality control planning to prevent excessive scrap production. *Journal of Manufacturing Systems*, *33*(3), 400–411.

Bogdan, R. C. & Biklen, S. K. (2003). Bogdan, R. C & Biklen, S. K. (2003). Qualitative Research for Education: An introduction to Theories and Methods (4th ed.). *New York: Pearson Education group.* (110-120).

Boisdeffre, M. (2006). The importance of records management in France. *Records Management Journal*. 16(2), 76-80.

Borglund, E. & Engvall, T. (2014). Open data?, *Records Management Journal*, *24*(2), 163–180.

Briner, M., Kessler, O., Pfeiffer, Y., Wehner, T. & Manser, T. (2010). Assessing hospitals' clinical risk management: Development of a monitoring instrument. *BMC Health Services Research*, *10*, 337.

Brooke, C. (1994). Information Technology and the Quality Gap. *Employee Relations*. 16 (4), 22-34.

Bryman, A. (2004). Triangulation and measurement. *In Encyclopedia of Social Science Research Methods*.

Bunney, H.S. & Dale, B.G. (1997). The implementation of quality management tools and techniques: a study. *The TQM Magazine*. 9 (3), 183–189.

Bustelo-Ruesta, C. (2011). The big issues related to document and record management: challenges and opportunities. *Profesional De La Informacion*, *20*(2), 129–133.

Cairns, D. A. (2011). Statistical issues in quality control of proteomic analyses: Good experimental design and planning. *Proteomics*. *11*(6), 1037-1048.

Cameron, K. S. & Quinn, R. E. (2011). An Introduction to changing organisational culture: Based on the competing values framework. *Diagnosing and Chaning Organisational Culture*, 1–12.

Campmans-Kuijpers, M.J.E., Lemmens, L.C., Baan, C.A., Gorter, K.J., Groothuis, J., Van Vuure, K.H. & Rutten, G.E.H.M. (2013). Defining and improving quality management in Dutch diabetes care groups and outpatient clinics: design of the study. *BMC Health Services Research*, *13*, 129.

Cassell, C., Buehring, A., Symon, G. & Johnson, P. (2006). Qualitative methods in management research: an introduction to the themed issue. *Management Decision*. 44(2) 161-166

Catterall, M. (1996). Using computer programs to code qualitative data. *Marketing Intelligence & Planning*. 4,29-33.

Chan, A.P. & Tam, C. . (2000). building projects in Hong Kong. *International Journal of Quality & Realiability Management*, *17*(4/5), 423–442.

Chandar, N., Chang, H. & Zheng, X. (2012). Does overlapping membership on audit and compensation committees improve a firm's financial reporting quality? *Review of Accounting and Finance*. 11(2), 141-165.

Chihuri, S. & Pretorius, L. (2010). Managing Risk For Success In A South African Engineering And Construction. *South African Journal of Industrial Engineering*, *21*(2), 63–77.

Chin, S., Kim, K. & Kim, Y.S. (2003). A process-based quality management information system. *Automation in Construction*. 13(2), 241-259

Chopra, A. & Garg, D. (2012). Introducing models for implementing cost of quality system. *The TQM Magazine*, *24*(6), 498–504.

Chopra, A. & Gargr, D. (2011). Behavior patterns of quality cost categories. *The TQM Magazine*, *23*(5), 510–515.

Chua, R.T. Mosley, P., Wright, G.A.N., & Zaman, H. (2000). Microfinance, Risk Management, and Poverty. Study submitted to: Office of *Microenterprise Development*, USAID.

Clegg, B., Rees, C. & Titchen, M. (2010). A study into the effectiveness of quality management training: A focus on tools and critical success factors. *The TQM Journal*. 22(2), 188-208.

Cleveland, D. A. & Soleri, D. (2005). Rethinking the risk management process for genetically engineered crop varieties in small-scale, traditionally based agriculture. *Ecology and Society*. 10(1), 9.

Cohanier, B. (2014). Qualitative Research in Accounting & Management Article information : *Qualitative Research in Accounting & Management*, *11*(4), 380–415.

Colledani, M., Tolio, T., Fischer, A., Iung, B., Lanza, G., Schmitt, R. & Váncza, J. (2014). Design and management of manufacturing systems for production quality. *CIRP Annals - Manufacturing Technology*, *63*(2), 773–796.

Craig, N. & Sommerville, J. (2007). Records management and information processing on construction sites using digital pen and paper. *Records Management Journalo*, *17*(3), 201–215.

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, 11, 100.

Cuellar, M. (2010). Assessing Project Success: Moving Beyond the Triple Constraint. *International Research Workshop on IT Project Management*, 13, 19-28

Dagbjartsdottir, S. (2012). Quality Status and Quality Aspects in The Icelandic Construction Industry.

Dai, W., Maropoulos, P. G., Tang, X., Huo, D. & Cai, B. (2010). Quality planning based on risk assessment. *Advances in Intelligent and Soft Computing (AISC)*, 223.

Dang, V. M., Francois, P., Batailler, P., Seigneurin, A., Vittoz, J.-P., Sellier, E., … `re. (2014). Medical record-keeping and patient perception of hospital care quality. *International Journal of Health Care Quality Assurance*, *27*(6), 531–542.

Dave, B., & Koskela, L. (2009). Collaborative knowledge management - A construction case study. *Automation in Construction*, *18*, 894–902.

Davenport, T. H. (2011). Rethinking knowledge work : A strategic approach. *McKinsey Quarterly*, 1, 1–11.

Dehghan, M., Dehghan, D., Sheikhrabori, A., Sadeghi, M., & Jalalian, M. (2013). Quality improvement in clinical documentation: Does clinical governance work? *Journal of Multidisciplinary Healthcare*, 6, 441–450.

Denney, A.S. & Tewksbury, R. (2012). How to Write a Literature Review. *Journal of Criminal Justice Education*. 24 (2), 218-234

Denzin, N.K. & Lincoln, Y.S. (2006). Introduction The Discipline and Practice of Qualitative Research. In *Handbook of Qualitative Research,* 1–20.

Detlor, B. (2010). Information management. *International Journal of Information Management*, 30(2), 103–108.

DeWalt, K. M., & DeWalt, B. R. (2010). *Participant Observation: A Guide for Fieldworkers*. Rowman Altamira

Dickinson, D. & Villeval, M.C. (2008). Does monitoring decrease work effort?. The complementarity between agency and crowding-out theories. *Games and Economic Behavior*, *63*(1), 56–76.

Dodge, P.R. (2011). Managing school behavior : a qualitative case study. Iowa State University.

Dudgikar, A. C. S., Kumthekar, E. M. B., & Khot, E. S. . (2012). Development of ERP Module for Quality Management in Construction Industry. *International Journal of Electronics and Communications*, *1*(1), 29–40.

Duffner, F., Freudenstein, D., Hohenstein, F., Skalej, M. & Grote, E. H. (2001). Quality planning for minimally invasive procedures in neurosurgery. *Minimally Invasive Neurosurgery : MIN*, *44*(2), 95–98.

Duranti, L. (1999). Concepts and principles for the management of electronic records , or records management theory is archival diplomatics 1. *Records Management Journal*, *9*(3), 149–171.

East, E. W., Kirby, J. G., & Liu, L. Y. (2008). Verification and validation of a project collaboration tool. *Automation in Construction*, *17*(2), 201–214.

Egbuji, A. (1999). Risk management of organisational records. *Records Management Journal*, *9*(2), 93–116.

Eldridge, S., Balubaid, M. & Barber, K. (2006). Using a knowledge management approach to support quality costing. *International Journal of Quality & Reliability Management*, *23*(1), 81–101.

Elg, M., Olsson, J. & Dahlgaard, J. J. (2008). Implementing statistical process control: an organizational perspective Mattias. *International Journal of Quality & Reliability Management*, *25*(6), 545–560.

Elghamrawy, T. & Shibayama, T. (2008). Total Quality Management Implementation in the Egyptian. *Journal of Management Engineering*, *24*(3), 156–161.

Erel, E. & Ghosh, J.B. (1997). ISO 9000 implementation. *International Journal of Operations & Production Management*, *17*(12), 1233–1246.

Evangelidis, A. (2005). FRAMES - A Risk Assessment Framework for e-Services. *Electronic Journal of E-Government*, *2*, 21–30.

Fernandez, D.J.(2008). Agile project management : Agilism versus traditional approaches. *The Journal of Computer Information Systems*, *49*(2), 10–17.

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*. *12*(2), 219-245

Flyvbjerg, B. (2011). Case study. *The Sage Handbook of Qualitative Research* , 301–316.

Foster, S. T. (2008). Towards an understanding of supply chain quality management. *Journal of Operations Management*, *26*(4), 461–467.

Fournier-Bonilla, S. D., Watson, K. L. & Malave, C. (2000). Quality planning in engineering education: Analysis of alternative implementations of a new first-year curriculum at Texas AM University. *Journal of Engineering Education*, *89*(3), 315 – 322+388+390+393.

Freeman, J.M. (2008). The case for quality costing simulation. *The TQM Magazine*, 20(5), 476–487.

Friedman, K. (2003). Theory construction in design research: criteria: approaches, and methods. *Design Studies*, 24(6), 507–522.

Friman, M. (2004). Implementing Quality Improvements in Public Transport. *Journal of Public Transportation*, 7(4), 49–65.

Ge, Z., Song, Z. & Gao, F. (2013). Review of Recent Research on Data-Based Process Monitoring. *Industrial & Engineering Chemistry Research*, *52*(10), 3543–3562.

Gelle, E., & Karhu, K. (2003). Information quality for strategic technology planning. *Industrial Management & Data Systems*. *103*(8), 633-643.

Gerring, J. (2004). What is a case study and what is it good for? *American Political Science Review*, *98*(02), 341–354.

Giri, B.C. & Dohi, T. (2007). Inspection scheduling for imperfect production processes under free repair warranty contract. *European Journal of Operational Research*, *183*(1), 238–252.

Gomes, W.J.S., Beck, A.T. & Haukaas, T. (2013). Optimal inspection planning for onshore pipelines subject to external corrosion. *Reliability Engineering and System Safety*, *118*, 18–27.

Gordon, C., Akinci, B. & Garrett, J.H. (2007). Formalism for Construction Inspection Planning: Requirements and Process Concept. *Journal of Computing in Civil Engineering*.

Gregory, K. (2005). Implementing an electronic records management system: A public sector case study. *Records Management Journal*, *15*(2), 80–85.

Gremyr, I. & Elg, M. (2014). A developmental view on implementation of quality management concepts. *International Journal of Quality and Service Sciences*.

Groocock, J. (2006). Perspectives The impact of powerful and weak customers on quality assurance systems and quality improvement programs.

Guidi, G.C., Poli, G., Bassi, A., Giobelli, L., Benetollo, P.P. & Lippi, G. (2009). Development and implementation of an automatic system for verification, validation and delivery of laboratory test results. *Clinical Chemistry and Laboratory Medicine : CCLM / FESCC*, 47(11), 1355–1360.

Gunnlaugsdóttir, J. (2002). The quality must be on record: a survey of organisations having an ISO 90 00 certification in Iceland. *Records Management Journal*, 12(2), 40–47.

Gunter, E. & Peled, D. (2005). Model checking, testing and verification working together. *Formal Aspects of Computing*, 17(2), 201–221.

Gustavsson, M., & Wänström, C. (2009). Assessing information quality in manufacturing planning and control processes. *The International Journal of Quality & Reliability Management*, *26*(4), 325–340.

Harrington, H.J. (1999). Performance improvement: a total poor-quality cost system. *The TQM Magazine*, *11*(4), 221–230.

Hassan, A., Baksh, M. S. N., & M.Shaharoun, A. (2000). Issues in quality engineering research. *International Journal of Quality & Realiability Management*, *17*(8), 858-875.

Haug, A., Zachariassen, F., & van Liempd, D. (2011). The costs of poor data quality. *Journal of Industrial Engineering and Management*.,4(2) ,168-193.

Haupt, T.C. & Whiteman, D.E. (2004). Inhibiting factors of implementing total quality management on construction sites. *The TQM Magazine*, *16*(3), 166–173.

Hayati Habibah, A.T., Khairul Anuar, M.A.& Fazli, I. (2014). Critical success factors of quality management practices among SMEs in the food processing industry in Malaysia. *Journal of Small Business and Enterprise Development*, 21(1), 152–176.

Healy, S. (2010). ISO 15489 Records Management: its development and significance. *Records Management Journal*, 20(1), 96–103.

Henderson, J., Mcadam, R. & Ireland, N. (2000). Managing quality in project- based emerging network organisations. *International Journal of Quality & Realiability Management*, 17(4/5), 364–376.

Hoonakker, P., Carayon, P. & Loushine, T. (2010). Barriers and benefits of quality management in the construction industry: An empirical study. *Total Quality Management & Business Excellence*. 21(9), 953-969.

Hu, H., Cheng, C., Chiu, S., & Hong, F. (2010). A study of customer satisfaction , customer loyalty and quality attributes in Taiwan ' s medical service industry. *Water*, 5(1), 187–195.

Hunter, J. (2002). Improving organizational performance through the use of effective elements of organizational structure. *Leadership in Health Services*, 15(3), 12–21.

Hurley, A.A. (2001). Components of quality control. *Current Protocols in Cytometry - Chapter 3*, Unit 3.2.

Idris, M.A., McEwan, W. & Belavendram, N. (1996). The adoption of ISO 9000 and total quality management in Malaysia. *The TQM Magazine*. 8(5), 65 – 68.

Irianto, D. (1995). On the in-process inspection. *International Journal of Quality & Realiability Management*, *12*(9), 110–122.

Ishikawa, K. (1981). What is total quality control : The Japanese way.

Jabnoun, N. (2002). Control processes for total quality management and quality assurance. *Work Study*, 51(4), 182–190.

Jabnoun, N. (2005). Organizational structure for customer-oriented TQM: an empirical investigation. *The TQM Magazine*, 17(3), 226–236.

Jafari, S. M., & Setak, M. (2010). Total Quality Management Tools And Techniques: The Quest For An Implementation Roadmap. *Proceedings of the AGBA 7th World Congress*, 1(3), 1–12.

Jepsen, D.M. & Rodwell, J.J. (2008). Convergent interviewing: a qualitative diagnostic technique for researchers. *Management Research News*. *31*(9), 650-658.

Jirwe, M. (2011). Analysing qualitative data. *Nurse Researcher*, 18(3), 4–5.

Joe Qin, S. (2003). Statistical process monitoring: basics and beyond. *Journal of Chemometrics*, 17(8-9), 480–502.

Johnston, A., (2014),"Rigour in research: theory in the research approach", *European Business Review*, 26(3), 206 – 217.

McKinner Jr, E.H. & Yoos II, C.J. (2010). Information About Information: A Taxonomy of Views. *Mis Quarterly*, *34*(2), 329–344.

Juran, M. (1986). The Quality Trilogy. *Quality Congress*, 19(8), 19–24.

Juran, M. & Gryna, F.M. (1988). *Quality Control Handbook. 5th Ed McGrawHill 1998.*

Juran, M., & Godfrey, A. B. (1998). *Juran's Quality Handbook.* (J. M.Juran & A. B. Godfrey, Eds.) (Fifth Edit.). Un: McGraw-Hill.

Kang, L. & Albin, S.L. (2000). On-line monitoring when the process yields a linear profile. *Journal of Quality Technology*, 32(4), 418–426.

Kano, M. & Nakagawa, Y. (2008). Data-based process monitoring, process control, and quality improvement: Recent developments and applications in steel industry. *Computers & Chemical Engineering*.

Kano, M., Hasebe, S., Hashimoto, I. & Ohno, H. (2002). Statistical process monitoring based on dissimilarity of process data. *AIChE Journal*, 48(6), 1231–1240.

Kapoulas, A. (2012). Understanding challenges of qualitative research: rhetorical issues and reality traps. *Qualitative Market Research: An International Journal. 15*(4), 354-368.

Karia, N. & Abu Hassan Asaari, M.H. (2006). The effects of total quality management practices on employees' work-related attitudes. *The TQM Magazine*, 18(1), 30–43.

Keng, T.C. & Abdul Rahman, H. (2011). Study of Quality Management in Construction Projects. *Chinese Business Review*, *10*(7), 542–552.

Khan, A.H., Azhar, S. & Mahmood, A. (2008). Quality Assurance and Control in the Construction of Infrastructure Services in Developing Countries – A Case Study of Pakistan. *First International Conference on Construction in Developing Countries*, 109–120.

Kheradia, A. (2011). Talevas Model: An Integrated Quality Methodology. *The TQM Journal*, 23(4), 403–422.

Kishida, K. (2003). Techniques of document clustering: A review. *LIBRARY AND INFORMATION SCIENCE*, (49), 33–75.

Kläs, M., Nakao, H., Elberzhager, F. & Münch, J. (2010). Support planning and controlling of early quality assurance by combining expert judgment and defect data- A case study. In *Empirical Software Engineering,* 15, 423–454.

Kleywegt, G.J. (2007). Quality control and validation. *Methods in Molecular Biology (Clifton, N.J.)*, 364, 255–272.

Köcher, T., Pichler, P., Swart, R. & Mechtler, K. (2011). Quality control in LC-MS/MS. *Proteomics*, 11(6), 1026–1030.

Krasachol, L., & Tannock, J. D. . (1999). A study of TQM implementation in Thailand. *International Journal of Quality & Realiability Management*, 16(5), 418–432.

Külcü, Ö. (2009). Quality documentation and records management: a survey of Turkish universities. *Aslib Proceedings*, 61(5), 459–473.

Kululanga, G. & Kuotcha, W. (2010). Measuring project risk management process for construction contractors with statement indicators linked to numerical scores. *Engineering , Construction and Architectural Management*, 17(4), 336–351.

Kunkel, S., Rosenqvist, U. & Westerling, R. (2007). The structure of quality systems is important to the process and outcome, an empirical study of 386 hospital departments in Sweden. *BMC Health Services Research*, *7*, 104

Landin, A. (2000). *Impact of Quality Management in the Swedish Construction Process*. Lund Institute of Technology.

Lau, R.S.M., Zhao, X.,& Xiao, M. (2004). Assessing quality management in China with MBNQA criteria. *International Journal of Quality & Reliability Management*, *21*(7), 699–713.

Laurie, C.C., Doheny, K.F., Mirel, D.B., Pugh, E.W., Bierut, L.J., Bhangale, T. & Weir, B.S. (2010). Quality control and quality assurance in genotypic data for genome-wide association studies. *Genetic Epidemiology*, *34*(6), 591–602.

Lee, C.Y. & Zhou, X. (2000). Quality management and manufacturing strategies in China. *International Journal of Quality & Realiability Management*, *17*(8), 876–899.

Leong, T.K., Zakuan, N., Mat Saman, M.Z., Ariff, M.S.M. & Tan, C.S. (2014). Using project performance to measure effectiveness of quality management system maintenance and practices in construction industry. *The Scientific World Journal*. 2014.

Leopoulos, V. & Chatzistelios, G. (2014). Quality management systems development based on a production systems taxonomy. *The TQM Journal*, *26*(2), 215–229.

Levner, E., Zuckerman, D. & Meirovich, G. (1998). Total quality management of a production-maintenance system: A network approach. *International Journal of Production Economics*. 56, 407-421

Li, S. & Lin, B. (2006). Accessing information sharing and information quality in supply chain management. *Decision Support Systems*, 42(3), 1641–1656.

Liang, D.H., Lii, P. & Liang, D.S. (2011). Quality management of rural and urban planning. *2011 International Conference on Multimedia Technology*, 4038–4041.

Liang, K. (2010). Aspects of Quality Tools on Total Quality Management. *Modern Applied Science*, 4(9), 66–74.

Liberatore, M. J. & Pollack-Johnson, B. (2013). Improving project management decision making by modeling quality, time, and cost continuously. *IEEE Transactions on Engineering Management*, 60(3), 518–528.

Lillrank, P. (2003). The quality of information. *International Journal of Quality & Reliability Management*, 20(6), 91–703.

Lin, W.C., Tsai, C.F. & Ke, S.W. (2014). Dimensionality and data reduction in telecom churn prediction. *Kybernetes*, 43(5), 737–749.

Lin, Y.H., Chen, J.M. & Chen, Y.C. (2011). The impact of inspection errors, imperfect maintenance and minimal repairs on an imperfect production system. *Mathematical and Computer Modelling*, *53*(9-10), 1680–1691.

Linderman, K., Schroeder, R.G., Zaheer, S., Liedtke, C. & Choo, A.S. (2004). Integrating quality management practices with knowledge creation processes. *Journal of Operations Management*, 22(6), 589–607.

M.Yusof, Z. & W.Chell, R. (1998). The eluding definitions of records and records management : is a universally acceptable definition possible ? Part 1 . Defining the record. *Records Management Journal*, 8(2), 95–112.

Ma, H., Zhou, T.C., Lyu, M.R. & King, I. (2011). Improving Recommender Systems by Incorporating Social Contextual Information. *ACM Transactions on Information Systems*. *29*(2), 9.

Mad-Lazim, H., Ramayah, T. & Ahmad, N. (2008). Total productive maintenance and performance: A Malaysian SME experience. *International Review of Business Research Papers*, 4(4), 237–250.

Mahajan, R., Agrawal, R., Sharma, V. & Nangia, V. K. (2014). Factors affecting Quality of Management Education in India: An Interpretive Structural Modelling Approach. *International Journal of Educational Management*, *28*(4), 4.

Mahanti, R., & R. Evans, J. (2012). Critical success factors for implementing statistical process control in the software industry. *Benchmarking: An International Journal*, 19(3), 374–394.

Mason, B. & Antony , J. (2000). Statistical process control: an essential ingredient for improving service and manufacuring quality. *Managing Service Quality*, 10(4), 233–238.

McDonald, J. (2010). Records management and data management: closing the gap. *Records Management Journal*, 20(1), 53–60.

McLeod, J., Childs, S. & Heaford, S. (2007). Records management capacity and compliance toolkits: a critical assessment. *Records Management Journal*, 17(3), 216–232.

McManus, J. & Wood-Harper, T. (2007). Software engineering: a quality management perspective. *The TQM magazine*, *19*(4), 315-327.

Meiling, J., Backlund, F. & Johnsson, H. (2012). Managing for continuous improvement in off-site construction: Evaluation of lean management principles. *Engineering, Construction and Architectural Management*, *19*(2), 141–158.

Milliken, J. & Colohan, G. (2004). Quality or Control? Management in Higher Education. *Journal of Higher Education Policy and Management*. *26*(3), 381-392

Mjema, E.M., Victor, M. & Mwinuka, M.S. (2005). Analysis of roles of IT on quality management. *The TQM Magazine*, *17*(4), 364–374.

Montgomery, D. (2009). Introduction to statistical quality control. *John Wiley & Sons Inc.*

Nelson, R.R., Todd, P.A. & Wixom, B.H. (2005). Antecedents of Information and System Quality: An Empirical Examination Within the Context of Data Warehousing. *Journal of Management Information Systems*, *21*(4), 199–235.

Oberkampf, W.L. & Trucano, T.G. (2002). Verification and validation in computational fluid dynamics. *Progress in Aerospace Sciences*, *38*(3), 209–272.

Omachonu , V.K., Suthummanon , S. & Einspruch, N.G. (2004). The relationship between quality and quality cost for a manufacturing company. *International Journal of Quality & Reliability Management*, *21*(3), 277–290.

Omar, M.K. & Murgan, S. (2014). An improved model for the cost of quality. *International Journal of Quality & Reliability Management*, *31*(4), 395–418.

Oney-yazic, E., Arditi, D. & Uwakweh, B.O. (2006). Organizational Culture In U.S Construction Companies. *Joint International Conference on Construction, Culture, Innovation and Management*. Dubai, United Arab Emirates (UAE), 26-29 November. Dubai: The British University in Dubai, 219-228.

Padmanabhan, P. & Lutz, R.R. (2005). Tool-supported verification of product line requirements. In *Automated Software Engineering* , 12, 447–465.

Paszkiewicz, K. H., Farbos, A., O'Neill, P. & Moore, K. (2014). Quality control on the frontier. *Frontiers in Genetics*. 5, 157.

Pheng, L.S. & Shiua, S. C. (2000). The maintenance of construction safety : riding on ISO 9000 quality management systems. *Journal of Quality in Maintenance Engineering*, 6(1), 28–44.

Pheng, L.S. & Yeo, H.K.C. (1997). ISO 9000 quality assurance in Singapore ' s construction industry : an update. *Structural Survey*, 15(3), 113–117.

Phua, F.T.T. & Rowlinson, S. (2004). How important is cooperation to construction project success? A grounded empirical quantification. *Engineering, Construction and Architectural Management*, *11*(1), 45–54.

Pinto, M. (2006). Data representation factors and dimensions from the quality function deployment (QFD) perspective. *Journal of Information Science*. *32*(2), 116-130.

Polat, G., Damci, A. & Tatar, Y. (2011). Barriers and benefits of total quality management in the construction industry : evidence from Turkish contractors. *Proceding of the 7th Research/Expert Conference with International Participations (quality 2011)*, 1115–1120.

Poots, A. J., & Woodcock, T. (2012). Statistical process control for data without inherent order. *BMC Medical Informatics and Decision Making*. *12*(1), 86.

Pope, C., Ziebland, S. & Mays, N. (2007). Analysing Qualitative Data. In *Qualitative Research in Health Care: Third Edition*, Chapter 7, 63–81.

Prajogo, D.I. & Sohal, A.S. (2006). The integration of TQM and technology/R&D management in determining quality and innovation performance. *Omega*, *34*(3), 296–312.

Price, A.D.F. (2003). The strategy process within large construction orgnisations. *Engineering, Construction and Architectural Management*, 10(4), 283–296.

Privault, C., Oapos, Neill, J., Ciriza, V. & Renders, J.M. (2010). A new tangible user interface for machine learning document review. *Artificial Intelligence and Law*, 18(4), 459–479.

Pun, K.F. & Nurse, A.H. (2010). Adopting quality management principles to revitalise the facilities maintenance practices at a port: A study in Trinidad and Tobago. *Asian Journal on Quality*, 11(3), 197–209.

Qu, S.Q. & Dumay, J. (2011). The qualitative research interview. *Qualitative Research in Accounting & Management*, 8(3), 238–264.

Raich, M., Mu, J. & Abfalter, D. (2014). Hybrid analysis of textual data quantitative analysis, 52(4), 737–754.

Raimona Zadry, H. & Mohd Yusof, S. (2006). Total Quality Management and Theory of Constraints Implementation in Malaysian Automotive Suppliers: A Survey Result. *Total Quality Management & Business Excellence*. 17(8), 999 – 1020.

Ramanathan, C., Narayanan, S. P., & Idrus, A.B (2002). Construction Delays Causing Risks on Time and Cost - A Critical Review. *Construction Economics and Building*, *12*(1), 37-57

Rao, S.K. (2006). Quality management system-some reflections. In *Defence Science Journal* ,56, 53–59.

Raymond, L. & Bergeron, F. (2008). Project management information systems: An empirical study of their impact on project managers and project success. *International Journal of Project Management*, *26*(2), 213–220.

Ridderhof, J.C., Van Deun, A., Kai, M.K., Narayanan, P.R. & Aziz, M.A. (2007). Roles of laboratories and laboratory systems in effective tuberculosis programmes. *Bulletin of the World Health Organization*.

Robson, C. (2002). *Real World Research: A resource for Social Scientists and Practitioner - Researchers*. (C. Robson, Ed.) (Second Edi.). Blackwell Publishing.

Rodchua, S. (2006). Factors, Measures, and Problems of Quality Costs Program Implementation in the Manufacturing Environment. *Journal of Industrial Technology*, *22*(4), 1–6.

Roden , S. & Dale , B.G. (2000). Understanding the language of quality costing. *The TQM Magazine*, *12*(3), 179–185.

Rose, A.N.M., Md. Deros, B. & Ab. Rahman, M.N. (2013). A study on lean manufacturing implementation in Malaysian automotive component industry. *International Journal of Automotive and Mechanical Engineering*, *8*(1), 1467–1476.

Rowley, J. (2012). Article information : *Management Research Review*, *35*(3/4), 260–271.

Rozinat, A. & Van Der Aalst, W.M.P. (2008). Conformance checking of processes based on monitoring real behavior. *Information Systems*, *33*(1), 64–95.

Ryu, K., Park, J. & Park, J. (2006). A Data Quality Management Maturity Model. *ETRI Journal*, *28*(2), 191–204.

Sabella, A., Kashou, R., & Omran, O. (2014). Quality management practices and their relationship to organizational performance. *International Journal of Operations & Production Management*, *34*(12), 1487–1505.

Said, I. (2005). *The implementation of ISO 9000 Quality Management System and Business Performance of Contractors in Malaysia.* Doctoral dissertation, Universiti Utara Malaysia.

Said, I., Ayub, A.R., Razaki, A.A. & Kooi, T.K. (2009). Factors Affecting Construction Organization Quality Management System In Malaysian Construction Industry.

Salem, O., Solomon, J., Genaidy, A. & Minkarah, I. (2006). Lean Construction : From Theory to Implementation. *Journal of Management Engineering*, (October), 168–176.

Salminen, A., Lyytikäinen, V. & Tiitinen, P. (2000). Putting documents into their work context in document analysis. *Information Processing and Management*, 36(4), 623–641.

Samoutis, G.A., Soteriades, E.S., Stoffers, H.E., Zachariadou, T., Philalithis, A. & Lionis, C. (2008). Designing a multifaceted quality improvement intervention in primary care in a country where general practice is seeking recognition: the case of Cyprus. *BMC Health Services Research*, 8, 181.

Samsudin, N.S., Ayop, S.M., Sahab, S.S. & Ismail, Z. (2012). The Advantages of Quality Management System in Construction Project. *IEEE Colloquium on Humanities, Science & Engineering Research*, 38–41.

Santos, A., Formoso, C.T. & Tookey, J.E. (2002). Expanding the meaning of standardisation within construction processes. *The TQM Magazine*, 14(1), 25–33.

Sargent, R.G. (2000). Verification, validation and accreditation of simulation models. *2000 Winter Simulation Conference Proceedings (Cat. No.00CH37165), 1.*

Savolainen, R. (2007). Information Behavior and Information Practice: Reviewing the "Umbrella Concepts" of Information-Seeking Studies. *The Library Quarterly*. 77(2).

Schiffauerova, A. & Thomson, V. (2006). A review of research on cost of quality models and best practices. *International Journal of Quality & Reliability Management A*, *23*(6), 647–669.

Schiffauerova, A. & Thomson, V. (2006). Managing cost of quality: insight into industry practice. *The TQM Magazine*, *18*(5), 542–550.

Seaman, C.B. (2008). Qualitative methods. In *Guide to Advanced Empirical Software Engineering* (35–62).

Seilonen, I., Pirttioja, T., Halme, A., Koskinen, K. & Pakonen, A. (2007). Indirect process monitoring with constraint handling agents. In *2006 IEEE International Conference on Industrial Informatics, INDIN'06* (1323–1328).

Semiz, S. (2011). The effects of quality management applications on automotive authorized sales and service firms. *African Journal of Business Management*, *5*(2), 306–315.

Senaratne, S. & Jayarathna, T. (2012). Quality Planning Process of Construction Contractors : Case Studies in Sri Lanka. *Journal of Construction in Developinb Countries*, *17*(1), 101–114.

Senol Okay, S.S. (2010). The effects of ISO 9000 quality management system implementation in small and medium-sized textile enterprises : Turkish experience. *African Journal of Business Management*, 4(14), 2921–2933.

Setijono, D. & Dahlgaard, J.J. (2008). The value of quality improvements. *International Journal of Quality & Reliability Management*, 25(3), 292–312.

Sharma, J. (2010). An expedition to quality: A review. *Quality Assurance Journal. 13*(1-2), 1-13.

Sheils, E., O'Connor, A., Breysse, D., Schoefs, F. & Yotte, S. (2010). Development of a two-stage inspection process for the assessment of deteriorating infrastructure. *Reliability Engineering and System Safety*, *95*(3), 182–194.

Shiau, Y.R. (2002). Inspection resource assignment in a multistage manufacturing system with an inspection error model. *International Journal of Production Research*. 40(8), 1787-1806.

Singels, J., Ruë, G. & Water, H. Van De. (2001). ISO 9000 series. *International Journal of Quality & Realiability Management*, *18*(1), 62–75.

Singels, J., Ruël, G., & Water, H. Van De. (2001). ISO 9000 series - Certification and performance. *International Journal of Quality & Reliability Management*. 18(1), 62-75.

Skyttner, L. (2002). Monitoring and early warning systems – A design for human survival. *Kybernetes*, 31(2), 220–245.

Smit, Y. & Watkins, J.A. (2012). A literature review of small and medium enterprises (SME) risk management practices in South Africa. *African Journal of Business Management*, 6(21), 6324–6330.

Smith, A., Oczkowski, E., Noble, C. & Macklin, R. (2003). New management practices and enterprise training in Australia. *International Journal of Manpower*. *24*(1), 31-47.

Sohail, M.S., Rajadurai, J. & Rahman, N.A.A. (2003). Managing quality in higher education: a Malaysian case study. *International Journal of Educational Management*, *17*(4), 141–146.

Spink, A. & Cole, C. (2006). Human information behavior: Integrating diverse approaches and information use. *Journal of the American Society for Information Science and Technology*, *57*(1), 25–35.

Srivastava, P.W. & Sharma, D. (2015). Journal of Quality in Maintenance Engineering. *Journal of Quality in Maintenance Engineering*, *21*(1), 112–132.

Stenbacka, C. (2001). Qualitative research requires quality concepts of its own. *Management Decision*.

Steward, B. (2004). Writing a literature review. *British Journal of Occupational Therapy*.

Stirling, A. C. & Scoones, I. (2009). From risk assessment to knowledge mapping: Science, precaution, and participation in disease ecology. *Ecology and Society*, *14*(2).

Study, C. & Flyvbjerg, B. (2011). Case Study. In *The Sage Handbook of Qualitative Research,* 301–316.

Su, Q., Li, Z., Zhang, S.X., Liu, Y.Y. & Dang, J.X. (2008). The impacts of quality management practices on business performance: An empirical investigation from China. *International Journal of Quality & Reliability Management*, 25(8), 809–823.

Sunkpho, J., Garrett, J. H. & McNeil, S. (2005). XML-Based Inspection Modeling for Developing Field Inspection Support Systems. *Journal of Infrastructure Systems*. 11(3),190-200.

Tang, S.L. & Kam, C.W. (1999). A survey of ISO 9001 implementation in engineering consultancies in Hong Kong. *International Journal of Quality & Realiability Management*, 16(6), 562–574.

Tribelsky, E. & Sacks, R. (2010). Measuring information flow in the detailed design of construction projects. *Research in Engineering Design*, 21(3), 189–206.

Turner, D.W. (2010). Qualitative Interview Design : A Practical Guide for Novice Investigators. *The Qualitative Report*, 15(3), 754–760.

Van Der Aalst, W.M.P. (2011). Conformance Checking. In *Process Mining*, (191–213).

Vaudel, M., Burkhart, J.M., Sickmann, A., Martens, L. & Zahedi, R.P. (2011). Peptide identification quality control. *Proteomics*, *11*(10), 2105–2114.

Waaijers, L. & Van Der Graaf, M. (2011). Quality of research data, an operational approach. *D-Lib Magazine*, 17(1-2).

Walker, D.H.T. (2000). Case studies Client / customer or stakeholder focus ? ISO 14000 EMS as a construction industry case study. *The TQM Magazine*, 12(1), 18–26.

Walker, D.H.T. & Keniger, M. (2002). Quality management in construction: an innovative advance using project alliancing in Australia. *The TQM Magazine*, *14*(5), 307–317.

Wan Yusoff, W.M., Mohammed, A.H., Misnan, M.S., Mohd. Yusof, Z. & Bakri, A. (2006). Development of quality culture in the construction industry. *The 5th IEEE International Conference on Cognitive Informatics*, 1–11.

Wang, L., Wang, S. & Li, W. (2012). RSeQC: Quality control of RNA-seq experiments. *Bioinformatics*, 28(16), 2184–2185.

Wang, N. & Luo, P. (2008). Research on the information resources management center construction in E-government. In *2008 International Conference on Wireless Communications, Networking and Mobile Computing, WiCOM 2008.*

Wang, W. (2009). An inspection model for a process with two types of inspections and repairs. *Reliability Engineering and System Safety*, 94(2), 526–533.

Water, H. Van De & Vries, J. De. (2006). Choosing a quality improvement project using the analytic hierarchy process. *International Journal of Quality & Reliability Management*, 23(4), 409–425.

Webster, A. (1999). Continuous improvement improved. *Work Study*.

Wetzstein, B., Karastoyanova, D., Kopp, O., Leymann, F. & Zwink, D. (2010). Cross-organizational process monitoring based on service choreographies. In *Proceedings of the 2010 ACM Symposium on Applied Computing SAC 10*,(2485–2490).

Wirth, S.W. (2014). Add to Visual In - process Inspection Article Options and Tools. *Circuit World*, 23(2), 2–5.

Woo, T.M. & Law, H. W. (2002). Modeling of a quality control information system for small- to medium-sized enterprises. *Integrated Manufacturing Systems*, 13(4), 222–236.

Wyngaard, J.V. (2012). Thery of the Triple Constraint – a Conceptual Review. *Proceedings of the IEEE IEEEM*, 1991-1997.

Xia, B.S. & Gong, P. (2014). Review of business intelligence through data analysis. *Benchmarking*, 21(2), 300–311.

Yang, C.C. (2006). Establishment of a Quality-Management System for Service Industries. *Total Quality Management & Business Excellence, 17*(9), 1129-1154.

Yang, G.Y. & Lê, T. (2008). Cultural and Political Factors in Conducting Qualitative Research in China. *Qualitative Research Journal*, 8(2), 113–123.

Yeung, A.C.L. (2008). Strategic supply management, quality initiatives, and organizational performance. *Journal of Operations Management*, 26(4), 490–502.

Yin, R.K. (2002). *Case Study Research Design And Methods*. (R. K. Yin, Ed.) (Third Edit., Vol. 5). SAGE Publications.

Yin, R. K. (2014). *Case Study Research: Design and Methods. Essential guide to qualitative methods in organizational research* (Vol. 5).

Yoshimi, S. (2006). Information. *Theory, Culture & Society*. 23 (2-3):271-278.

Yu, A.T.W., Chan, E.H.W., Chan, D.W.M., Lam, P.T.I. & Tang, P.W.L. (2010). Management of client requirements for design and build projects in the construction industry of Hong Kong. *Facilities*, 28(13/14), 657–672.

Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, 9, 1–6.

Zairi, M. (2013). The TQM legacy – Gurus' contributions and theoretical impact. *The TQM Journal*, 25(6), 659–676.

Zalk, D.M., Kamerzell, R., Paik, S., Kapp, J., Harrington, D. & Swuste, P. (2010). Risk level based management system: a control banding model for occupational health and safety risk management in a highly regulated environment. *Industrial Health*, 48(1), 18–28.

Zeng, S.X., Lou, G.X. & Tam, V.W.Y. (2007). Managing information flows for quality improvement of projects. *Measuring Business Excellence*, 11(3), 30–40.

Zhang, J. (2008). Visualization for information retrieval. *Seminar*, 23.

APPENDIX A
THE RESEARCH TRAIL RECORD

DATE	DESCRIPTION OF ACTIVITIES	REMARK
27/9/2013	- UUM Registration (Doctor of Management)	
28/9/2013	- Class of Methodology 1 (UUM Sintok, Kedah) - Meeting 1 with Prof. Madya Dr. Mohd. Rizal bin Razalli, Supervisor - Preparing Research Proposal Chapter 1	
25/10/2013	- Class of Methodology 2 (UUM Kuala Lumpur) - Preparing Research Proposal Chapter 1	
15/11/2013	- Class of Methodology 3 (UUM Sintok, Kedah)	
9/12/2013	- Registration on Program MyPHD Industry, Kementerian Pengajian Tinggi, Putrajaya	
6/1/2014	- Work observation activities starting on Jan 2014	
24/1/2014	- Meeting with Timbalan Naib Canselor - Akademik & International , Dean (UUM Kuala Lumpur) - Preparing Research Proposal Chapter 2	
21/3/2014	- Class of Academic Writing 1 (UUM Kuala Lumpur) - Preparing Research Proposal Chapter 2 & 3	
5/4/2014	- Class of Academic Writing 2 (UUM Kuala Lumpur)	
14/4/2014	- Meeting 2 with Prof. Madya Dr. Mohd. Rizal bin Razalli, Supervisor (UUM Sintok, Kedah) - Discussion on the research objective	
25/4/2014	- Class of Academic Writing 3 (UUM Kuala Lumpur) - Preparing Research Proposal Chapter 2 & 3	
7/6/2014	- Meeting 3 with Prof. Madya Dr. Mohd. Rizal bin Razalli, Supervisor (UUM Sintok, Kedah) - Discussion on 1st draft of research proposal	
20/6/2014	- SUNWAY PUTRA Hotel , Kuala Lumpur.UUM, Universiti Utara Malaysia, Kuala Lumpur. (ACTION RESEARCH).	
01/7/2014	- Gathering all previous work inspection activities from year July 2014 – December 2014 and Report of Rejection for previous ship construction - Documents review for all record and make an analysis - Detail up and record all results of the observation activities	Information will be recorded in Microsoft Database

23/07/2014	-	Discussion with head of Quality Department and all head of section/units regarding to problems and suggestion in work inspection monitoring	Agreed to create new system information monitoring for work inspection activities
04/08/2014	-	Constructing a new system information management (Ship Inspection Monitoring – Using Microsoft Access and Mars System)	Information according to record gathering from previous work inspection
01/10/2014	-	Dry run on new system information management (Ship Inspection Monitoring – Using Microsoft Access and Mars System)	
11/08/2014	-	Write up correction in the research proposal	
17/10/2014	-	Meeting 4 with Prof. Madya Dr. Mohd. Rizal bin Razalli, Supervisor (Marina Island, Perak)	
	-	Discussion on 2nd draft of research proposal	
2/12/2014	-	Submit 3rd draft of Research Proposal to Supervisor	
11/12/2014	-	Submit 4rd draft of Research Proposal to Supervisor (Restructure after Turnitin)	
05/1/2015	-	Development work instruction of quality information system	
15/1/2015	-	Proposal Defence UUM Sintok.	
	-	Examiner : 1.Dr.Che Azlan Taib 2.Dr.Hendrik Lamsali	Pass with minor correction
19/1/2015	-	Writing the correction on chapter 1-3 after defence	
26/1/2015	-	Preparing structure of chapter 4 and chapter 6	
04/2/2015	-	Start to conducting interview session	3 Persons
05/2/2015	-	Conducting interview session	7 Persons
06/2/2015	-	Conducting interview session	6 Persons
09/2/2015	-	Conducting interview session	3 Persons
12/2/2015	-	Submit 1st draft Final Thesis to supervisor	
24/2/2015	-	Meeting 5 with Prof. Madya Dr. Mohd. Rizal bin Razalli, Supervisor (UUM Sintok, Kedah)	
	-	Discussion Final Thesis	
25/2/2015	-		PROF. MADYA DR. MOHD RIZAL RAZALLI
–	-	SUBMIT JOURNAL ARTICLES. (TO BE PLAN).	Timbalan Dekan
30/3/2015	-		Pusat Pengajian Pengurusan Teknologi dan Logistik
	-		Universiti Utara Malaysia
	-	NOTE : (1) Published journal at isijournal.info	
	-		
	-	(2) The success factors in Quality Management implementation	
	-	of work Inspection Planning for ship Construction Company	
	-		
	-	Journal received on: January 2015, Published on: Feb 2015	
	-	volume : Vol 4, No.2, Iss: 23 page: 88-99	

	-	
3/3/2015	-	Submission to Journal of Construction in Developing Countries - Manuscript

Manuscript ID	Manuscript Title	Date Created	Date Submitted	Status
JCDC-OA-03150013	Managing Work Inspection Information in Ship Construction Company	03-Mar-2015	03-Mar-2015	ADM: Not Assigned * Awaiting JCDC Admin Processing → cancel
JCDC-OA-03150012	The research study in Quality Management for a Ship Construction Company	03-Mar-2015	03-Mar-2015	ADM: Not Assigned * Awaiting JCDC Admin Processing → Cancel and submit to www.IJSR.net.

	-	
16/3/2015	-	Re-arrange Chapter 1
23/3/2015	-	Re-arrange Chapter 3
27/3/2015	-	Re-arrange Chapter 4
	-	
3/4/2015 - 6/4/2015	-	Program Pemantapan PhD Industri D.Mgmt (UUM Sintok, Kedah Objective: - To discuss and complete all chapters - Examiner requirements for PD and Viva
	-	Meeting 6 with Prof. Madya Dr. Mohd. Rizal bin Razalli, Supervisor (UUM Sintok, Kedah)
	-	
14/04/2015	-	Published Journal at www.IJSR.net (ISSN (ONLINE): 2319-7064)
	-	
	-	Title: The research study in Quality Management for a Ship Construction Company
	-	
	-	Reference:
	-	
	-	Mohamad Dasuki, M.K., & Razalli, R. (2015). The Research Study in Quality Management for a Ship Construction Company. International Journal of Science and Research, Vol 4 (4), pp: 995-998.
	-	
	-	Submit to supervisor ① Chapter 3 correction. ② Chapter 4 correction. ③ Chapter 5 correction. ④ Schedule Approval for VIVA preparation

PROF. MADYA DR. MOHD RIZAL RAZALLI
Timbalan Dekan
Pusat Pengajian Pengurusan Teknologi dan Logistik
Universiti Utara Malaysia

20/4/2015 - Schedule preparation for VIVA

Schedule for VIVA preparation PhD Industry
Universiti Utara Malaysia

Student Name: Mohamad Kamal Bin Mohamad Dasuki
Student No.: 95709
Supervisor: Prof. Madya Dr. Mohd. Rizal bin Razalli

No	Description	Date
1	Chapter 1 (Introduction) - Discussion with Supervisor - Appointment with proof-reader	11 May 2015
2	Chapter 2 (Literature Review) - Discussion with Supervisor - Appointment with proof-reader	18 May 2015
3	Chapter 3 (Methodology) - Discussion with Supervisor - Appointment with proof-reader	25 May 2015
4	Chapter 4 (Result and Finding) - Discussion with Supervisor - Appointment with proof-reader	1 June 2015
5	Chapter 5 (Discussion and Recommendation) - Discussion with Supervisor - Appointment with proof-reader	8 June 2015
6	Pre-VIVA preparation	TBA
7	VIVA	TBA

**Note: Date will be change depending on the supervisor and proof-reader availability*

-

ASSOC. PROF. DR. MOHD. RIZAL RAZALLI
Associate Professor
School of Technology Management and Logistics
Universiti Utara Malaysia

23/4/2015 - Submit form
INTENT TO SUBMIT GRADUATE THESIS/DISSERTATION

EXTERNAL EXAMINER

1. Name : **Dr.Khairul Anuar Mohd Ali**
   Address (Office) : **UKM-Graduate School of Business, UKM, 43600 UKM Bangi, Selangor Darul Ehsan**
   Telephone/ Hand phone : **+6019-2400211** Fax No : **03-89254519**
   Email : **kabma@ukm.my**

2. Name : **Dr.Ahmad Bin Jusoh**
   Address (Office) : **Management Department, Faculty of Management and Human Resource Development, Universiti Teknologi Malaysia, 81300, Skudai, Johor**
   Telephone/ Hand phone : **012-7666097** Fax No : -
   Email : **ahmadj@utm.my**

3. Name : Prof. Amran bin Md Rasli

Address (Office) : Dean, Faculty of Management and Human Resource Development, Universiti Teknologi Malaysia, 81310 Skudai, Johor

Telephone/ Hand phone : 019-7925000 Fax No : 07-5566911

Email : m-amran@utm.my/amrasli@gmail.com

INTERNAL EXAMINER

1. Name : Dr. Hendrik Lamsali

College : School of Technology Managmenet and Logistic, College of Business, 06010 UUM Sintok, Kedah

Ext. No: 6957 Hand Phone No : +6013-4878748 Email : hendrik@uum.edu.my

2. Name : Dr. Che Azlan Taib

College : School of Technology Managmenet and Logistic, College of Business, 06010 UUM Sintok, Kedah

Ext. No: 6983 Hand Phone No : +60194740666 Email : c.azlan@uum.edu.my

28/5/2015	-	School of Othman Yeop Abdullah (OYA) inform to bring the name of external examiner on 09/06/2015 for VIVA preparation.
08/6/2015	-	Compiling all chapters from proofreading UNIKL-Mimet Lumut, Perak
29/10/2015	- -	Participate with SETNC 2015 Conference Received Best Paper Award
4/11/2015	-	Received invitation for VIVA VOCE – UUM Sintok
23/12/2015	-	VIVA VOCE Presentation Othman Yeop Abdullah School (OYA) UUM Sintok Result: Pass with Condition (Major Correction)
4/01/2016	-	Received letter of VIVA VOCE Result
17/2/2016	- -	Submission Full Thesis to Pusat Bahasa UUM Sintok for proofreading process. En.Noor Allam Bin Wan Chek (Proofreader)
23/03/2016	- -	Proofread Completed Payment made for RM3343.50 to UUM Sintok Maybank online transfer Ref.3064520224
24/03/2016	-	Received softcopy thesis and scanned copy letter of payment from Pusat Bahasa UUM, Sintok Reconstruct back all proofread thesis according to the UUM format
April 2016	-	Submit hardcopy thesis to UUM
June 2016	-	OYA Meeting and Re-submit Abstract
August 2016	- -	Senate Meeting (Accepted) Submission of Hardcover Thesis

APPENDIX B:
CASE STUDY PROTOCOL INTERVIEW

MANAGING QUALITY MANAGEMENT PROCESS IN A NAVAL SHIP CONSTRUCTION COMPANY: A QUALITATIVE CASE STUDY

MENGURUSKAN PROSES PENGURUSAN KUALITI DALAM SYARIKAT PEMBINAAN KAPAL TENTERA LAUT: KES KAJIAN KUALITATIF

Date : ____________________

Time : ____________________

Section/Unit : ____________________

Name : ____________________

Position : ____________________

Direction (to be read to the interviewee)
Arahan (untuk dibaca untuk ditemu duga itu)

These interview sessions were conduct as a part of the research study in Managing Quality Management Process in a Naval Ship Construction Company. The purposes of this research study are:
Sesi temubual sebagai sebahagian daripada kajian penyelidikan dalam Proses Pengurusan Kualiti Urusan dalam Syarikat Pembinaan Kapal Tentera Laut . Tujuan kajian penyelidikan ini adalah:

- To identify how deep the knowledge of quality management in ship construction, especially in the quality department.
  Mengenalpasti berapa dalam pengetahuan pengurusan kualiti dalam pembinaan kapal , terutama di Jabatan Kualiti

- To identify in more detail about the issues that occur in quality management in this company.
  Mengenalpasti dengan lebih terperinci mengenai isu-isu yang berlaku dalam pengurusan kualiti di syarikat ini

- To provide an analysis of the study and also suggestions that can improve and enhance the quality of management in preparing quality ships.
  Menyediakan analisis kajian dan juga cadangan yang boleh memperbaiki dan meningkatkan kualiti pengurusan dalam menyediakan kapal-kapal yang berkualiti

- To accomplish the company's mission -"*to provide excellence in quality and timely delivery of products and services and to maximize stakeholder return*"
  Untuk mencapai misi syarikat - " untuk menyediakan kecemerlangan dalam kualiti dan penghantaran tepat pada masa produk dan perkhidmatan dan untuk memaksimumkan pulangan pemegang kepentingan "

Interview sessions will be audio-recorded and write out within a day of the completion of the interviews sessions. The confidential information and it only use in this research study. The copy of written transcript from the interview will be given to interviewee. Interviewees were guaranteed complete secrecy and their responses will keep completely confidential. The interview will be conducted in 5 mains topics. This entire interview is designed to take approximately one hour. The interviewee can freely ask any question regarding to this interview session.
Sesi temuduga akan pandang direkodkan dan menulis dalam hari selepas selesainya sesi temuduga . Maklumat sulit dan ia hanya digunakan dalam kajian penyelidikan ini . Salinan transkrip bertulis daripada temu bual itu akan diberikan kepada ditemu duga . Ditemubual telah dijamin kerahsiaan lengkap dan jawapan mereka akan menjaga sepenuhnya sulit . Temuduga akan dijalankan dalam 5 topik utama . Seluruh temu direka bentuk untuk mengambil kira-kira satu jam . Ditemu duga yang bebas boleh meminta apa-apa soalan mengenai untuk sesi temu bual ini .

MANAGING QUALITY MANAGEMENT PROCESS IN A NAVAL SHIP CONSTRUCTION COMPANY: A QUALITATIVE CASE STUDY

MENGURUSKAN PROSES PENGURUSAN KUALITI DALAM SYARIKAT PEMBINAAN KAPAL TENTERA LAUT: KES KAJIAN KUALITATIF

Part 1: Introduction and Demographic Information
Bahagian 1 : Pengenalan dan Maklumat Demografi

1. Tell me about yourself?
   Beritahu saya tentang diri anda?
2. How long have you been in this company?
   Berapa lama anda berada dalam syarikat ini?
3. Can you describe your work in the company?
   Bolehkah anda menerangkan tugas kerja di syarikat ini?
4. Tell me about your work experience in Quality Department?
   Beritahu saya tentang pengalaman kerja anda di Jabatan Kualiti?
5. What is your technical background?
   Apakah latar belakang teknikal anda?
6. How would you describe yourself as a Quality Staff?
   Bagaimana anda menggambarkan diri anda sebagai pekerja Kualiti?
7. What is quality mean to you?
   Apakah maksud kualiti kepada anda?

Part 2: Research Question No.1
Bahagian 2 : Penyelidikan Soalan No.1

What is an effective work planning in implementing the quality management particularly in the inspection planning activities in Quality Department toward the completion of the ship construction and maintenance projects?
Apakah yang dimaksudkan dengan perancangan kerja yang berkesan dalam melaksanakan pengurusan kualiti terutama dalam pemeriksaan aktiviti di Jabatan Kualiti ke arah penyiapan projek pembinaan dan penyelenggaraan kapal?

7. How do you plan your work activities?
   Bagaimana anda merancang aktiviti kerja anda ?
8. What do you think about the work process in this company especially in Quality Inspection activities?
   Apa yang anda fikir tentang proses kerja di syarikat ini terutama dalam aktiviti Pemeriksaan Kualiti ?
9. How often inspection activities been postpone or cancel and what reason? *Berapa kerap aktiviti pemeriksaan telah ditangguhkan atau dibatalkan dan apa sebab ?*
10. How do you measure the work effectiveness in your daily activities? *Bagaimana anda mengukur keberkesanan kerja dalam aktiviti harian anda ?*
11. What is your suggestion and expectation in improving work planning for inspection activities?

Apakah cadangan dan harapan anda dalam meningkatkan perancangan kerja bagi aktiviti pemeriksaan ?

Part 3: Research Question No.2
Bahagian 3 : Penyelidikan Soalan No.2

How to overcome the weakness and lack of monitoring activities in the work process of the project completion especially in ship construction and maintenance activities?
Bagaimana untuk mengatasi kelemahan dan kekurangan aktiviti pemantauan dalam proses kerja penyiapan projek ini terutamanya dalam pembinaan dan aktiviti penyelenggaraan kapal?

1. How do you do about preventing any problems from occurs?
Bagaimana anda lakukan dalam mencegah masalah daripada berlaku ?
2. Do you know about correction, corrective and preventive maintenance?
Adakah anda tahu tentang pembetulan, pembaikkan dan pencegahan dalam penyelenggaraan?
3. How many times you done your observation or survey a day?
Berapa kali anda lakukan pemerhatian atau meninjau dalam sehari?
4. Are you willing to do your observation or survey without any instruction from your superior? If not, why?
Adakah anda bersedia untuk melakukan pemerhatian atau kajian anda tanpa apa-apa arahan dari atasan anda ? Jika tidak , mengapa ?
5. What is your opinion about work inspection monitoring in the ship project construction activities?
Apakah pandangan anda tentang kerja-kerja memantau dalam aktiviti pemeriksaan pembinaan projek kapal ?

Part 4: Research Question No.3
Bahagian 4 : Penyelidikan Soalan No.3

How to improve the work process in preparing the good quality report?
Bagaimana untuk meningkatkan proses kerja dalam penyediaan laporan kualiti yang baik ?

1. How you manage your inspection record activities?
Bagaimana anda menguruskan aktiviti rekod pemeriksaan anda ?
2. How do you write your record?
Bagaimana anda menulis rekod anda ?
3. What sort of problem that you are facing in preparing your report?
Apakah jenis masalah yang anda hadapi dalam menyediakan laporan anda ?
4. How do you reporting your work status to your superior?
Bagaimana anda melaporkan status kerja anda kepada pihak atasan ?
5. How often you discuss with your superior about your work activities?
Berapa kerap anda berbincang dengan ketua anda tentang aktiviti kerja anda ?

6. If there are problems, how do you handle the situations that require you to prepare any supporting documents?
Jika ada masalah , bagaimana anda mengendalikan situasi yang memerlukan anda untuk menyediakan apa-apa dokumen sokongan ?

7. What is your suggestion to improve the work process in managing the inspection information record?
Apakah cadangan anda untuk memperbaiki proses kerja dalam menguruskan rekod maklumat pemeriksaan ?

8. Who should to be responsible to manage this information and preparing the report?
Siapakah yang harus bertanggungjawab untuk menguruskan maklumat ini dan menyediakan laporan itu ?

Part 5: Closing the Interview Session
Bahagian 5 : Penutup Sesi Temuduga

Is there anything else that you would like to offer that I did not specially ask about?
Adakah terdapat apa-apa lagi yang anda ingin tawarkan kepada saya atau bertanya tentang sebarang perkara khusus?

Researcher's Remarks:
Ulasan penyelidik

Thank you for your valuable time in participates for the interview session. The information you have will contributed will be a significant and important of the successful for this research study. If you have any further thoughts on this topic, you are welcome to call me.
Thank you.
Terima kasih untuk masa anda yang berharga dalam menyertai untuk sesi temuduga ini. Maklumat yang anda sumbangkan akan menjadi perkara penting dalam menjayakan kajian penyelidikan ini . Jika anda mempunyai apa-apa pemikiran lanjut mengenai topik ini , anda dialu-alukan untuk menghubungi saya. Terima kasih.

APPENDIX C:
CASE STUDY TRANSCRIPT INTERVIEW

MANAGING QUALITY MANAGEMENT PROCESS IN A NAVAL SHIP CONSTRUCTION COMPANY: A QUALITATIVE CASE STUDY

Date : ____________________ QC Staff No: __________

Time : ____

Section/Unit : ____

Name : ____

Position : ____

Direction (to be read to the interviewee)

These interview sessions were conduct as a part of the research study in Managing Quality Management Process in a Naval Ship Construction Company. The purposes of this research study are:

- To identify how deep the knowledge of quality management in ship construction, especially in the quality department.
- To identify in more detail about the issues that occur in quality management in this company.
- To provide an analysis of the study and also suggestions that can improve and enhance the quality of management in preparing quality ships.
- To accomplish the company's mission -"*to provide excellence in quality and timely delivery of products and services and to maximize stakeholder return*"

Interview sessions will be audio-recorded and write out within a day of the completion of the interviews sessions. The confidential information and it only use in this research study. The copy of written transcript from the interview will be given to interviewee. Interviewees were guaranteed complete secrecy and their responses will keep completely confidential. The interview will be conducted in 5 mains topics. This entire interview is designed to take approximately one hour. The interviewee can freely ask any question regarding to this interview session.

RESULT INTERVIEW

Part 1: Introduction and Demographic Information

Part 2: Research Question No.1

What is an effective work planning in implementing the quality management particularly in the inspection planning activities in Quality Department toward the completion of the ship construction and maintenance projects?

Part 3: Research Question No.2

How to overcome the weakness and lack of monitoring activities in the work process of the project completion especially in ship construction and maintenance activities?

Part 4: Research Question No.3

How to improve the work process in preparing the good quality report?

Part 5: Closing the Interview Session

Is there anything else that you would like to offer that I did not specially ask about?

Verification

Signature : ____________________ Date Interview: ____________

Thank you for your time and willingness to participate in this research study. As mentioned earlier, this information is confidential and it only will be used for this research project. You will receive a copy of the written transcript from this interview for your review.

APPENDIX D

QC/INSPECTION & TESTING REQUEST/XXXXX

COMPANY LOGO	QUALITY CONTROL INSPECTION & TESTING REQUEST FORM		VERSION 02
PROJECT:		ORDER NO :	
REF.NO:		ACTIVITY NO :	
SUBJECT :		WORK NO:	
FROM :		INFO:	
TO :			

THE BELOW COMPONENT / EQUIPMENT TO BE INSPECTED / TESTED / CHECKED / WITNESSED BY YOUR REPRESENTATIVE.

ITEM	COMPONENT/EQUIPMENT	JOB DESCRIPTION	DATE	TIME

JOB DONE BY:

☐ - YARD

☐ - CONTRACTOR (COMPANY **NAME :**..)

COMMENT/REMARKS: -

Requested /Prepared by : Technician / Supervisor Date :	Approved by : Unit Head Date :

APPENDIX E
PROJECT VERIFICATION

PROJECT CHARTER		
PART A		
Project Name	System Information Management for Quality Department	
Project Objective	To create central information database for work inspection planning, work observation and quality report management	
Kick-off Date	23/07/2014	
Completion Date	30/01/2015	
Location	Quality Department	
Project Team	**Name**	**Department**
Team Leader	Mohamad Kamal Bin Mohamad Dasuki	Quality Department
Team members	Firdaus Bin Ramly	Quality Department
	Muhamad Tajul Asiken Bin Yunus	IS Department
Champion	Omar Bin Abd Rahim	Quality Department
Problem Statement	The research study was intended to find a way to overcome the shortcomings and difficulties encountered in the implementation of quality management of the ship construction and maintenance company with regard to project completion, especially in work inspection planning, monitoring and preparing a good quality report.	
Project Scope	Quality Department and Information System Department	
Include/Exclude	**Include**	**Exclude**
	Quality Department Work Process	
Deliverable	Quality Information System Database	

Team Leader	**Project Champion**
Name: Mohamad Kamal Mohamad Dasuki Date: 23/07/2014	Name: Omar Abd Rahim Date: 23/07/2014

PART B

Project Type* (can be more than 1):		Mark "Y"	Project Class
	Safety, Health and Environment		New project development
	Ergonomic		
	Customer Satisfaction		
	Quality	Y	
	Productivity	Y	
	Inventory		
	Waste		
	Moral	Y	
	Cost Savings (Refer attachment)	Y	
	Others (Please specify)		