THE IMPACT OF QUALITY MANAGEMENT SYSTEM IMPLEMENTATION: A CASE STUDY OF METAL PROCESSING AND TRADING IN MALAYSIA

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JULY 2019

The Impact of Quality Management System Implementation: A Case Study of Metal Processing and Trading In Malaysia

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A research paper submitted in partial fulfillment of the requirement for the degree of

Master of Business Administration

Universiti Tunku Abdul Rahman

Faculty of Accountancy and Management

July 2019

The Impact of Quality Management System Implementation: A Case Study of Metal Processing and Trading In Malaysia

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DECLARATION

I hereby declare that:

(1) This MKMA 29906 is the end result of my own work and that due acknowledgement has been given in the references to all sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

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ACKNOWLEDGEMENT

First of all, I would like to express my sincere gratitude and appreciation to all parties who have guided and helped me throughout the duration of this research.

I would like to express my deep and sincere gratitude to my supervisor, Dr Foo Meow Yee, who has been guiding me patiently from the beginning until the completion of this research. She has spent her valuable time to help and guide me when I was in doubt or encountered any problem throughout the development of this research. Her invaluable guidance and advice has facilitated and benefited me. Without her supervision, I may not able to complete my research report within the time frame given.

Also, I would like to thank Universiti Tunku Abdul Rahman for giving me the chance to conduct this research project. By conducting this research, I have learnt and developed my skills and knowledge. This knowledge will be put into good use in different ways for the benefit of the society.

Besides that, I would like to express my highest appreciation to my family and friends who have given their support and encouragement throughout my study.

Last but not least, I would like to thank the case company's management and employees for their cooperation throughout this research project. This research project would not have been completed successfully without their assistance.

Dedication

To my family and all my loved ones,

Thanks for being there when I needed you the most.

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PREFACE

This research project is a compulsory subject needed to be done for students of Master of Business Administration in order to complete their Master studies. The research title for this thesis is "The Impact of Quality Management System Implementation: A Case Study of Metal Processing and Trading in Malaysia".

The immensely competitive business environment and rapid economic development makes it more important than ever for companies to provide value-added products and services to their customers and fulfil the needs of interested parties. Failure of a company to sustain their competitive edge against their competitors may cause a company to go out of business. As such, it is important to have a system to manage business processes in an effective manner to ensure provision of quality products and services to customers.

The main purpose of this research project is to study how to effectively execute a QMS into a case company's operations and whether the implementation of a quality management system (QMS) in the operations of a case company will be able to standardise the method of operations and improve product quality and delivery performance. The quality management system (QMS) analysed in this research is in compliance with ISO 9001:2015 standard requirements. This study also can provide recommendations for improvement to the Top Management of the case company.

ABSTRACT

In the competitive business environment today, it is more critical than ever for businesses to implement an effective and robust ISO 9001 quality management system to focus on important areas of business and improve efficiency. However, executing the ISO 9001 QMS does not naturally convey advantages to an organization; rather, some prerequisites shall be complied. Hence, the aim of this research is to determine whether the effective implementation of ISO 9001:2015 QMS at the case company will be able to standardise their business operations, reduce the number of customers' complaints on product non-conformances and improve delivery performance. The researcher also conducted a QMS internal audit to gauge the effectiveness and efficiency of the established QMS against the ISO 9001:2015 standard requirements.

The study reveals that the total number of customers' complaints has been **reduced by 30.30%** five (5) months after ISO 9001:2015 implementation. As for the total cases of late delivery, a reduction of **37.60%** has been observed. The relevant QMS documents or procedures to standardise business processes have been established in compliance with ISO 9001:2015 requirements. Thus, it can be concluded that the QMS implementation has indeed been effective in reducing the number of customers' complaints, improving delivery performance and standardising business processes.

A QMS internal audit was also conducted by the researcher and a total of 8 non-conformances and 6 observations were issued. This signifies that the quality system is still fairly new and the employees still need more time to get use to implementing the system. The outcome of this study can be used by the Top Management of the case company to improve the performance of its business operations in order to provide quality products and services to their customers.

CHAPTER 1

INTRODUCTION

1.0 Introduction

The purpose of this research is to study how to effectively execute a QMS into a case company's operations and whether the implementation of a quality management system (QMS) in the operations of a case company will be able to standardise the method of operations and improve product quality and delivery performance. The quality management system (QMS) analysed in this research is in compliance with ISO 9001:2015 standard requirements.

1.1 Research background

1.1.1 Case Company

The case company i.e. Leon Fuat Hardware Sdn. Bhd. is a subsidiary of a public company i.e. Leon Fuat Berhad. Leon Fuat Berhad is the sole holding company of Leon Fuat Hardware Sdn. Bhd. The case company is mainly involved in the trading, cutting, processing and distribution of steel products. Their primary business is processing of long steel products and thanks to their supporters, the case company has been a growing force in the steel industry for the past 30 years ("Leon Fuat Berhad | Structure," n.d.). Their products are sold and distributed both locally and overseas, including to related companies. Their production process mainly involves cutting of long steel products to the required size. The activity of product design is not applicable for and implement the ISO 9001:2015 Management System.

The Management level felt that business operations within the company were not standardised as employees were performing their job using their own preferred method. The company was also experiencing a high number of customers' complaints on product non-conformances and high number of late delivery cases thus incurring high costs associated with product returns. Hence, the company has decided to go towards ISO 9001:2015 because the Top Management has a need to standardise business processes, reduce the number of customers' complaints and improve delivery performance in order to provide value-added services and products to customers.

1.1.2 Quality Management System (QMS)

There are many interpretations and definitions of quality management system. The International Organisation for Standardisation (ISO) defines quality management system as "a part of a management system with the case company as they purely cut or shear steel products according to customer's requirements depicted in product drawings. Currently, the case company has yet to establish regard to quality". Management system is defined as "set of interrelated or interacting elements of an organisation to establish policies and objectives, and processes to achieve those objectives" (*ISO 9000:2015:Quality Management System-Fundamentals and Vocabulary*, 2015). In other words, QMS is an official framework that archives work methods, and duties for accomplishing quality policies and quality goals.

ISO 9001:2015 is without any doubt the most perceived and executed quality management system on the planet. ISO 9001:2015 indicates the prerequisites for a QMS that companies can use to build up their own particular plans. With the QMS, a company's activities becomes more focused and guided which provide a foundation to improve process effectiveness and efficiency ("ISO 9001 | International Quality Management Standard | NQA," n.d.).

Executing and documenting a quality management system provides two significant advantages which include:

1. Complying with the customer's requirements, which creates confidence in the company, hence attracting additional customers and additional repeat business.

2. Complying with the company's requirements, thus automatically ensuring alignment with management's directions and managing business processes using the best cost-effective method. This will provide room for expansion, innovation and financial profit (Rusjan & Alič, 2010).

The general elements that a QMS should have are:

1. The organisation's quality policy and quality objectives
2. Context of the Organisation
3. Standard Operating Procedures, work instructions, and records
4. Document and record management
5. Core, support and management processes
6. Customer satisfaction from product quality
7. Opportunities for improvement
8. Monitoring, measurement, analysis and evaluation

Every component of a quality management system contributes toward the general objectives of meeting the clients' and company's needs and expectations. The effectiveness and efficiency of the QMS is assured by making sure each and every component is available (Simões, Dias, Santos, & Lima, 2016).

The structure of the ISO 9001:2015 is based on Plan-Do-Check-Act (PDCA) cycle and promotes both product and process continual improvement (*ISO 9001:2015:Quality Management Systems-Requirements*, 2015). The basic steps to implementing a QMS are planning, system design and documentation and system establishment (Simões et al., 2016).

a) Planning

This step involves setting of QMS Committee members, assigning specific tasks to committee members and key personnel, determining scope of QMS, identifying the resources required, establishing deadlines, establishing business process map, defining Quality Policy and defining Quality Objectives. The Quality Policy should reflect the organisation's commitment to product quality, supply high quality products and services and fulfilling customer's needs and expectations.

b) System Design and Development

This step involves building the QMS structure. There are four (4) main steps involved:

Step1: Process documentation and control

The first step was establishing the required QMS documentations such as Quality Policy, Quality Objectives, procedures, Work Instructions, Standard Forms and other supporting documents.

Step 2: Resource Management

The second step requires the identification and management of resources required for the QMS. Resources here refers to human resource, infrastructure, budget, materials, knowledge and trainings.

Step 3: System Definition

The third step involves developing a matrix to cross link the ISO 9001:2015 QMS clauses against the established procedures or documents or processes. This will provide an overall framework to explain how the company complies with each clause of the standard.

Step 4: Internal and Customer Communication

The fourth step involves the communication of relevant QMS topics such as Quality Policy, Objectives, procedures and etc. to internal and external customers.

c) System Establishment

This involves review and approval of documents, implementing the QMS, monitoring and measuring the key performance indicators of each process, periodical audits of the quality management system and management review. Contingent on size and potential hazards, this step is customised to suit an organisation's practice.

This step also involves the management of monitoring and measurement results. The objectives are to gauge the performance of each process against its goals and create awareness among process owners of any findings for proposal of improvement actions amid the review (Simões et al., 2016).

The ISO 9001:2015 version of the quality management system standard was published in September 2015 by the international standardisation committee ISO/ TC 176. There are a few significant changes introduced to the new version of the standard namely (Anttila & Jussila, 2017):

a) Seven (7) Quality Management Principles compared to eight (8) principles in previous standard;
b) New structure of ISO 9001:2015 standard (consisting Clause 4.0 until 10.0) as per ISO Directives Annex SL;
c) Risk management approach and risk-based implementation;
d) Context of the Organisation approach with is more relevant to business and technological challenges

1.2 Problem Statement

The ISO 9001:2015 Quality Management System project is initiated by the Top Management of the case company. The Top Management has a need to standardise work practices at every functional level of the business processes to better fulfil the requirements and needs of stakeholders. The Managing Director also wishes to reduce the number of customers' complaints and improve delivery performance. It is the Top Management's aim to provide products and services that satisfy customer's requirements to attain total customer satisfaction.

The operations of some of the business processes at Leon Fuat Hardware Sdn. Bhd. is consistent but work processes are not documented and not properly defined to achieve standardisation. This ends up in diverse operation methods within the case company which leads to significant process variations, incorrect process outputs, miscommunication and double checking. Hence, improving the consistency of process operations becomes one of the internal motivation to implement the ISO 9001:2015 QMS. The case company also experiences high number of customers' complaints on product non-conformances and high number of late delivery cases thus incurring high costs associated with product returns, including costs of

transportation and handling of customers' complaints. This prompted the holding company i.e. Leon Fuat Berhad to impose a QMS implementation on the case company i.e. Leon Fuat Hardware Sdn. Bhd. Thus, this serve as one of the external motivation to implement the ISO 9001:2015 QMS for the case company.

Several previous studies have shown the positive effects of an effective quality management system implementation on consistency of product quality and process performance. Experimental results show that if the ISO 9001 standard is practised well (complying with established requirements and principles), substantial improvement in a company's performance could be anticipated but the distinguished advantages of QMS implementation fluctuates among companies (Singels, J., Ruel, G. and Van de Water, 2001). The research confirms that certain pre-requisites need to be fulfilled before a company can enjoy the advantages of QMS implementation.

Organisations with internal motivation to execute a quality system for the purpose of continual improvement instead of just obtaining an ISO 9001 certificate enjoy substantial advancement in terms of corporate performance and company's attractiveness (Van der Wiele, T., Williams, A.R.T., Brown, A. and Dale, 2001). The internal motivation for quality improvement has been found to have a significant correlation with overall performance improvement (Katerina D. Gotzamani, Tsiotras, Nicolaou, Nicolaides, & Hadjiadamou, 2007). In contrast, the ISO 9001 implementation has a smaller significance on organisation's performance in organisations compelled to execute the system because of external pressure (advertisement and promotion reasons) (Van der Wiele *et al.*, 2001). Top Management's commitment and leadership is also crucial to ensure the effectiveness and efficiency of the QMS, resulting in a favourable outcome of the company's process and product quality consistency (Porter, L. and Tanner, 1996; Rao, S.S., Ragu-Nathan, T.S. and Solis, 1997).

It is the hope of the case company's Top Management to provide the necessary resources for an effective QMS implementation to maximise its positive impact on product and delivery performance. Studies by Leung et al. (1999) and Lee (1998)

found that an effective QMS implementation will lead to a decrease in customer complaints, improved delivery performance and improved process effectiveness.

Furthermore, there is very few research conducted on the QMS execution premised on the ISO 9001:2015 revised standard. This is because the standard was just published on Sept 2015 and there are a few significant amendments in the 2015 edition of ISO 9001 standard (Lazarte, 2015). Hence, the researcher aims to study the QMS implementation in the case company with the ISO 9001:2015 standard as a basis.

The business problem of this project is illustrated in Figure 1 below.

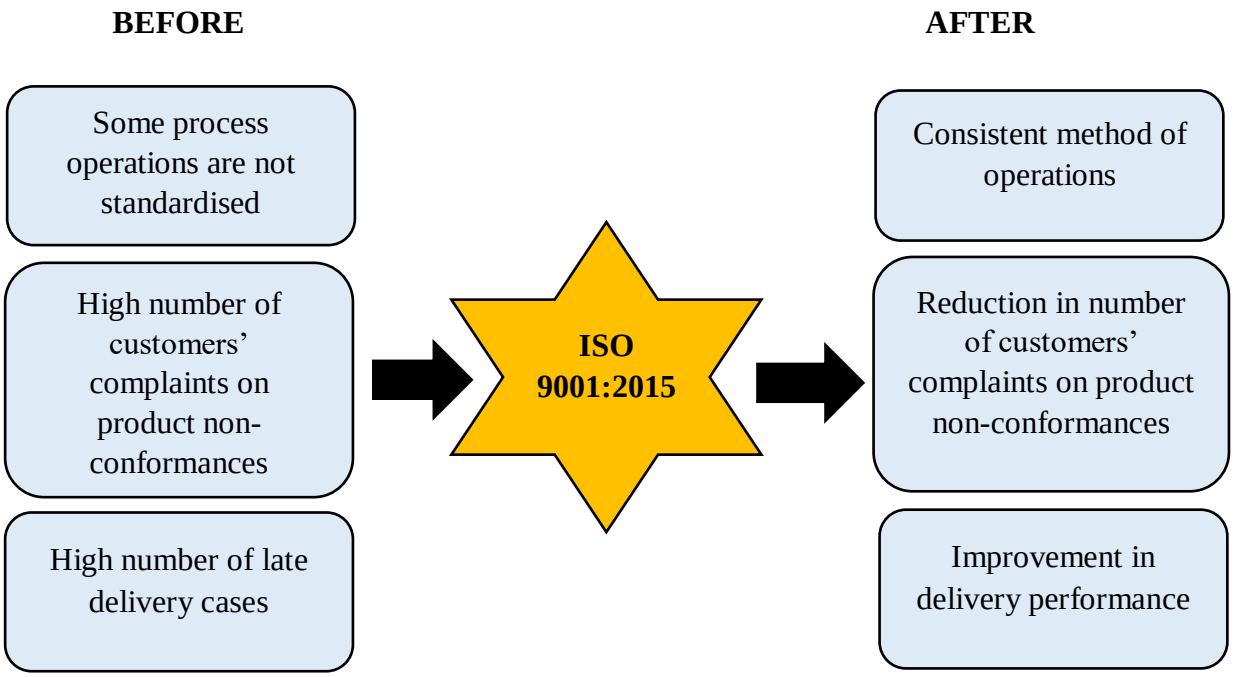


Figure 1: Illustration of Business Problem

Figure 1 illustrates the business problem and the objectives of the research project. It is the opinion of the Top Management that a customised Quality Management System will help to achieve the desired goals. Since the ISO 9001:2015 Quality Management System standard is widely used in its holding company and other related subsidiary companies, the case firm also decided to implement the system. Another factor that triggered the case company to implement the ISO 9001:2015 Quality Management System is that they are subjected to periodical quality audits by their holding company.

1.3 Research Questions

The research questions in this study are:

i) What is the method to effectively execute the ISO 9001:2015 quality management system in the case firm's operations in order to achieve a consistent method of operations?

ii) Can the implementation of ISO 9001:2015 quality management system in the case firm reduce the number of customers' complaints on product non-conformance?

iii) Can the implementation of ISO 9001:2015 quality management system in the case firm improve delivery performance?

1.4 Research Objectives

The goal of this study is to identify whether the implementation of ISO 9001:2015 QMS in the operations of a case company will be able to improve consistency in product and process performance:

i) To determine how to effectively execute the ISO 9001:2015 quality management system in the case company's operations in order to achieve a consistent method of operations.

ii) To investigate whether the implementation of ISO 9001:2015 quality management system in the case company can reduce the number of customers' complaints on product non-conformance.

iii) To investigate whether the implementation of ISO 9001:2015 quality management system in the case company can improve delivery performance.

1.5 Significance of the Study

As the distinguished advantages of QMS implementation fluctuates among companies (Singels, J., Ruel, G. and Van de Water, 2001), this research is able to determine the specific impact of QMS implementation on the case company (Leon Fuat Hardware Sdn. Bhd.). Thus far, no study has been conducted to determine whether the implementation of QMS could improve consistency in product quality and delivery performance of the case company (Leon Fuat Hardware Sdn. Bhd.) because its journey towards implementation of ISO 9001:2015 QMS has just commenced. Hence, this is the first time the case company becomes the subject of a business case study on QMS.

Furthermore, very few studies have been conducted using ISO 9001:2015 QMS implementation. Thus, this study will offer new insight on the impact of the revised standard on the operations of the case company. The main contribution of this research is to determine whether implementation of ISO 9001:2015 QMS can align the case company's operations or activities towards the general objective of the organisation to remain competitive in the steel or metal industry.

In addition, the results of this study will provide valuable information to the Top Management of the case company to determine further actions required to improve its QMS, business operations, customers' satisfaction level and consistency in product quality.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter provides a literature review of the impact of ISO 9001:2015 QMS implementation in a case company on consistency in operations method, product quality and delivery performance. The objective of conducting a literature review is to report what is already known and proven on this topic, including their strengths and shortcomings. It also allows you to find the concurred scholarly sentiment on the topic and discover the contradictions on a similar subject. Subsequently, the researcher will develop a theoretical framework to clarify the interactions between the various contributors to lay a foundation for this research.

2.1 ISO 9001:2015 Quality Management System

The ISO 9001:2015 (5^{th} edition) quality management system standard was published in September 2015 and encompasses a number of significant changes compared to the previous version of ISO 9001:2008, which may be challenging to comprehend and execute (Anttila & Jussila, 2017; Zimon & Gajewska, 2017). Among the changes that are challenging to implement are (Chiarini, 2017; Fonseca, 2015; Wilson, & Campbell, 2016):

a) Understanding the organisation and its context;
b) More focus on the role of top management;
c) High level structure according to Annex SL;
d) A risk-based approach;
e) Introduction to organisational knowledge management;

f) More emphasis on process approach and less documentation.

Based on risks identification and risks control, this standard has promoted a shift to risk-based thinking. Its high-level structure with 10 clauses makes it easier to integrate with other management standards (*ISO 9001:2015:Quality Management Systems-Requirements*, 2015).

There are now seven (7) quality management principles (QMPs) in the 2015 version that back the ISO 9000 and ISO 9001 standards. The updated QMPs that represent the values of the ISO 9001 standard are:

No.	QMP	Statement
1	Customer focus	The primary focus of quality management is to meet customer's requirements and to strive to exceed customer's expectations.
2	Leadership	Functional managers should create a work environment that is conducive for participation of people towards achieving organisation's goals with a common purpose.
3	Engagement of people	Involvement and empowerment of people in the QMS.
4	Process approach	Understand and manage organisation's activities as interrelated processes where the output from the previous process becomes an input to the subsequent process.
5	Improvement	Fruitful organisations continually concentrates on improvement.
6	Evidence-based decision- making	Make informed decisions based on the investigation and assessment of information and data to achieve the desired outcomes.
7	Relationship management	An organisation needs to handle its relationships with interested parties, such as vendors, for continued success. The goal is to achieve a

No.	QMP	Statement
		mutually-beneficial relationship with interested parties.

Sources: *ISO 9000:2015:Quality Management System-Fundamentals and Vocabulary* (2015) and Fonseca & Domingues (2016)

The ISO 9001:2015 standard has both good aspects and some imperfections as summarised in the Table 1 below (Anttila & Jussila, 2017):

Table 1 Good Aspects and Imperfections of the Standard

Good Aspects of the Standard	Imperfections of the Standard
• Structure is more harmonised. • Explicit emphasising of the risk-based thinking and reference to the ISO 31000. • More business-centred focus on business processes. • Development from distinct requirement items to more liberal discretion.	• Lack of design verification in design specifications requirements. • Nothing revolutionary for the modern changed business environment. • The link between Quality Management Principles (QMPs) and main contents of the standard is weak. • Does not provide any particular method for risk-management and risk-related terminology is not explicitly defined thus may be exposed to misinterpretations. • Unclear whether risk-based thinking should be applied everywhere in the standard or only certain clauses.

Nevertheless, most IRCA registered auditors concurred that the ISO 9001:2015 coincides with current business and quality administration ideas and will be a helpful tool for the organizations. This is a significant validation to the approval of ISO 9001:2015 release, and its value for all sort of associations around the world (Fonseca & Domingues, 2016).

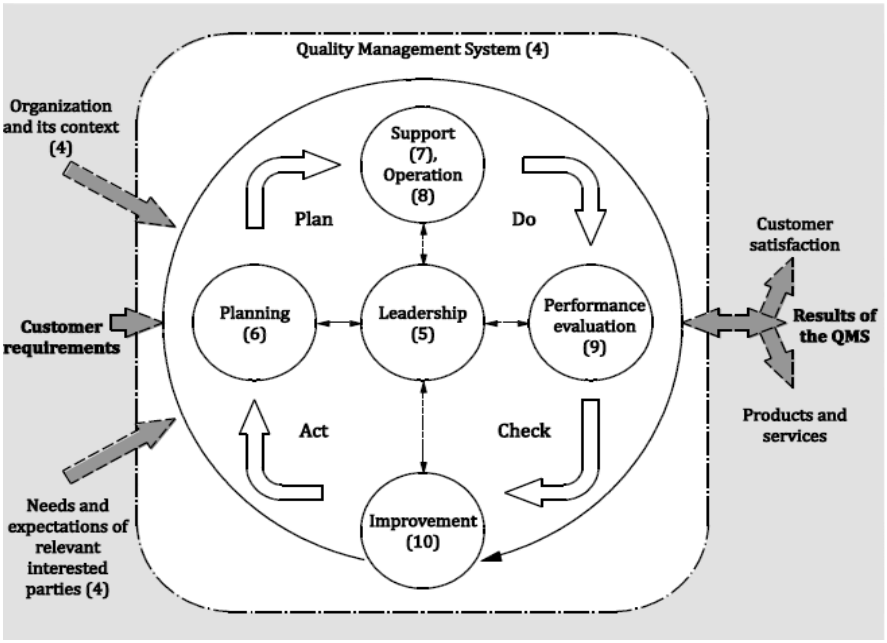
Additionally, the ISO 9001:2008 and 2015 have approximately the same requirements. Table 2 below stipulates the clauses of the two different versions of the standard. The first three clause (Clause 1, 2 and 3) just provide some vital information related to the requirements of QMS implementation thus, not considered as requirements of the standard (Neyestani, 2016).

Table 2: The comparison between the clauses of ISO 9001:2008 and ISO 9001:2015

Clause	**ISO 9001:2008**	**ISO 9001:2015**
1	Scope	Scope
2	Normative references	Normative references
3	Terms and definitions	Terms and definitions
4	Quality Management System	Context of the Organisation
5	Management Responsibility	Leadership
6	Resource Management	Planning
7	Product Realisation	Support
8	Measurement, Analysis and Improvement	Operation
9		Evaluation
10		Improvement

The arrangement of ISO 9001:2015 International Standard in PDCA cycle is illustrated below (*ISO 9001:2015:Quality Management Systems-Requirements*, 2015):

Representation of the structure of ISO 9001:2015 in PDCA cycle



The ISO 9001:2015 QMS Clause Structure is presented is the table 3 below (*ISO 9001:2015:Quality Management Systems-Requirements*, 2015):

Table 3: ISO 9001:2015 QMS Clause Structure

Clause 4 : Context of the Organisation	
Clause	***Requirements***
Clause 4.1	Understanding the organisation and its context
Clause 4.2	Understanding the needs and expectations of interested parties
Clause 4.3	Determining the scope of the Quality Management System
Clause 4.4	QMS and its processes
Clause 5 : Leadership	
Clause	***Requirements***
Clause 5.1	Leadership and commitment
Clause 5.2	Policy
Clause 5.3	Organisational roles, responsibilities and authorities
Clause 6 : Planning	
Clause	***Requirements***
Clause 6.1	Actions to address risks and opportunities
Clause 6.2	Quality objectives and planning to achieve them

Clause	***Requirements***
Clause 6.3	Planning of changes
Clause 7 : Support	
Clause	***Requirements***
Clause 7.1	Resources
Clause 7.2	Competence
Clause 7.3	Awareness
Clause 7.4	Communication
Clause 7.5	Documented Information
Clause 8 : Operation	
Clause	***Requirements***
Clause 8.1	Operational planning and control
Clause 8.2	Requirements of products and services
Clause 8.3	Design and development of products and services
Clause 8.4	Control of externally provided processes, products and services
Clause 8.5	Production and service provision
Clause 8.6	Release of products and services
Clause 8.7	Control of non-conforming outputs
Clause 9 : Performance Evaluation	
Clause	***Requirements***
Clause 9.1	Monitoring, measurement, analysis and evaluation
Clause 9.2	Internal audit
Clause 9.3	Management review
Clause 10 : Improvement	
Clause	***Requirements***
Clause 10.1	General
Clause 10.2	Nonconformity and corrective action
Clause 10.3	Continual improvement

2.2 Quality Management System Implementation

There are numerous solid evidence substantiating the fact that organisations with a properly planned and established QMS beat their rivals because such organisations enjoy certain advantages (Casadesús & De Castro, 2005; Su, Li, Zhang, Liu, & Dang, 2008; Singels, J., Ruel, G. and Van de Water, 2001; Awan & Bhatti, 2003). The QMS is an essential tool for organisations to support their operations performance and continual improvement of their business processes, thus providing a positive impact to the organisation (Drinke, Janovs, & Administration, 2011). But, there are quite a number unsuccessful cases of QMS implementation because of the magnanimous effort involved to integrate its practices into business processes (Cândido & Santos, 2011; Tan & Syazwan, 2016). The most critical implementation barriers identified are summarised in Table 4 below:

Table 4: Critical QMS Implementation Barriers

No.	QMS Implementation Barriers	References
1	Lack of top management commitment	Al-Najjar & Jawad (2011); Jang & Lin (2008); Magd (2008); Psomas, Fotopoulos, & Kafetzopoulos (2010)
2	Employee resistance	Al-Najjar & Jawad (2011); Psomas et al. (2010)
3	Challenging to perform internal audit	Souza-Poza, Altinkilinc, & Searcy (2009); Al-Najjar & Jawad (2011)
4	Unrealistic requirements of ISO 9001	Al-Najjar & Jawad (2011); Seddon (1997)
5	Lack of financial resources	Al-Najjar & Jawad (2011); Magd (2008); Jang & Lin (2008)
6	Insufficient human resources	
7	Insufficient employee training and quality education	

Gotzamani (2005) notes that it is difficult to change the mind-set of people to a quality management approach. The organisation itself should initiate the implementation of ISO 9001:2015 triggered by its needs to improve operations and product consistency.

QMS is only a tool towards process and product quality improvement and it is up to the organisation whether the system is simple or complex. The QMS should be integrated into the organisation's business process instead of being treated as an isolated system in order to enjoy its full value (Rusjan & Alič, 2010; Anttila & Jussila, 2017). As such, it is this researcher's aim to determine how to effectively execute the QMS into the case company's business processes and whether its implementation could reduce the number of customers' complaints on product non-conformance and improve delivery performance.

One study offered a theoretical structure to successfully integrate and execute QMS practices into business processes. The structure has five (5) stages (Garza-Reyes, Rocha-Lona, & Kumar, 2015):

- Stage 1 – QMS and Gap Analysis. This step involves identifying the strengths of current practice and opportunities for improvement;
- Stage 2 – Strategic Planning. This step involves business analysis, strategy formulation by developing company's vision, mission, objectives and policies; deployment and setting the metrics to measure performance.
- Stage 3 – Choose Correct Methods and Tools. This step consists of choosing the right models or methods considering the organizational factors.
- Stage 4 – QMS Implementation. This step involves implementing the documented QMS procedures or work instructions.
- Stage 5 – Evaluation of QMS and Business Practices. This step involves monitoring, measurement and evaluation of QMS and business process performance.

Since insufficient employee training is the quickest barrier that can be resolved among the seven (7) critical barriers identified in Table 4 and considering the time-

frame limitation of the final year research project, this researcher counter-proposed the below conceptual framework for the QMS implementation at Leon Fuat Hardware Sdn. Bhd.:

Table 5: Proposed Conceptual Framework for QMS Implementation at Leon Fuat S/B

Stage	Activity	Objectives
1.0	Gap Analysis	To understand the client processes and analyse the gap between existing processes and ISO 9001:2015 requirements
2.1	***Understanding ISO 9001:2015 training**	**To improve the understanding of the Top Management and QMS Committee members on the ISO 9001:2015 requirements before starting the QMS Design and Development activities**
2.2	QMS Strategic Planning	To develop company's vision, mission, objectives and policies; deployment and setting the metrics to measure performance
2.3	QMS Design and Development	To plan and development the QMS documents (procedures, work instructions and other supporting documents) that fully comply with ISO 9001 requirements
3.1	QMS Implementation Planning	To plan the implementation and prepare all necessary activities for effective implementation of QMS.
3.2	QMS implementation	To implement the documented QMS procedures or work instructions.
4.0	Evaluation of QMS and Business Practices	To monitor, measure, analyse and evaluate of QMS and business process performance.

This is because barriers Item 1 to 6 in Table 4 involves cultural and resource changes, which would take longer time than the organisation's time-frame for ISO 9001 certification (Souza-Poza et al., 2009).

2.3 Impact of Quality Management System Implementation on Consistent Method of Operations

ISO 9001:2015 QMS implementation necessitates an organisation to retain five (5) mandatory documented procedures and twenty two (22) records. The mandatory documents and records required are tabled below (*ISO 9001:2015:Quality Management Systems-Requirements,* 2015):

Table 6: ISO 9001:2015 Mandatory Documents and Records

Mandatory Documents

No.	Mandatory Documents
1	Clause 4.3 – Scope of QMS
2	Clause 4.4.2 (a) – Information to support the operations of business processes.
3	Clause 5.2 – Quality Policy Documented information of Quality Policy to be maintained.
4	Clause 6.2.1 – Documented information on quality objectives to be maintained.
5	Clause 8.5.1 - Data that characterises qualities of products and services, exercises to be performed, and the outcomes to be accomplished.

Mandatory Records

No.	Mandatory Records
1	Clause 4.4.2 (b) – Necessary supporting records as evidence that processes are implemented as planned.
2	Clause 7.1.5.1 – Calibration or verification records for monitoring and measuring resources.
3	Clause 7.1.5.2 – Basis used for calibration or verification as evidence of traceability to national or international standard.
4	Clause 7.2 – Competence Records or evidence of competence of human resources.

No.	Mandatory Records
5	Clause 8.1 – Operational Planning and Control Records that provide certainty that processes are implemented according to documented procedures and comply with requirements.
6	Clause 8.2.3 – Review of the Requirements for Products and Services Records of results of review associated with products and services prior to confirming customer's order.
7	Clause 8.3.2 – Design and Development Planning Records showing evidence that design and development requirements are complied with.
8	Clause 8.3.3 – Design and Development Inputs Documented information on design and development inputs shall be retained by the organisation.
9	Clause 8.3.4 – Design and Development Controls Records of controlling design and development activities shall be retained.
10	Clause 8.3.5 – Design and Development Output Records of design and development outputs shall be maintained and retained.
11	Clause 8.3.6 – Design and Development Changes Evidence records of design and development changes, the results of reviews, the authorisation of the changes and the actions taken to prevent adverse impacts.
12	Clause 8.4.1 – Control of Externally Provided Products and Services Information on the results of vendors' evaluation, selection, performance monitoring and re-evaluation of vendors.
13	Clause 8.5.1 – Control of Production and Service Provision Documented information that defines the characteristics of the products to be produced, the services to be provided, or the activities to be performed; and the results to be achieved.

No.	Mandatory Records
14	Clause 8.5.2 – Identification and Traceability Documented information necessary to facilitate traceability shall be retained.
15	Clause 8.5.3 –Property Belonging to Customers or External Providers Retain records of what has occurred when property belonging to customers or external providers is lost, damaged or found unsuitable for use.
16	Clause 8.5.6 – Control of Changes Records specifying the results of the review of changes, the persons authorizing the change, and any necessary actions arising from the review.
17	Clause 8.6 – Release of Products and Services Retain records on the release of products and services, including evidence of complying with product and process specifications and traceability to the person(s) authorising the release.
18	Clause 8.7.2 – Control of Non-Conforming Outputs Retain records on the non-conformity, actions taken, concessions obtained and the authority deciding the action related to the non-conformity.
19	Clause 9.1.1 General – Monitoring, Measurement, Analysis and Evaluation Documented information as evidence of the results shall be retained.
20	Clause 9.2 – Internal Audit The organisation shall maintain records of internal audit implementation and the audit results.
21	Clause 9.3 – Management review The organisation shall maintain records of the results of management reviews.
22	Clause 10.2 – Non-Conformity and Corrective Action Records of the nature of the non-conformities and any subsequent actions taken; and the results of any corrective action shall be retained.

Source: *ISO 9001:2015:Quality Management Systems-Requirements* (2015)

The compulsory documents and records necessitated by ISO 9001:2015 standard promotes procedural and systemised work, less act of spontaneity and enhanced coordination between different levels and functions in the company (Awan & Bhatti, 2003; Casadesús & De Castro, 2005; Magd, 2008; Rusjan & Alič, 2010; Stevenson, 2014; Heizer, Render, & Munson, 2017).

Studies found that most organisations' structures are hierarchal and have diverse divisions or practical units. The units frequently work vertically with autonomously determined outputs. Regularly, these outputs do not have a similar general target of consumer satisfaction. The consequence of business segments working in parallel or in 'storehouses' implies that business goals are not met (da Silva, Damian, & de Pádua, 2012; Biazzo & Bernardi, 2003).

The process approach, one of the seven management principles supporting the ISO 9001 standard, is an alternative method of managing business activities or processes (Biazzo & Bernardi, 2003; Gryna, Chua, & DeFeo, 2007). Process approach means managing an organisation's activities as interrelated processes where the output from the previous process becomes an input to the subsequent process (*ISO 9000:2015:Quality Management System-Fundamentals and Vocabulary*, 2015). It cuts across the business units or 'storehouses' and ensures the departmental objectives are in line with the principal objective of the company. Some benefits of QMS based on process approach are incorporation and adjustments of procedures to achieve desired results, focus on process adequacy and proficiency, improves clarity of operations and improves operations consistency with foreseeable results. Hence, QMS implementation promotes consistency in work operations by encouraging the management of an organisation's business units using process approach and standardising business operations using documented procedures or records (Gryna et al., 2007).

2.4 Impact of Quality Management System Implementation on Reduction in Number of Customers' Complaints on Product Non-Conformances

There are numerous literature studies that confirmed the benefits of QMS implementation as summarised in below table:

Performance Measures	Supporting Literature
Improved product quality performance	Su et al. (2008); Agus & Shukri Hajinoor (2012); Avella & Vazquez-Bustelo (2010)
Improved operations performance in terms of effectiveness and efficiency	Singels, J., Ruel, G. and Van de Water (2001); Feng, Terziovski, & Samson (2008); Carmignani (2008); Leung et al. (1999); Casadesús & Karapetrovic (2005)
Improved customer satisfaction	Awan & Bhatti (2003); Douglas, A., Coleman, S. and Oddy (2003)
A reduction in customers' complaints	Awan & Bhatti (2003); Casadesús & De Castro (2005); Piskar (2007)
Supply Chain Management	Casadesús & De Castro (2005)

However, a company can only enjoy the full benefit of QMS implementation in reducing the number of customers' complaints on product non-conformances if the QMS are well executed and utilised (Singels, J., Ruel, G. and Van de Water, 2001). The research affirms that executing the ISO 9001 QMS does not naturally convey advantages to an organization; rather, some prerequisites shall be complied. A few essential ones like inspiration and a tactical approach are talked about underneath.

Experimental research shows that the actual results of QMS implementation in reducing cases of product non-conformances are significantly affected by the motivation for introducing the ISO 9001 together with management support (Leung

et al., 1999; Singels, J., Ruel, G. and Van de Water, 2001; Kaynak, 2003; Jang & Lin, 2008). The impact of QMS implementation in reducing number of customers' complaints on product non-conformances will be more positively felt in companies that were internally motivated to obtain ISO 9001 certification, such as for quality improvements reason. In contrast, companies that are compelled to implement the ISO 9001 QMS due to external pressure, such as marketing purposes order to increase sales and profits, enjoy lesser benefit in reducing product non-conformances (Van der Wiele, T., Williams, A.R.T., Brown, A. and Dale, 2001). This means that companies must have the internal intention to improve their product and/or service quality in order to feel the full benefit of QMS implementation. Companies that are internally motivated attempt to continually improve the effectiveness and efficiency of their QMS because their main intention is not only to attain the ISO 9001 QMS certificate for show. Such organizations are likewise intrigued by thinking about the fundamental quality management principles, which speak to the premise of the right and successful usage of the ISO 9000 fundamentals. This implies that organizations need to comprehend the spirit behind standard necessities (Katerina D. Gotzamani et al., 2007; Psomas et al., 2010).

Besides internal motivation, management leadership and commitment in ensuring the company's policy and goals are consistent with the strategic direction of the company, significantly affects the impacts of actualizing the ISO 9001 on company's performance. Several research confirms this fact (Rao, S.S., Ragu-Nathan, T.S. and Solis, 1997; Sharma & Gadenne, 2002; Van der Wiele, T., Williams, A.R.T., Brown, A. and Dale, 2001; Piskar, 2007). This demonstrates that a QMS adds to an organisation's performance through usage of an organization's vision and mission and of key objectives related with the two.

Bearing in mind that the impact of QMS implementation is different for every company as it depends upon certain pre-requisites such as internal or external motivation and top management support and commitment, it is this researcher's aim to determine whether the QMS implementation at Leon Fuat Hardware Sdn. Bhd. is able to reduce the number of customers' complaints on product non-conformances for the company.

2.5 Impact of Quality Management System Implementation on Improvement in Delivery Performance

Empirical studies have confirmed that an effective QMS implementation in an organisation does have a positive impact on meeting delivery deadlines, thus improving delivery performance.

Performance Measures	Supporting Literature
Meeting the delivery date, improved delivery accuracy, shorter delivery period	Leung et al. (1999); Magd & Curry (2003); Fuentes, Benavent, Moreno, Cruz, & del Val (2003); Neyestani (2016)

However, some studies have shown a statistically significant decrease in perceived benefits related to meeting the delivery date. Simply put, even though QMS implementation provides many positive benefits to an organisation, the benefit of improved delivery performance is not valued as highly or positively in recent year compared to a few years ago. In fact, there was no significant statistical differences from Year 1998 to Year 2002 in terms of perceived benefits of meeting delivery date (Casadesús & De Castro, 2005). Are there any reasons behind this temporary erosion of benefits? One possible explanation might be that the genuine advantages acquired without a doubt have diminished after some time. The more regimented execution process practiced by ISO consultants and certification bodies, coupled with relaxed criteria for certification, may have added to this. The decrease in implementation and auditing processes could have abated the advantages of improved delivery performance. Moreover, more and more companies are getting certified to ISO 9001 QMS, thus reducing its competitive advantage in the market as the number of certified companies have become significant across all industries (Casadesús & De Castro, 2005).

Findings from previous studies also proved that supplier assessment or evaluation as required under Clause 8.4 of ISO 9001:2015 standard does not show a significant relationship with delivery and cost performance of the company. This finding is

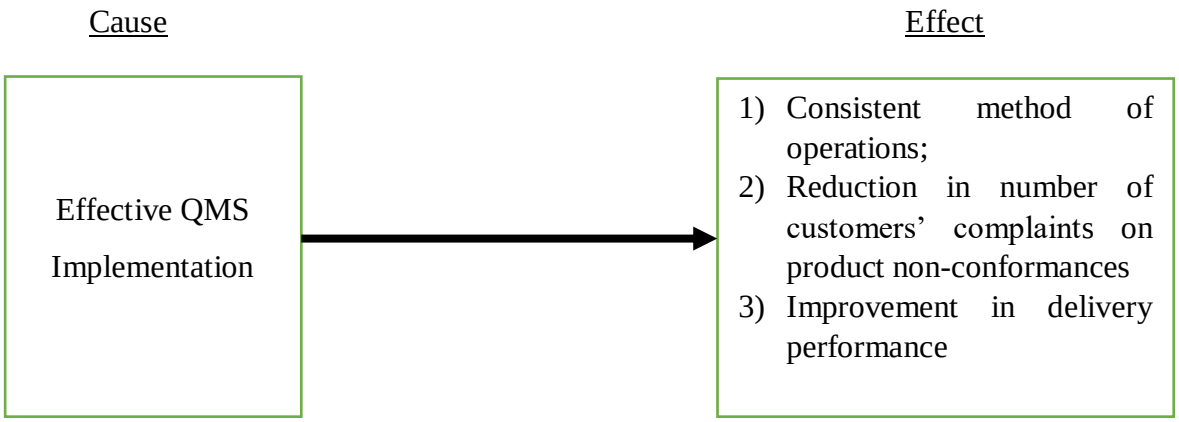
somewhat unexpected because the criterion of on-time delivery of incoming materials is usually included in selecting suppliers. This finding shows that while choosing the right supplier is vital, it is not adequate to achieve high delivery performance for the company (Prajogo, Chowdhury, Yeung, & Cheng, 2012). Logistics integration, however, shows a positive relationship with a company's delivery performance. This demonstrates that a well-facilitated flow of raw materials from suppliers allows a company to run their manufacturing processes within the expected cycle-time. Logistics integration allows a company and its suppliers to operate as a single unit to improve flow and speed in production process, thus improving the company's delivery performance (Prajogo et al., 2012).

Hence, besides the supplier performance evaluation system which is required under Clause 8.4 of the ISO 9001:2015 standard, this researcher may propose improving the logistics integration to the case company (Leon Fuat Hardware Sdn. Bhd.) in order to improve its delivery performance.

2.6 Research Framework

The conceptual framework is the foundation for a research project. The figure below illustrates the conceptual framework established to study the impact of quality management system (QMS) implementation in the operations of Leon Fuat Hardware Sdn. Bhd. on consistency in product and delivery performance.

Figure 2: Proposed Conceptual Framework



2.7 Conclusion

In general, chapter two has deliberated the literature review and a proposed conceptual framework was established. The next chapter (Chapter 3) will focus primarily on the research methodology used to carry out this research.

CHAPTER 3

RESEARCH METHODOLOGY

3.0 Introduction

This research has the main goal in determining whether a QMS implementation has an effect on consistency in method of operations, product quality and delivery performance at Leon Fuat Hardware Sdn. Bhd. The research methodology of the study is described in this chapter. It elaborates the research paradigm, design and approach that were adopted with justifications. This chapter also described the research design, study population, study sample, sampling techniques, data collection methods and instruments; and the research procedure. This chapter concludes with description of ethical considerations and methodological and practical challenges that were encountered in the course of the study.

3.1 Research Design

A descriptive research is adopted in this study. A research design is a master plan that illustrated the methods and procedures for collecting and analysing the needed information (Zikmund, 2003; Cooper & Schindler, 2008). Research design is established to determine the method of data collection, data analysis and data interpretation to find a solution to the problem (Sekaran, 2003). For this study, the researcher will use a blend of quantitative (data analysis) and qualitative (interviews) method. The objective of this method is to provide a comprehensive insight of the research problem. Data in numbers were generated using quantitative methods and was analysed using graphs so that it could be described in fractions

and probabilities (Amin, 2005). This is due to a need to layout some information statistically in order to bring out the statistical aspects of the study visibly.

The researcher adopted both quantitative and qualitative methods in this study mainly because data from one resource is inadequate to determine the consistency, effectiveness and efficiency of QMS implementation in the case company. The initial findings of quantitative results need to be further justified by qualitative method in order to introduce continual improvement activities into the case company. The interview session during internal audit will provide an insight on perceptions of employees and top management towards the QMS procedures and tools that have been implemented. Furthermore, the qualitative results will assist to justify why and how effective and consistent implementation of the QMS will impact product and delivery performance in the case company.

This research method will therefore provide a better comprehension of the research question from other perspectives and explain unforeseen results.

As described under Clause 2.2 in Chapter 2 Literature Review, the below conceptual framework will be adopted for this research project:

Stage	Activity	Objectives
1.0	Gap Analysis	To understand the client processes and analyse the gap between existing processes and ISO9001:2015 requirements
2.1	***Understanding ISO 9001:2015 training**	**To improve the understanding of the Top Management and QMS Committee members on the ISO 9001:2015 requirements before starting the QMS Design and Development activities**
2.2	QMS Strategic Planning	To develop company's vision, mission, objectives and policies; deployment and setting the metrics to measure performance

Stage	Activity	Objectives
2.2	QMS establishment	To plan and development the QMS documents (procedures, work instructions and other supporting documents) that fully comply with ISO 9001 requirements
3.1	QMS Implementation Planning	To plan the implementation and prepare all necessary activities for effective implementation of QMS.
3.2	QMS implementation	To implement the documented QMS procedures or work instructions.
4.0	Evaluation of QMS and Business Practices	To monitor, measure, analyse and evaluate of QMS and business process performance.

3.1.1 Inferential Statistics

Researchers try to describe the numerical features of their data in descriptive statistics. For inferential statistics, researchers try to go further than their data to summarise the results to the larger population (Johnson, B., & Christensen, 2017). The researcher uses inferential statistics to predict the data collected based on the features of the samples from the probability of population characteristics.

In addition, this method is used to meet the requirements of the quantitative and qualitative methods that the researcher must perform before and after QMS implementation to gauge whether the QMS implementation is able to improve company's performance. This enables the researcher to determine the likelihood of success before making any recommendations that are valuable for the researcher's time and effort. One section of inferential statistics is to approximate parameters using the sample data statistics. The data is then used to depict the specifications of population.

3.1.2 Qualitative Method

The purpose of the qualitative study is to fully understand a certain subject, which includes the root-causes why the results are so. Qualitative research generally seeks answers as to why, when, when and how (Crowther, D., & Lancaster, 2009). Some

researchers concurred that qualitative research could conquer quantitative research weaknesses (Cooper, D. R., & Schindler, 2008).

The methods of collecting qualitative data may be unstructured or semi-structured. This can be done by methods such as interviews or focus group discussions and usually in small sample size or fewer respondents in order to achieve the target sample. In order to collect data from this interview, purposeful sampling is used. The target sample for this research will be the employees whose work directly impacts the effectiveness of the QMS, process owners and Top Management or the case company.

In this research, questions based on defined audit criteria will be asked during internal audit. The replies will substantiate the quantitative findings.

3.1.3 Quantitative Method

Quantitative study involves using arithmetical data that can be transformed to statistics to measure a problem. When data are transformed into something measurable, they provide information to certain occurrences that can be generalise across the population. If it is not measurable, then it is not a quantitative study (Cooper, D. R., & Schindler, 2008).

Quantitative research is used to determine accurate measurements for some things (Cooper, D. R., & Schindler, 2008). In order to determine certain trends in the study, facts are conveyed using measurable data. Data can be collected using performance instruments and the results will be analysed statistically to confirm research questions or any assumptions.

For this research, data of customers' complaints, delivery performance and internal audit results will be analysed and evaluated to determine whether the QMS implementation managed to improve consistency in method of operations, product quality and delivery performance.

3.2 Research Population

The full arrangement of cases from which a sample is obtained is known as the population. In sampling, the term "population" is not limited to only individuals but also include occasions, creatures and articles who/which are the objective of the research (Saunders, M., Lewis, P. & Thornhill, 2012). This research was based on the population of relevant departments, processes, functions or activities within Leon Fuat Hardware Sdn. Bhd. covered by the scope of QMS and the QMS records generated.

3.3 Sample Size Determination

In this research, sampling is only applicable for QMS internal audit purposes. Sampling is determining the representative segment size from a quantifiable population to judge traits of the total population. It is the way toward choosing adequate quantities of elements from the populace with the goal that an investigation of the sample and its qualities would make it feasible for the researcher to sum up such attributes to the populace components. A sample is an example as a subset of a specific populace in a given research (Cooper, D. R., & Schindler, 2008).

Sampling Plan

The objectives of a sampling plan for this research is to minimise audit interruptions to the operations of the case company and ensure all audit criteria are covered within the time allocated in the audit plan, but still have a representative sample that gives confidence in the audit findings.

The QMS internal audit scope for the case company is defined as below:

- Location: Leon Fuat Hardware Sdn. Bhd.
- Duration of audit agreed by case company: 2 to 2.5 man-days.
- Who: All departments or functions or activities within the organisation.

The QMS internal audit criteria are:

- ISO 9001:2015 standard.
- Company's QMS procedures, process and policies.
- Customer's requirements.
- Legal or other requirements applicable to the company's trade (if any).

Sampling Method

Two (2) types of audit sampling methods are allowed by both ISO 19011:2018 standard (*ISO 19011:2018-Guidelines for auditing management systems*, 2018) and Institute of Internal Auditors, Australia (IIA) (IIA Australia, 2017). They are statistical sampling and judgement-based sampling.

Statistical sampling uses a probability-based sample selection process. It enables the auditor to conclusions based on arithmetic confidence levels regarding a data output population. For example, let us assume there are 1000 purchase orders being issued over the past five months. By referring to statistical sample size table (Table 7) below, you should sample 278 orders or a 27.8% sample for a statistically valid audit at a confidence level of 95% and noncompliance rate of 5% or less.

Table 7: Statistical Sample Size Table

Required Sample Size†

Population Size	Confidence = 95% Margin of Error				Confidence = 99% Margin of Error			
	5.0%	3.5%	2.5%	1.0%	5.0%	3.5%	2.5%	1.0%
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
1,000	278	440	606	906	399	575	727	943
1,200	291	474	674	1067	427	636	827	1119
1,500	306	515	759	1297	460	712	959	1376
2,000	322	563	869	1655	498	808	1141	1785
2,500	333	597	952	1984	524	879	1288	2173

Source: ("Sample Size Table," n.d.)

Judgement-based sampling depends on the auditor's know-how, skills and experience. The sampling should take into account (*ISO 19011:2018-Guidelines for auditing management systems*, 2018):

a) Former experience within the scope of audit;
b) Process intricacy and interactions;
c) Technology and system deviations;
d) Previous audit results.

A disadvantage of judgement-based sampling is that audit findings are not supported by statistical estimate of the effect of uncertainty.

However, based on the researcher's industry experience, the judgement-based sampling method is highly used by quality auditors in auditing quality management systems in Malaysia. Most auditors in quality system certification bodies uses judgement-based sampling technique because they are required to complete the audit covering all audit criteria and scope within the stipulated man-days.

Select Sampling Method

Considering the limitations of this business case study, this researcher has decided to use judgement sampling technique when conducting the QMS internal audit. The limitations encountered for this case study are:

a) The researcher is the sole internal auditor for the case company. Thus, the researcher have to cover all audit criteria and processes within the audit scope;
b) Time-constraint as the audit duration permitted by the case company is 2 to 2.5 man-days;
c) The internal audit should minimise any disruptions to business operations of the case company;
d) The sample size required using statistical sampling method is too large to cover by a sole auditor within the stipulated audit duration.

Hence, this researcher will use the judgement-based sampling method when conducting the QMS internal audit to derive the appropriate audit conclusions. Necessary steps are taken to minimise the risks in judgement-based sampling such as ensuring the competency of the researcher in conducting QMS internal audits.

The researcher has many years of experience in auditing QMS and has undergone relevant trainings such as QMS internal audit trainings as per training certificates attached in **Appendix B**. Also, all types of evidence are included in the audit sample such as documents, activities and records. At least three (3) samples or evidence shall be selected from every audit area/activity/process to minimise invalidity of audit findings.

3.4 Sampling Technique

Judgement-based sampling or purposive sampling technique was adopted at each audit element for the QMS internal audit purpose where interview subjects were selected based on their direct involvement in QMS implementation. When selecting samples of QMS records for audit purposes, the researcher will also use judgement-based sampling technique with appropriate steps taken to minimise the risks of judgement-based sampling as explained in Section 3.3 above. This technique was chosen due to time constraint, manpower constraint and other limitations such as ensuring minimal disruptions to the business operations of the case company during auditing.

3.5 Data Collection Methods

Data for this study was derived from both primary and secondary sources and collected using documentary reviews, customers' complaints records, delivery records and internal audit records. In order to determine consistent method of operations, Leon Fuat Hardware Sdn. Bhd.'s "QMS Document Master List" will be compared against the five (5) mandatory documented procedures and twenty two (22) records required by the ISO 9001:2015. This is to conclude that work processes are documented to ensure consistency in operations. QMS internal audit will also be performed relevant functions and levels within the case company to evaluate the effectiveness of the QMS performance against the ISO 9001:2015 requirements. The internal audit results will be analysed and evaluated to determine consistency

and effectiveness in method of operations. The details of data collection methods are described below.

3.5.1 Documentary Reviews

A document analysis is a research method which is used as a tool to obtain relevant documented evidence to verify and corroborate facts stated in the research, especially during literature review. It includes explanatory perusing and survey of loads of composed material (Bowen, 2009).

This researcher reviewed various documents related to ISO 9001:2015 QMS and the impact of its implementation on a company to complement data from other sources in this research. In spite of the various difficulties associated with documentary reviews such as the requirements for consent, inaccessibility and obsolesce, Hardon, Hodgkin, & Fresle (2004) and Mogalakwe (2006) support their utilizations since they are a cost-productive method for doing surveys and have a tendency to evade duplication of endeavours.

3.5.2 Documents and Records

This method comprises of looking at existing documented information such as data analysis results, meeting minutes, reports, relevant records of process outputs and so forth. It alludes to the examination of records that contain data about the phenomenon we wish to research. This technique is similarly as great and in some cases considerably more financially savvy than social studies, exhaustive interviews or member surveillance (Mogalakwe, 2006).

This researcher has reviewed documented information related to consistency in method of operations, customers' complaints on product defects and delivery performance for this study.

3.5.3 QMS Internal Audit

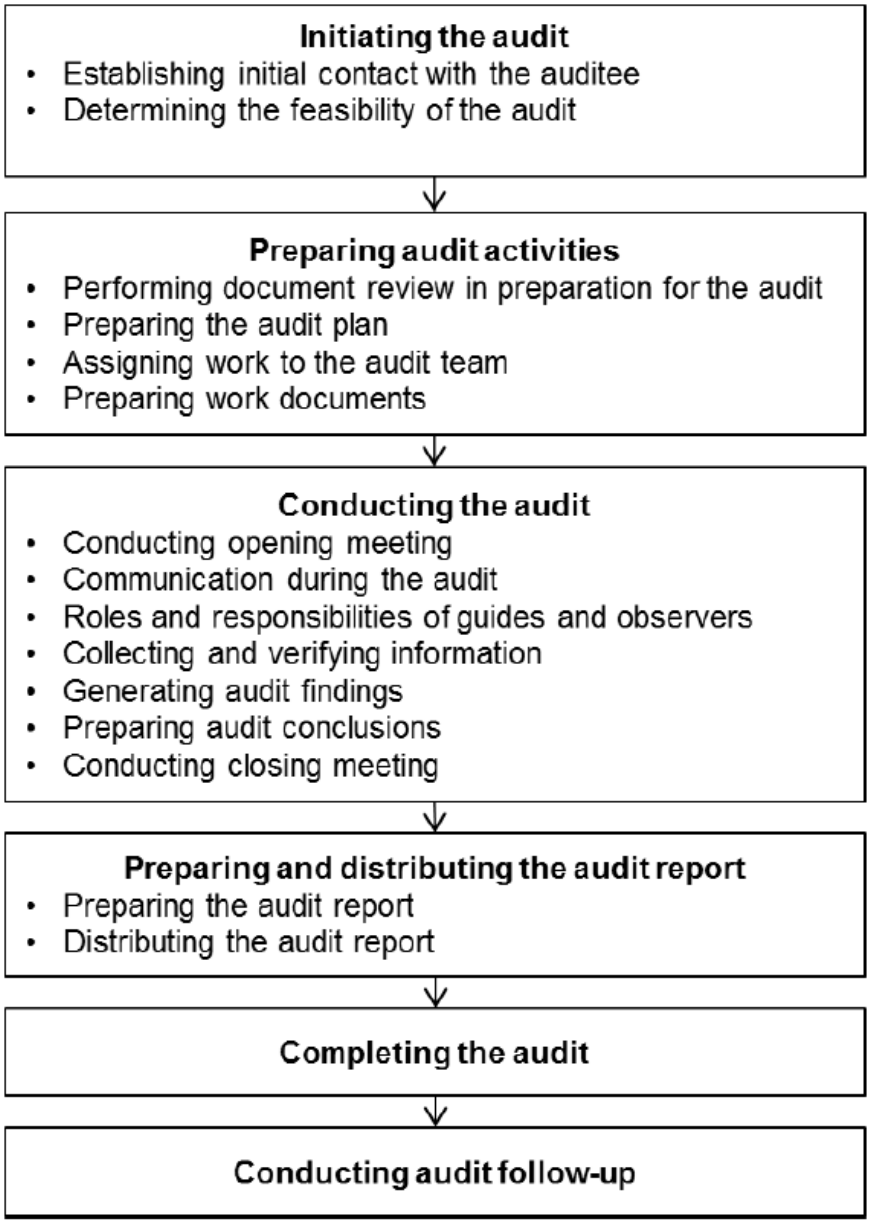
Auditing is defined as a "systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled". The fundamental elements of an audit include determining the compliance against documented QMS requirements performed by a personnel independent of the process or element being audited (*ISO 9000:2015:Quality Management System-Fundamentals and Vocabulary,* 2015).

There are three (3) categories of audit defined in ISO 19011 auditing standard i.e. internal audit, second party audit and third party audit. Internal audit is not so formal in contrast to the more official second or third party audit. Mostly, the focus of the internal audit is more on the company's operations rather than accounts (*ISO 19011:2018-Guidelines for auditing management systems,* 2018).

For this study, the internal audit is performed by the researcher as she has the required qualifications and work experience as a consultant for ISO 9001:2015 QMS. The internal audit is performed in compliance with the ISO 19011:2018 recommended auditing process of initiating the audit, preparing audit activities, conducting the audit, preparing and distributing audit report, completing the audit and conducting audit follow-up. Internal audit is conducted at least 3 months after the effective date of QMS implementation. Since the effective date of ISO 9001:2015 QMS implementation for Leon Fuat Hardware Sdn. Bhd. is 1st Aug 2018, the researcher conducted the internal audit at least 3 months after Aug 2018 to determine effectiveness and efficiency of QMS implementation.

Figure 3 below sourced from the ISO 19011 standard provides an overview of a normal audit process (*ISO 19011:2018-Guidelines for auditing management systems,* 2018):

Figure 3: The process of performing an audit



Initiating the audit

The researcher contacted the company representative to establish the internal audit date (2 man-days) and determine the viability of the audit.

Audit preparation

The researcher performed a QMS document review, prepared audit plan and audit checklists. The audit plan is attached in **Appendix C** in this research report.

Conducting the internal audit

The researcher conducted the opening meeting and performed the audit by interviewing relevant key personnel, sampling relevant records and observing the actual practice to verify information against requirements. The researcher also generated the audit findings, prepare audit conclusions and revealed the audit findings to the case company during the closing meeting.

Preparing and distributing the audit report

The researcher prepared and distributed the audit report to the case company for their further actions.

Completing the audit

The researcher ensured that every audit activity has been completed and every party has approved the audit report. All relevant parties (i.e. the auditors and auditees) agreed on the timeframe for all audit findings to be cleared by the case company for verification and closure by the auditor.

Conducting audit follow-up

The researcher as the internal auditor followed-up, verified and closed all internal audit findings two weeks after the date of internal audit. The closure of internal audit findings are supported by evidence of actions taken to prevent recurrence of the problem or non-conformance.

3.6 Data Collection Instruments

3.6.1 Documentary Review Checklist

A documentary review checklist is a device used for obtaining relevant important documented proof to substantiate details indicated in a study. It shows the different kinds of literature reviewed with regards to the research (Bowen, 2009).

3.6.2 Documented Information Related to Consistency in Method of Operations, Customers' Complaints on Product Defects and Delivery Performance

It is a requirement of the ISO 9001:2015 standard that details of customer's complaints on non-conformances are to be documented ("ISO 9001 | International Quality Management Standard | NQA," n.d.). Thus, Leon Fuat Hardware Sdn. Bhd. has established a "Control of Non-Conforming Output procedure (PR-13)" which states that details of customers' complaints on product defects are to be recorded in "Customer Complaint Report" form.

In terms of delivery performance, the data collection instruments were the "Customer Complaint Report Form" and the "Non-Conformance Report Form". This is because according to the case company's procedure, customer's complaint on late delivery shall be recorded in "Customer Complaint Report Form" and internally detected delivery performance issues shall be recorded in "Non-Conformance Report Form".

With regards to consistency in method of operations, a "QMS Document Master List" has been established to cross-check the established documented information at Leon Fuat Hardware Sdn. Bhd. against the mandatory documented information required by the ISO 9001:2015 standard in order to derive a conclusion that work processes are documented to ensure consistency in operations. The internal audit checklist and/or report have also been generated to determine compliance against company's documented procedures and other audit criteria such as ISO 9001:2015 standard, customers' requirements and; applicable legal and other requirements.

As a summary, the data collection instruments include Customer Complaint Report Form, Non-Conformance Report Form, QMS Document Master List and Internal Audit Report.

3.6.3 Internal Audit Checklist and/or Report

An ISO 9001 internal audit checklist is an important element in facilitating the internal audit. The checklist for any internal audit comprised of a set of elements to look for or check points derived from audit criteria such as the company's QMS documents, ISO 9001 standard, customer's requirements and applicable legal and other requirements (Phillips, 2015).

An internal audit checklist was designed by the researcher for this case study with check points derived from Leon Fuat Hardware Sdn. Bhd.'s QMS documents, ISO 9001:2015 standard, customer's requirements and applicable legal and other requirements. This is because the researcher personally performed the internal audit as she has the required qualifications and work experience as a consultant for ISO 9001:2015 QMS.

3.7 Validity of the Instruments

Sekaran (2003) defined that validity decided how well something measures the object or question it is expected to gauge. It alludes to exactness in measurements to guarantee that a specific information accumulation instrument really measures what it was proposed to quantify or the degree to which surmises or conclusions drawn from information are sensible and reasonable.

There are three (3) main types of validity to consider for quantitative research instruments. They are content validity, construct validity and criterion validity (Heale & Twycross, 2015). In order to evade invalidity of instruments however much as reasonably expected, notes were taken amid the meetings or audits and the information was then accumulated and changed it into valuable data. The fact that the research instrument measures only one construct ensures homogeneity, a key evidence for construct validity. Furthermore, customer's complaints and non-conformances reports were investigated by Leon Fuat Hardware Sdn. Bhd. to

determine the root-cause(s). This intensified the validity and reliability of this research as it ensured that only genuine complaints are being taken into account.

In order to ensure validity of internal audit results, the following steps have been taken:

1) A competent person is used to perform the QMS internal audit. The researcher, as the internal auditor, has many years of experience in conducting QMS audits and has undergone ISO 9001:2015 internal audit training as per biodata attached as **Appendix B**. The researcher also has relevant QMS consultancy experience in the metal industry, supported by client's testimonial in **Appendix B**.
2) At least three (3) samples from every activity/area/process shall be selected as audit evidence to minimise invalidity of audit findings.
3) Every audit findings are supported by relevant audit evidence to ensure validity of audit results.
4) The internal auditor has no direct interest or independent of the process being audited.

3.8 Data Analysis

The quantitative and qualitative method is used for analysis in this research considering the research design and approach suggested. The effective date of ISO 9001:2015 QMS implementation for Leon Fuat Hardware Sdn. Bhd. is 1st August 2018. In solving the research questions, the below data need to be collected five (5) months before and five (5) months after the ISO 9001:2015 effective date. This means that the below-mentioned data needs to be collected and analysed from 1st March 2018 until end of December 2018:

a) Leon Fuat Hardware Sdn. Bhd.'s QMS document master list against the five (5) mandatory documented procedures and twenty two (22) records required by the ISO 9001:2015 standard in order to conclude that work processes are documented to ensure consistency in operations.

b) QMS internal audit results to determine compliance against company's QMS documents, ISO 9001:2015 standard, customer's requirements and; applicable legal and other requirements;
c) Number and details of customers' complaints on product non-conformance; and
d) Delivery performance

The information gathered was checked for fulfilment, coded and organised before final analysis. Descriptive statistics were used to compute, align the spread and mean area of the data being analysed.

3.9 Procedure for Data Analysis

The researcher pursued the endorsement of the research project by the supervisor. The researcher also seek the consent of the case company (Leon Fuat Hardware Sdn. Bhd.) to conduct this research. Once the consent is obtained, the researcher prepared a research proposal and research instrument were established to assist in data collection. These letters were utilized to acquaint her with guardians and key personnel in the case company in the span of gathering information. Definite field notes were taken and altered after a day's work. The information was sorted out, cleaned and used to accumulate a report to be submitted.

3.10 Measurement of the Variables

Customers' complaints and delivery performance were measured using ratio types of measurements. Consistency in methods of operations, including internal audit results, were measured using both nominal and ratio types of measurement.

3.12 Conclusion

In summary, this chapter have deliberated the methodology used in performing this research. Analysis of data will be performed using appropriate statistical methods such as graphs or charts upon completeness of data collection. The next chapter will emphasise on the deduction and interpretation of the study result.

CHAPTER 4

RESEARCH RESULTS

4.0 Introduction

Researcher will use descriptive analysis to examine the data collected from this research.

4.1 Descriptive Analysis

In order to explain the key characteristics of the data collected, descriptive analysis is applied. At the end of the day, it was a deduction strategy that is utilised to depict some key highlights of the information obtained from this research study.

4.2 QMS Documented Information

Prior to the ISO 9001:2015 effective date of implementation, the case company has not established any documented procedures to ensure standardisation and consistency in operations. This is evident from the **ISO 9001 Gap Analysis Report** attached as **Appendix A**. In order to comply with ISO 9001:2015 requirements, the case company has since established the required documented information.

The case company's QMS Document Master List is compared against the five (5) mandatory documented procedures and twenty two (22) records required by the ISO 9001:2015 standard in order to conclude that work processes are documented to ensure consistency in operations. Table 8 below is the QMS Document Master List

for the case company, depicting the documented procedures established and relevant records required for the QMS.

Table 8: Documented Information Established for Case Company

a) Procedures

Doc. No.	Procedure Title	Supporting Forms or Records
PR-01	Purchasing Process	1) PR-01-01 (Purchase Order); 2) PR-01-02 (Purchase Requisition Form); 3) Forwarder's Delivery Order; 4) Supplier's Delivery Order; and 5) Supplier's Quotation.
PR-02	Supplier Selection & Evaluation	1) PR-02-01 (Approved Suppliers List); 2) PR-02-02 (Supplier Evaluation Report); 3) PR-02-03 (New Supplier Evaluation Form); and 4) Supplier's Company Profile and relevant supplier information.
PR-03	Receiving & Inventory	1) Supplier Delivery Order; 2) Mill Certificate; 3) Inventory Record in ERP system; and 4) Stock Card or Stock List
PR-04	Delivery	1) PR-04-01 (Store Outgoing Note); 2) PR-04-02 (Delivery Order); and 3) Daily Delivery Record.
PR-05	Sales Enquiry & Order Processing	1) PR-05-01 (Customer Enquiry Form); 2) PR-05-02 (Sales Confirmation); 3) PR-05-03 (Sales Order); 4) PR-05-04 (Job Sheet).

Doc. No.	Procedure Title	Supporting Forms or Records
PR-05	Sales Enquiry & Order Processing	5) PR-05-05 (Material Requisition); and 6) Customer's confirmed order (Customer's PO).
PR-06	Production Planning	1) PR-06-01 (Raw Material Issue to Production); 2) PR-06-02 (Daily Cutting Report);
PR-07	Inspection & Testing, including Quality Plan.	1) PR-07-01 (Inspection Checklist); 2) PR-07-02 (Material Receiving List); and 3) Incoming material inspection records.
PR-08	Control of Monitoring & Measuring Resources	1) PR-08-01 (Equipment Calibration / Verification Master List); 2) PR-08-02 (Calibration / Verification Report); 3) Equipment Calibration Certificate.
PR-09	Infrastructure Maintenance	1) PR-09-01 (Preventive Maintenance Plan); 2) PR-09-02 (Maintenance Checklist); 3) PR-09-03 (Breakdown Report); and 4) Machine Service Reports.
PR-10	Recruitment	1) PR-10-01 (Man Power Requisition); 2) PR-10-02 (Job Application Form); 3) PR-10-03 (On Job Training); 4) PR-10-04 (Appraisal Form); and 5) PR-10-05 (Briefing Checklist);

Doc. No.	Procedure Title	Supporting Forms or Records
PR-11	Competence and Awareness	1) PR-11-01 (Training Evaluation Form); 2) PR-11-02 (Training Requisition Form); 3) PR-11-03 (Staff Training Record); 4) PR-11-04 (Annual Training Plan); and 5) Training Attendance List.
PR-12	IT Maintenance	1) PR-12-01 (IT Preventive Maintenance Schedule); 2) PR-12-02 (IT Preventive Maintenance Checklist); and 3) File Backup records.
PR-13	Control of Non-Conforming Outputs	1) PR-13-01 (Non-Conformance Report)
PR-14	Customer Feedback	1) PR-14-01 (Customer Satisfaction Survey); 2) PR-14-02 (Customer Complaint Report);
PR-15	Internal Audit	1) PR-15-01 (Corrective Action Request); 2) PR-15-02 (Audit Checklist) ; 3) PR-15-03 (Observation Sheet); 4) Internal Audit Plan; and 5) Audit Summary Report.
PR-16	Management Review	1) Management Review Meeting Minutes.
PR-17	Analysis of Data	1) PR-17-01 (Preventive Action / Continual Improvement); 2) Data Analysis Records for QMS Key Performance Indicators.

Doc. No.	Procedure Title	Supporting Forms or Records
PR-18	Control of Documents	1) PR-18-01 (QMS Change Request Form); 2) PR-18-02 (External Document Master List); and 3) List of Product Drawings received from Customer.
PR-19	Control of Records	1) List of QMS Records.
PR-20	Risks & Opportunities Review	1) Risks and Opportunities Report for Context of the Organisation; 2) Risks and Opportunities Review List for Core Business Processes; 3) Business Process Map.
PR-21	Communication	1) Relevant communication records.
PR-22	Knowledge Management	2) Process Knowledge Base
PR-23	Identification and Traceability	Records generated under procedure: a) Receiving & Inventory (PR-03); b) Delivery (PR-04); c) Sales Enquiry & Order Processing (PR-05); d) Production Planning (PR-06); e) Inspection and Testing (PR-07).
PR-24	Control of Changes	1) PR-22-01 (Engineering Change Notice)

b) Quality Manual

Doc. No.	Document Title
QM-01	List of Contents
QM-02	Company Introduction

Doc. No.	Document Title
QM-03	Quality Manual Administration • Scope of QMS, including relevant exclusions of ISO 9001:2015 clauses.
QM-04	Quality Policy and Quality Objectives.
QM-05	Business Process Map
QM-06	Quality Management System
QM-07	Management Responsibilities
QM-08	Resource Management
QM-09	Product Realisation
QM-10	Measurement, Analysis and Improvement
QM-11	QMS Procedures and Forms Listing
QM-12	Company's Organisation Chart

b) Work Instructions

Doc. No.	Document Title
WI-01 – WI-05	Work Instructions for Cutting Using Band Saw Machines.

Table 9 below compares the case company's established QMS documented information against documented information required by ISO 9001:2015.

Table 9: Documented Information Established for Case Company Against Documented Information Required by ISO 9001:2015.

a) Mandatory Documents

No.	Mandatory Documents	Where Is It Addressed in QMS Documents of Case Company
1	Clause 4.3 – Scope of QMS	Quality Manual Administration (QM-03) of Quality Manual.

No.	Mandatory Documents	Where Is It Addressed in QMS Documents of Case Company
2	Clause 4.4.2 (a) – Information to support the operations of business processes.	Business Process Map (QM-05) of Quality Manual.
3	Clause 5.2 – Quality Policy Documented information of Quality Policy to be maintained.	Quality Policy and Quality Objectives (QM-04).
4	Clause 6.2.1 – Documented information on quality objectives to be maintained.	Quality Policy and Quality Objectives (QM-04).
5	Clause 8.5.1 - Data that characterises qualities of products and services, exercises to be performed, and the outcomes to be accomplished.	1) Inspection & Testing, including Quality Plan (PR-07); 2) Relevant Product Drawings from Customer; 3) PR-05-04 (Job Sheet); and 4) Relevant Product Specifications.

b) <u>Mandatory Records</u>

No.	Mandatory Records	Where Is It Addressed in QMS Documents of Case Company
1	Clause 4.4.2 (b) – Necessary supporting records as evidence that processes are implemented as planned.	Supporting records under each QMS procedure.
2	Clause 7.1.5.1 – Calibration or verification records for monitoring and measuring resources.	Records generated under procedure "Control of Monitoring and Measuring Resources (PR-08)".

No.	Mandatory Records	Where Is It Addressed in QMS Documents of Case Company
3	Clause 7.1.5.2 – Basis used for calibration or verification as evidence of traceability to national or international standard.	Records generated under procedure "Control of Monitoring and Measuring Resources (PR-08)".
4	Clause 7.2 – Competence Records or evidence of competence of human resources.	Records generated under procedure "Competence and Awareness (PR-11)".
5	Clause 8.1 – Operational Planning and Control Records that provide certainty that processes are implemented according to documented procedures and comply with requirements.	Records generated under procedure "Inspection & Testing (PR-07)".
6	Clause 8.2.3 – Review of the Requirements for Products and Services Records of results of review associated with products and services prior to confirming customer's order.	Records generated under procedure "Sales Enquiry & Order Processing (PR-05)".
7	Clause 8.3.2 – Design and Development Planning Records showing evidence that design and development requirements are complied with.	Not applicable because case company does not perform design and development activities.
8	Clause 8.3.3 – Design and Development Inputs Documented information on design and development inputs shall be retained by the organisation.	Not applicable because case company does not perform design and development activities.

No.	Mandatory Records	Where Is It Addressed in QMS Documents of Case Company
9	Clause 8.3.4 – Design and Development Controls Records of controlling design and development activities shall be retained.	Not applicable because case company does not perform design and development activities.
10	Clause 8.3.5 – Design and Development Output Records of design and development outputs shall be maintained and retained.	Not applicable because case company does not perform design and development activities.
11	Clause 8.3.6 – Design and Development Changes Evidence records of design and development changes, the results of reviews, the authorisation of the changes and the actions taken to prevent adverse impacts.	Not applicable because case company does not perform design and development activities.
12	Clause 8.4.1 – Control of Externally Provided Products and Services Information on the results of vendors' evaluation, selection, performance monitoring and re-evaluation of vendors.	Records generated under procedure: a) Recruitment (PR-10) b) Supplier Selection and Evaluation (PR-02).
13	Clause 8.5.1 – Control of Production and Service Provision Documented information that defines the characteristics of the products to be produced, the services to be provided, or the	Records generated under procedure: a) Receiving & Inventory (PR-03); b) Delivery (PR-04); c) Production Planning (PR-06);

No.	Mandatory Records	Where Is It Addressed in QMS Documents of Case Company
	activities to be performed; and the results to be achieved.	d) Inspection and Testing (PR-07). e) Work Instructions for Cutting Using Band Saw Machine (WI-01-05)
14	Clause 8.5.2 – Identification and Traceability Documented information necessary to facilitate traceability shall be retained.	Records generated under procedure "Identification and Traceability (PR-23)".
15	Clause 8.5.3 –Property Belonging to Customers or External Providers Retain records of what has occurred when property belonging to customers or external providers is lost, damaged or found unsuitable for use.	Records generated under procedure "Receiving and Inventory (PR-03)".
16	Clause 8.5.6 – Control of Changes Records specifying the results of the review of changes, the persons authorizing the change, and any necessary actions arising from the review.	Records generated under procedure "Control of Changes (PR-24)"
17	Clause 8.6 – Release of Products and Services Retain records on the release of products and services, including evidence of complying with product and process specifications and traceability to the person(s) authorising the release.	Records generated under procedure "Inspection and Testing (PR-07)".

No.	Mandatory Records	Where Is It Addressed in QMS Documents of Case Company
18	Clause 8.7.2 – Control of Non-Conforming Outputs Retain records on the non-conformity, actions taken, concessions obtained and the authority deciding the action related to the non-conformity.	Records generated under procedure: a) Control of Non-Conforming Output (PR-13); b) Customer Feedback (PR-14).
19	Clause 9.1.1 General – Monitoring, Measurement, Analysis and Evaluation Documented information as evidence of the results shall be retained.	Records generated under procedure "Analysis of Data (PR-17)".
20	Clause 9.2 – Internal Audit The organisation shall maintain records of internal audit implementation and the audit results.	Records generated under procedure "Internal Audit (PR-15)".
21	Clause 9.3 – Management review The organisation shall maintain records of the results of management reviews.	Records generated under procedure "Management Review (PR-16)".
22	Clause 10.2 – Non-Conformity and Corrective Action Records of the nature of the non-conformities and any subsequent actions taken; and the results of any corrective action shall be retained.	Records generated under procedure: a) Control of Non-Conforming Output (PR-13); b) Customer Feedback (PR-14).

Table 8 and Table 9 above shows that the relevant documented procedures and records mandated by the ISO 9001:2015 QMS have been established and its implementation is effective from 1st August 2018. This concludes that since the QMS implementation, work processes are documented to ensure consistency in business operations.

4.3 Customers' Complaints on Product Non-Conformance

The case company has established a target of "*To achieve not more than 0.80% of complaints per month of total sales order generated*" as one of the quality objectives towards minimum customer's complaint effective from 1st August 2018. Data on customer's complaints were collected five (5) months before and five (5) months after the effective date of QMS implementation.

Table 10 below summarises the data on customer's complaints from 1st March 2018 until end of Dec 2018.

Table 10: Summary Data on Customer's Complaints

Quality Objective: To achieve not more than 0.80% of complaints per month of total sales order generated.

Month (Year 2018)	Total Sales Order	No. of customer's complaints	Percentage (%) of complaints	Details of complaints
Mar	1,954	22	1.10% (Target not achieved)	a) 12 cases due to product length or width out of specifications; b) 8 cases due to thickness out of specifications; c) 2 cases due to material dented or rusty.

Month (Year 2018)	Total Sales Order	No. of customer's complaints	Percentage (%) of complaints	Details of complaints
Apr	1,851	18	1.00% (Target not achieved)	a) 7 cases due to product length or width out of specifications; b) 5 cases due to thickness or diameter out of specifications; c) 4 cases due to material rusty or pitted hole. d) 2 cases because customer received wrong sizes.
May	1529	16	1.00% (Target not achieved)	a) 7 cases due to product length or width out of specifications; b) 6 cases due to thickness or diameter out of specifications; c) 3 cases due to material surface scratches or rusty.
June	1,808	19	1.10% (Target not achieved)	a) 10 cases due to product length or width out of specifications; b) 5 cases due to thickness or diameter out of specifications; c) 4 cases due to material rusty or dented.

Month (Year 2018)	Total Sales Order	No. of customer's complaints	Percentage (%) of complaints	Details of complaints
July	2,147	24	1.10% (Target not achieved)	a) 12 cases due to product length or width out of specifications; b) 5 cases due to thickness or diameter out of specifications; c) 4 cases due to material rusty or dented. d) 3 cases due to customer receive wrong sizes.
Aug	2,255	20	0.89% (Target not achieved)	a) 11 cases due to product length or width out of specifications; b) 4 cases due to thickness or diameter out of specifications; c) 3 cases due to material surface scratches or rusty. d) 2 cases due to customer receive wrong sizes.
Sept	1,765	11	0.62% (Target achieved)	a) 6 cases due to product length or width out of specifications; b) 3 cases due to thickness or diameter out of specifications; c) 2 cases due to material dented or rusty.

Month (Year 2018)	Total Sales Order	No. of customer's complaints	Percentage (%) of complaints	Details of complaints
Oct	2,190	13	0.59% (Target achieved)	a) 6 cases due to product length or width out of specifications; b) 3 cases due to thickness or diameter out of specifications; c) 2 cases due to material surface scratches or rusty. d) 2 cases due to customer receive wrong sizes.
Nov	2343	14	0.60% (Target achieved)	a) 8 cases due to product length or width out of specifications; b) 3 cases due to thickness or diameter out of specifications; c) 3 cases due to material surface scratches or rusty.
Dec	2215	11	0.50 (Target achieved)	a) 6 cases due to product length or width out of specifications; b) 4 cases due to thickness or diameter out of specifications; c) 1 case due to customer receive wrong sizes.

Data tabulated in Table 10 above indicates that the target of "*To achieve not more than 0.8% of complaints per month of total sales order generated*" was not achieved

from Mar 2018 until Aug 2018. However, since the QMS implementation, target was achieved for period of Sept 2018 until Dec 2018.

The case company has analysed the root-causes of each and every customer's complaints as per required by the ISO 9001:2015 standard. Table 11 below illustrates the causes of customers' complaints.

Table 11: Summary of Causes of Customers' Complaints

i) March until July 2018 (Before ISO 9001 effective date)

Details of complaints	Root-Cause(s)	No. of Cases
a) Cases due to product length or width out of product specifications.	There were no activities established to verify production process to ensure production process is capable of producing products that meet specifications.	48
b) Cases due to thickness out of specification.	1) There was no system established for verification of incoming materials against product specifications.	16
	2) There was no system established to ensure the store personnel loaded the correct materials or products for delivery to customer.	13
c) Cases due to material dented, surface scratches, rusty or pitted hole.	1) There was no process established for preservation of product from incoming materials until delivery to ensure no damage, deterioration or loss. Preservation of products includes proper identification, handling, storage, packaging, transmission, transportation and protection.	10

Details of complaints	Root-Cause(s)	No. of Cases
c) Cases due to material dented, surface scratches, rusty or pitted hole.	2) There was no system established for verification of incoming materials against product specifications.	7
d) Cases due to customer receive wrong product sizes.	There was no system established to ensure the sales personnel captured and key-in the correct customer's requirement (i.e. correct product type and sizes) in the Sales Order prior to confirming the order.	5

ii) <u>August until Dec 2018 (After ISO 9001 effective date)</u>

Details of complaints	Root-Cause(s)	No. of Cases
a) Cases due to product length or width out of product specifications.	There was no proper enforcement and follow-up on the implementation of first piece and last piece inspection to verify production process is capable of producing products that meet specifications.	37
b) Cases due to thickness out of specification.	1) There was no proper enforcement and implementation monitoring on verification of incoming materials against product dimension specifications.	10
	2) There was no proper enforcement on checking that correct materials or products are loaded onto lorry before delivery to customer.	7

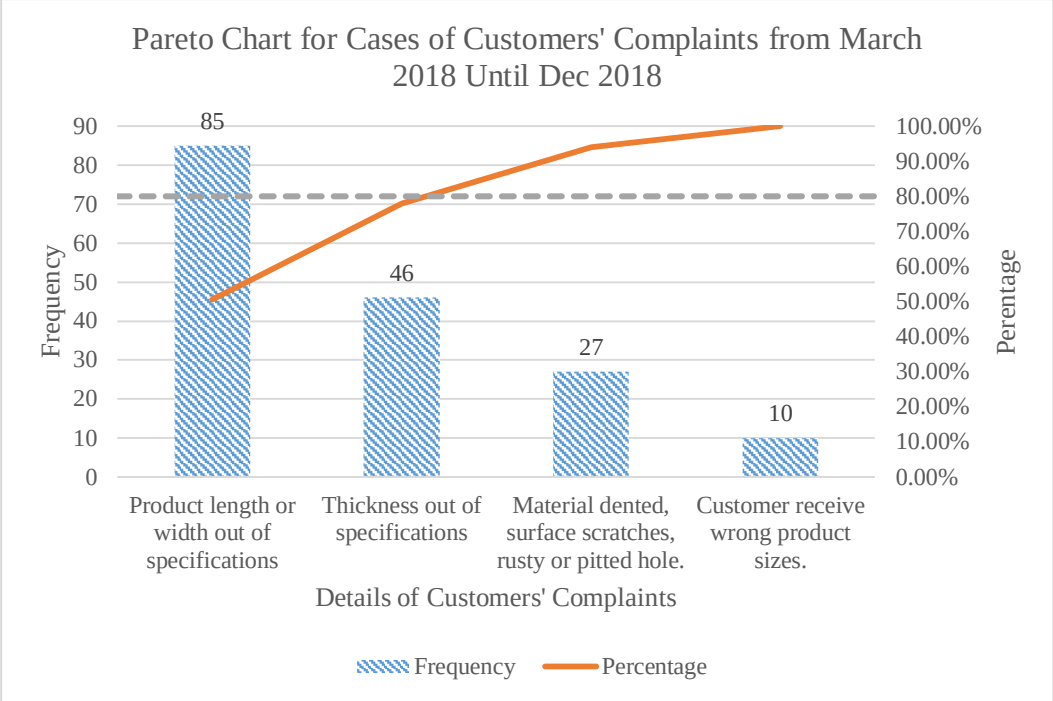
Details of complaints	Root-Cause(s)	No. of Cases
c) Cases due to material dented, surface scratches, rusty or pitted hole.	1) The preservation of products requirements of the ISO 9001:2015 requirements was not fully enforced and its implementation was not periodically monitored.	6
	2) The system established for appearance inspection of incoming materials was not fully enforced.	4
d) Cases due to customer receive wrong product sizes.	There was no proper enforcement and implementation monitoring on sales order processing procedure for reviewing customer's requirements prior to confirming order.	5

Vilfredo Pareto, a late nineteenth-century economist/sociologist, was the person who first noticed that for many problems, about 80 percent of the effects are generated by 20 percent of the causes. His stated observation formed the basis for the Pareto Principle or 80/20 rule. Quality practitioners have found this principle tremendously useful in identifying problems and ranking them from the most significant to the many problems of lesser significance. When one has distinguished the couple of issues that represent 80 percent of discrepant quality, one can focus endeavours on looking for solutions for those couple of issues instead of endeavouring to handle the entire array of issues at the same time (Sanders, 1987).

The objective of a Pareto chart is to emphasise the most significant problems and the most frequent causes of the problems (Magar & Shinde, 2013). This will enable the researcher to focus on effort to eliminate or minimise the most significant causes to prevent recurrence of the problem. Thus, this researcher has decided to use a Pareto chart to analyse the data on frequency of customer's complaints against its causes.

Figure 4 below illustrates the Pareto chart for data analysis on customers' complaints from March 2018 until Dec 2018.

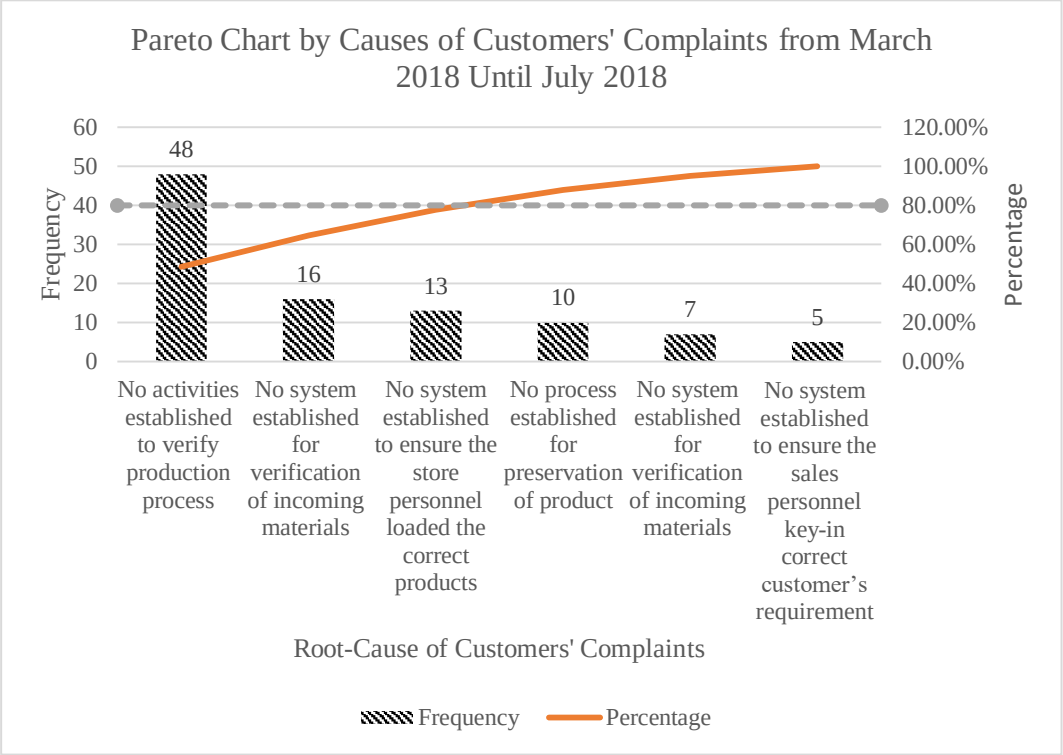
Figure 4: Pareto Chart for Data Analysis on Customers' Complaints from March 2018 until Dec 2018



The cumulative percentage line from Figure 4 (Pareto Chart for Cases of Customer's Complaints from March until Dec 2018) shows that (85 + 46)/168 ≈ 80% of the complaints are due to two types of problems i.e. product length or width out of specifications and thickness out of specifications. According to Pareto principle, improvement efforts should be made on the vital few that contributes 80% of the effects. In this case, the vital few are: product length or width out of specifications and thickness out of specifications.

Figure 5 below illustrates the Pareto chart by causes of customers' complaints before ISO 9001:2015 implementation from March 2018 until July 2018.

Figure 5: Pareto Chart by Causes of Customers' Complaints from Mar 2018 until July 2018



The cumulative percentage line from Figure 5 (Pareto Chart by Causes of Customers' Complaints from March until July 2018 (i.e. 5 months before ISO 9001 implementation) shows that (48 + 16 + 13)/99 ≈ 80% of the causes of complaints are:

1) There were no activities established to verify production process to ensure it has the ability to yield products that satisfy specifications.
2) There was no system established for verification of incoming materials against product specifications.
3) There was no system established to ensure the store personnel loaded the correct materials or products for delivery to customer.

In applying the Pareto principle, roughly 80% of customer's complaints prior to ISO 9001:2015 implementation come from the above three (3) main causes. Hence, below actions have been taken to address or eliminate the above three (3) main causes:

1) **Root-cause**: There were no activities established to verify production process to ensure production process is capable of producing products that meet specifications.

   Corrective action(s): The case company has established an "Inspection and Testing procedure (PR-07, effective 1st Aug 2018)" incorporating a first piece and last piece inspection using sample item from the initial production run.

2) **Root-cause**: There was no system established for verification of incoming materials against product specifications.

   Corrective action(s): The case company has established an "Inspection and Testing procedure (PR-07, effective 1st Aug 2018)" incorporating a system for verification of incoming materials against product specifications. Results of incoming materials inspection are recorded in "Supplier Delivery Order" and "Material Receiving List Form".

3) **Root-cause**: There was no system established to ensure the store personnel loaded the correct materials or products for delivery to customer.

   Corrective action(s): The case company has established an "Inspection and Testing procedure (PR-07, effective 1st Aug 2018)" and "Delivery procedure (PR-04, effective 1st Aug 2018)" which includes verifying the "Store Outgoing Note" against "Delivery Order" to ensure store personnel loaded the correct materials for delivery to customer.

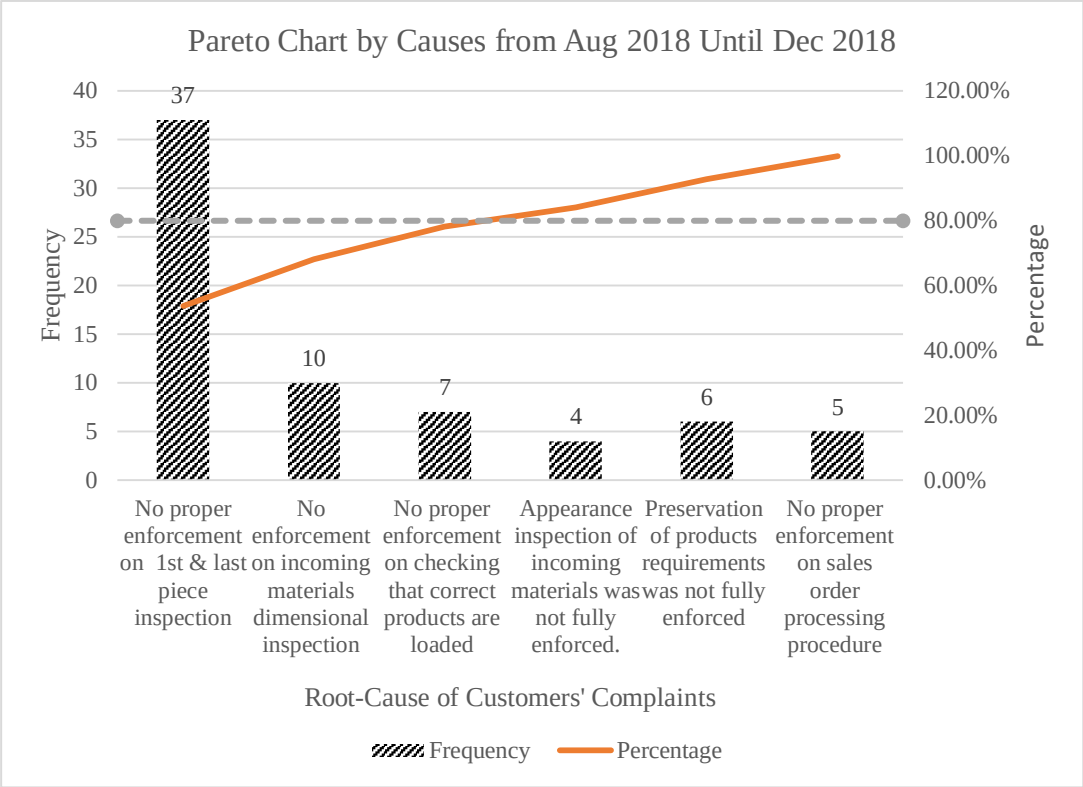
Figure 6 below illustrates the Pareto chart by causes of customers' complaints after ISO 9001:2015 implementation from Aug 2018 until Dec 2018.

The cumulative percentage line from Figure 6 (Pareto Chart by Causes of Customers' Complaints from Aug until Dec 2018 (i.e. 5 months after ISO 9001 implementation) shows that (37 + 10 + 7)/69 ≈ 80% of the causes of complaints are:

1) There was no proper enforcement and follow-up on the implementation of first piece and last piece inspection to verify production process is capable of producing products that meet specifications.

2) There was no proper enforcement and implementation monitoring on verification of incoming materials against product dimension specifications.
3) There was no proper enforcement on checking that correct materials or products are loaded onto lorry before delivery to customer.

Figure 6: Pareto Chart by Causes of Customers' Complaints from Aug 2018 until Dec 2018



According to Pareto principle, improvement efforts should be made on the vital few that contributes 80% of the effects. In this case, the vital few are the above-mentioned three (3) main causes. Thus, below corrective actions have been taken to address or eliminate the above three (3) main causes to prevent recurrence of problem:

1) **Root-cause**: There was no proper enforcement and follow-up on the implementation of first piece and last piece inspection to verify production process is capable of producing products that meet specifications.

   Corrective action(s): The case company has authorised the Quality Management Representative (Mr. Kelvin Ng) to enforce and internally audit the

implementation of first piece and last piece inspection on a monthly basis effective from 2nd January 2019.

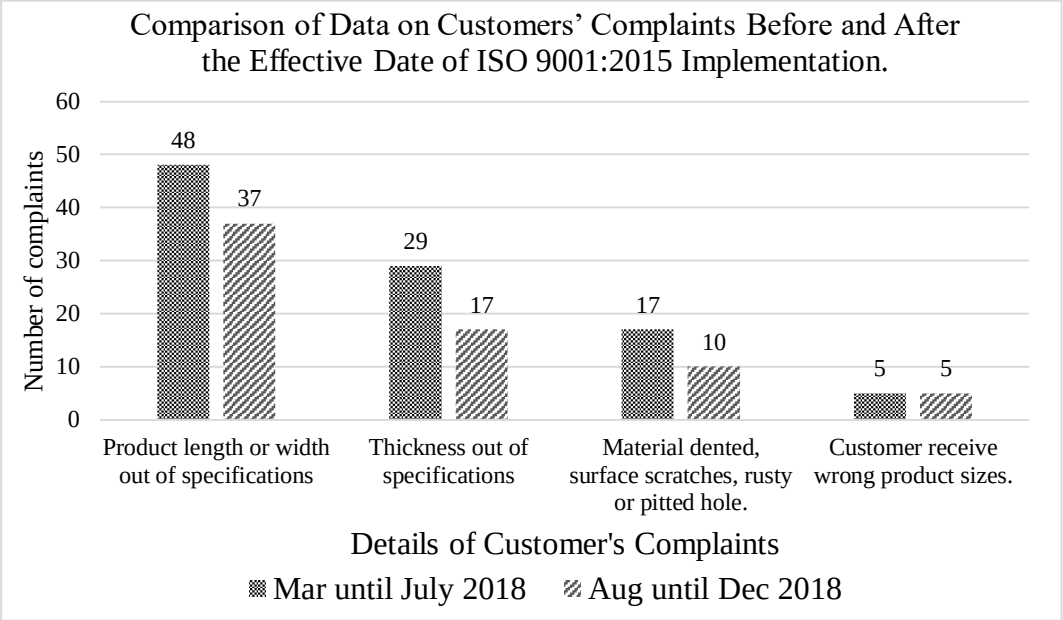
2) **Root-cause**: There was no proper enforcement and implementation monitoring on verification of incoming materials against product dimension specifications.
Corrective action(s): The case company has authorised the Quality Management Representative (Mr. Kelvin Ng) to enforce and internally audit the implementation of verification of incoming materials on a monthly basis effective from 2nd January 2019.

3) **Root-cause**: There was no proper enforcement on checking that correct materials or products are loaded onto lorry before delivery to customer.
Corrective action(s): The case company has authorised the Purchasing Head (Ms. Choong Pei Huen) to enforce and internally audit the implementation of verification of outgoing finished goods on a monthly basis effective from 2nd January 2019.

Figure 7 below illustrates the comparison of data on customers' complaints five months before and five months after the effective date of ISO 9001:2015 implementation.

Comparison data from Figure 7 indicates that the total number of customers' complaints has been **reduced by 30.30%** since the effective date of ISO 9001:2015 implementation i.e. from ninety-nine (99) cases before ISO 9001:2015 implementation (Mar until July 2018) to sixty-nine (69) cases after ISO 9001:2015 implementation (Aug until July 2018). In terms of the vital few, which is product length or width out of specifications and thickness out of specifications, the number of customers' complaints has **reduced by 29.87%** since the effective date of ISO 9001:2015 implementation .e. from seventy-seven (77) cases before ISO 9001:2015 implementation (Mar until July 2018) to fifty-four (54) cases after ISO 9001:2015 implementation (Aug until July 2018).

Figure 7: Comparison of Data on Customers' Complaints Before and After the Effective Date of ISO 9001:2015 Implementation.



Note: The effective date ISO 9001:2015 implementation is 1st August 2018.

4.4 Delivery Performance

The case company has established a target of "*To achieve more than 90% on-time delivery per month*" as one of the quality objectives towards improving delivery punctuality effective from 1st August 2018. This key performance indicator evaluates the on-time delivery performance to customer's requested delivery date. Data on delivery performance were collected five (5) months before and five (5) months after the effective date of QMS implementation.

Table 12 below summarises the data on delivery performance from 1st March 2018 until end of Dec 2018. Target of more than 90% on-time delivery per month has yet to be achieved from Mar 2018 until Aug 2018. Since the implementation of a QMS, target was successfully achieved for period of Sept 2018 until Dec 2018.

Table 12: Summary Data on Delivery Performance

Quality Objective: To achieve **more than 90% on-time delivery** per month.

Month (Year 2018)	Total Sales Order	*No. of On-Time Deliveries (Cases)	Percentage (%) of on-time delivery (Number of on-time deliveries x 100/Total Sales Order per month)	Target Achieved/ Not Achieved
Mar	1,954	1,544	79.02	Not achieved
Apr	1,851	1,501	81.09	Not achieved
May	1,529	1,285	84.04	Not achieved
June	1,808	1,490	82.41	Not achieved
July	2,147	1,755	81.74	Not achieved
August	2,255	1,950	86.47	Not achieved
Sept	1,765	1,610	91.22	Achieved
Oct	2,190	2,015	92.01	Achieved
Nov	2,343	2,180	93.04	Achieved
Dec	2,215	2,091	94.40	Achieved

**Note: On-Time means number of orders that is delivered on or before customer requested delivery date.*

The case company has analysed the root-causes of every case of late delivery as per required by the ISO 9001:2015 standard. Table 13 below illustrates the causes of late deliveries before ISO 9001:2015 implementation while Table 14 illustrates the causes of late deliveries after ISO 9001:2015 implementation.

Table 13: Summary of Causes of Late Deliveries Before ISO 9001:2015 Implementation

i) March until July 2018 (Before ISO 9001 effective date)

Month (Year 2018)	No. of Late Deliveries (Cases)	Root-Cause(s)	No. of Cases due to the Cause
Mar	410	**1) Quality Issue (Internally Detected Product Defects)** Internally detected manufactured product defects where product is out of specifications.	162
		2) Quality Issue (Purchased Materials Defects) Purchased materials were found to be defective.	138
		3) Manufactured Part Delay Manufactured part delay due to under capacity (staffing and equipment constraint).	110
Apr	350	**1) Quality Issue (Purchased Materials Defects)** Purchased materials were found to be defective.	142
		2) Quality Issue (Internally Detected Product Defects) Internally detected manufactured product defects where product is out of specifications.	120
		3) Inventory Adjustment Raw material inventory corrections or adjustments at the Warehouse.	88

Month (Year 2018)	No. of Late Deliveries (Cases)	Root-Cause(s)	No. of Cases due to the Cause
May	244	**1) Quality Issue (Internally Detected Product Defects)** Internally detected manufactured product defects where product is out of specifications.	122
		2) Quality Issue (Purchased Materials Defects) Purchased materials were found to be defective.	75
		3) Poor Planning Functions Delivery date committed to customer is not practical or too short lead time.	47
June	318	**1) Quality Issue (Internally Detected Product Defects)** Internally detected manufactured product defects where product is out of specifications.	90
		2) Manufactured Part Delay Manufactured part delay due to under capacity (staffing and equipment constraint).	82
		3) Quality Issue (Purchased Materials Defects) Purchased materials were found to be defective.	61
		4) Manufactured Part Delay Production cutting machine repair.	45

Month (Year 2018)	No. of Late Deliveries (Cases)	Root-Cause(s)	No. of Cases due to the Cause
June	318	**5) Poor Planning Functions** Delivery date committed to customer is not practical or too short lead time.	40
July	392	**1) Manufactured Part Delay** Manufactured part delay due to under capacity (staffing and equipment constraint).	120
		2) Manufactured Part Delay Manufactured part delay due to insufficient cutting tools. Some cutting tools have to be scrapped because of wear and tear.	110
		3) Quality Issue (Purchased Materials Defects) Purchased materials were found to be defective.	80
		4) Quality Issue (Internally Detected Product Defects) Internally detected manufactured product defects where product is out of specifications.	71
		5) Purchased Part Delay Late delivery from vendor but company placed order on time.	11

Table 14: Summary of Causes of Late Deliveries After ISO 9001:2015 Implementation

ii) August until Dec 2018 (After ISO 9001 effective date)

Month (Year 2018)	No. of Late Deliveries (Cases)	Root-Cause(s)	No. of Cases due to the Cause
Aug	305	**1) Manufactured Part Delay** Manufactured part delay due to error in sales forecast where customers' orders were more than what was forecasted.	116
		2) Inventory Adjustment Raw material inventory corrections or adjustments at the Warehouse.	101
		3) Quality Issue (Internally Detected Product Defects) Internally detected manufactured product defects where product is out of specifications.	50
		4) Quality Issue (Purchased Materials Defects) Purchased materials were found to be defective.	38
Sept	155	**1) Poor Planning Functions** Delivery date committed to customer is not practical or too short lead time.	45
		2) Manufactured Part Delay Manufactured part delay due to error in sales forecast when customers' orders were more than what was forecasted.	43

Month (Year 2018)	No. of Late Deliveries (Cases)	Root-Cause(s)	No. of Cases due to the Cause
Sept	155	**3) Inventory Adjustment** Raw material inventory corrections or adjustments at the Warehouse.	32
		4) Quality Issue (Internally Detected Product Defects) Internally detected manufactured product defects where product is out of specifications.	20
		5) Quality Issue (Purchased Materials Defects) Purchased materials were found to be defective.	15
Oct	175	**1) Manufactured Part Delay** Manufactured part delay due to error in sales forecast when customers' orders were more than what was forecasted.	84
		2) Inventory Adjustment Raw material inventory corrections or adjustments at the Warehouse.	68
		3) Poor Planning Functions Delivery date committed to customer is not practical or too short lead time.	11
		4) Quality Issue (Internally Detected Product Defects) Internally detected manufactured product defects where product is out of specifications.	8

Month (Year 2018)	No. of Late Deliveries (Cases)	Root-Cause(s)	No. of Cases due to the Cause
Oct	175	**5) Quality Issue (Purchased Materials Defects)** Purchased materials were found to be defective.	4
Nov	163	**1) Manufactured Part Delay** Manufactured part delay due to error in sales forecast when customers' orders were more than what was forecasted.	71
		2) Inventory Adjustment Raw material inventory corrections or adjustments at the Warehouse.	59
		3) Poor Planning Functions Delivery date committed to customer is not practical or too short lead time.	25
		4) Quality Issue (Internally Detected Product Defects) Internally detected manufactured product defects where product is out of specifications.	5
		5) Quality Issue (Purchased Materials Defects) Purchased materials were found to be defective.	3
Dec	196	**1) Manufactured Part Delay** Manufactured part delay due to error in sales forecast when customers' orders were more than what was forecasted.	82

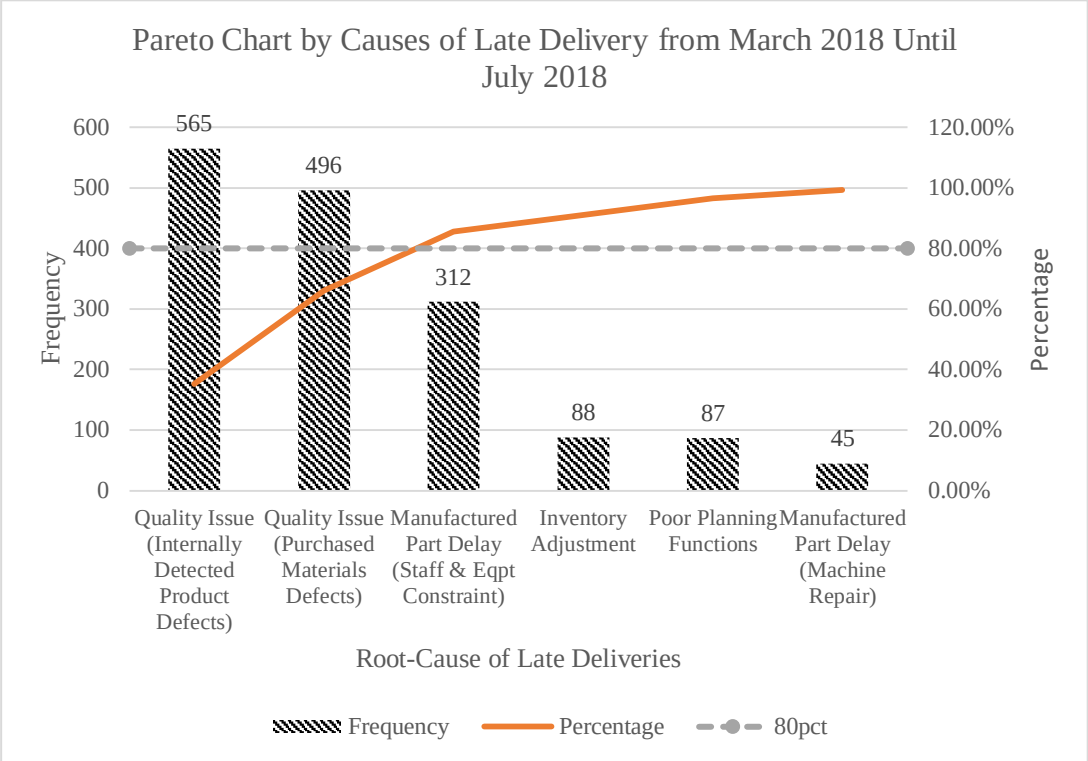
Month (Year 2018)	No. of Late Deliveries (Cases)	Root-Cause(s)	No. of Cases due to the Cause
Dec	196	**2) Inventory Adjustment** Raw material inventory corrections or adjustments at the Warehouse.	73
		3) Poor Planning Functions Delivery date committed to customer is not practical or too short lead time.	37
		4) Quality Issue (Internally Detected Product Defects) Internally detected manufactured product defects where product is out of specifications.	4

Figure 8 below shows the Pareto chart by causes of late delivery before ISO 9001:2015 implementation from March 2018 until July 2018.

The cumulative percentage line from Figure 8 (Pareto Chart by Causes of Late Delivery from March until July 2018 (i.e. 5 months before ISO 9001 implementation) shows that (565 + 496 + 312)/1604 ≈ 85.60% of the causes of complaints are:

1) Quality issues due to internally detected non-conforming products.
2) Quality issues due to purchased materials defects.
3) Manufactured part delay due to staffing and equipment constraint when customers' orders were more than what was forecasted.

Figure 8: Pareto Chart By Causes of Late Delivery from March 2018 until July 2018



When the Pareto principle is applied, it was found that roughly 80% of cases of late deliveries prior to ISO 9001:2015 implementation come from the above three (3) main causes. Hence, below actions have been taken to address or eliminate the above three (3) main causes:

1) **Root-cause**: Quality issues due to internally detected non-conforming products.
   Corrective action(s):
   (a) The case company has established documented "Work Instructions for Cutting Using Band Saw Machines (WI-01 until WI-05, effective 1st Aug 2018)" specifying the proper cutting tooling, process specifications of spacing between cutting tools and process specifications for cutting machines speed setting based on material type, material thickness or diameter and machine capacity.
   (b) The case company has established an "Inspection and Testing procedure (PR-07, effective 1st Aug 2018)" incorporating a "Production In-Process Inspection Form" where machine operators are to inspect machine

parameters are set according to established Work Instructions prior to starting cutting process.

2) **Root-cause**: Quality issues due to purchased materials defects.
   Corrective action(s): The case company has established a "Supplier Selection and Evaluation procedure (PR-02, effective 1st Aug 2018)" specifying the criteria for selection and evaluation of direct material supplier's performance based on product quality, delivery performance, service and cost.

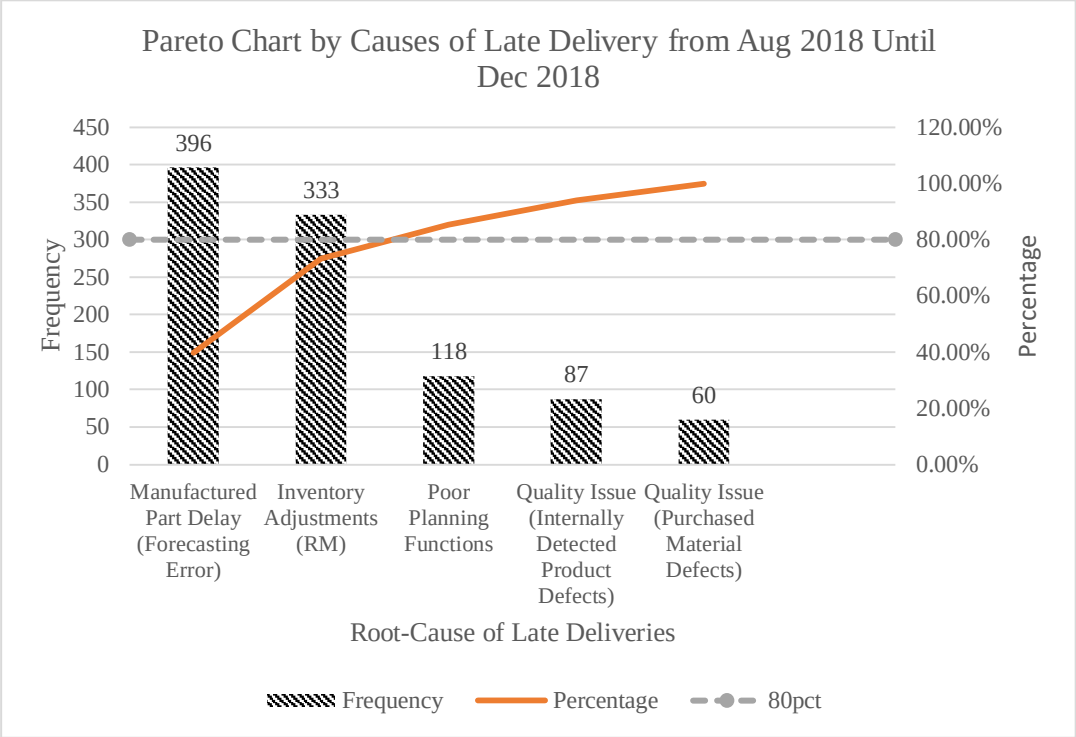
3) **Root-cause**: Manufactured part delay due to staffing and equipment constraint when customers' orders were more than what was forecasted.
   Corrective action(s):
   1) The case company has decided on a two-shift production system instead of single shift and hire temporary workers in the event that the number of sales order for the month is expected to be more than or equal to 1,800.
   2) The case company has also decided to outsource the cutting process to their sister company (Leon Fuat Metal Sdn Bhd) in the event that the two-shift production system could not cope with the increasing order demand due to machine and staffing constraint. The outsourced process shall be controlled and managed as per "Supplier Selection and Evaluation procedure (PR-02, effective 1st Aug 2018)". This procedure is established to ensure that outsourced processes do not affect the case company's ability to regularly provide products and services that meet customer's requirements.

Figure 9 below shows the Pareto chart by causes of late delivery after ISO 9001:2015 implementation from Aug 2018 until Dec 2018.

The cumulative percentage line from Figure 9 (Pareto Chart by Causes of Late Delivery from Aug until Dec 2018 (i.e. 5 months after ISO 9001 implementation) shows that (396 + 333 + 118)/994 ≈ 85.21% of the causes of late deliveries are:

1) Manufactured part delay due to error in sales forecast when customers' orders were more than what was forecasted.
2) Raw material inventory corrections or adjustments at the Warehouse.
3) Poor planning functions.

Figure 9: Pareto Chart By Causes of Late Delivery from Aug 2018 until Dec 2018



When applying Pareto principle, it was found that roughly 80% of cases of late deliveries after ISO 9001:2015 implementation come from the above three (3) main causes. Thus, below actions have been taken to address or eliminate the above three (3) main causes:

1) **Root-cause**: Manufactured part delay due to error in sales forecast when customers' orders were more than what was forecasted.

   Corrective action(s): The sales team has implemented and documented three critical steps to improve accuracy of sales forecast. The three critical steps below are integrated in "Sales Enquiry and Order Processing procedure (PR-05):

   i) Based on customers' actions, the measurable entry and exit criteria for each phase of the sales process are specified. Sales Manager has briefed all Sales personnel on the defined measurable entry and exit criteria.

   ii) Keep the salesperson answerable to their own forecast.

   iii) Allocate likelihood rating and the expected action date of a confirmed order from customer.

2) **Root-cause**: Raw material inventory corrections or adjustments at the Warehouse.

   Corrective action(s): Perform partial stock takes every month instead of conducting a comprehensive stock take every six months because it is more efficient and operations can still continue while doing them.

3) **Root-cause**: Poor planning functions where delivery date committed to customer is not practical or too short lead time.

   Corrective action(s): Sales personnel shall check inventory records in ERP system and obtain input from Production Planner on the status of current jobs prior to committing the delivery date to customer.

4.5 Internal Audit

The researcher has conducted the QMS internal audit from 18th March 2019 to 19th March 2019. The internal audit covered the QMS implementation period from Aug 2018 until Dec 2018, which is five (5) months after QMS effective date, and Jan 2019. The case company has declined the use of any audit recordings for the internal audit but allowed the audit results to be published for this business research.

A total of eight (8) non-conformances and six (6) observations have been issued during the internal audit. A non-conformance is defined in the case company's internal audit procedure as a deviation or lapses from defined audit criteria. An observation is defined as a suggestion for improvement. Details of the non-conformances and observations are attached as **Appendix C** in this research paper.

The eight (8) non-conformances are:

1) **CAR2019-01**

Fact:

There was no evidence effectiveness of action(s) taken to address risks and opportunities is periodically reviewed for ALL process "Risks and Opportunities

Review List (RORL)" before the annual internal audit. The effectiveness of action(s) taken have yet to be reviewed since the ISO 9001 effective date (1st Aug 2018) until to date.

Evidences:

a) RORL-01 dated 01/08/2018;

b) RORL-10 dated 01/08/2018;

c) RORL-04 dated 01/08/2018

Charge Against: Clause 6.1.2 (Actions to address risks and opportunities) of the ISO 9001:2015 standard which states that the organisation shall plan action(s) to address risks and opportunities and evaluate the effectiveness of these actions.

2) CAR2019-02

Fact:

Found that JS00047990 and JS00047991 dated 16th Jan 2019 have yet to be registered in "Daily Cutting Report" although cutting services is currently being performed at the time of audit.

Evidence(s):

JS00047990 and JS00047991 dated 16th Jan 2019 and "Daily Cutting Report" for month of Jan 2019".

Charge Against: Clause 5.0 item#2 (Procedures) of the Production Planning procedure (PR-06) which states that "Daily Cutting Report" will be updated once Job Sheet is issued to ensure proper planning based on production capacity. Also can be charged under Clause 8.1 (Operational Planning) of ISO 9001:2015 standard which states that the company shall plan, implement and control processes.

3) CAR2019-03

Fact:

Found that there was no evidence of first piece and last piece inspection conducted and recorded in "In-Process Inspection Checklist".

Evidence(s):

In-Process Inspection Checklist dated 24th Sept 2018 for JS 42529, In-Process Inspection Checklist dated 23rd Oct 2018 for JS 44284, In-Process Inspection

Checklist dated 27th Nov 2018 for JS 46454 and In-Process Inspection Checklist dated 20th Dec 2018 for JS 48654.

Charge Against: Clause 7.0 Quality Plan of "Inspection & Testing procedure (PR-07)" which states that production personnel should perform first piece and last piece inspection to verify production process. Also can be charged under Clause 8.5.1 (Control of Production and Service Provision) of ISO 9001:2015 standard which states that the organisation shall perform production under controlled conditions which includes implementing the required monitoring and measurement activities.

4) CAR2019-04

Fact:

Long Product

There was no evidence of monitoring compliance against the relevant machine parameter setting (i.e. speed) prior to cutting.

Evidence(s):

Checking the machine parameter setting against the correct speed setting for product seamless steel hollow bar OD 133mm x 20mm (thickness) x 62mm was not recorded in "Production Inspection Checklist dated 16th Jan 2019".

Charge Against: Clause 8.5.1 (Control of Production and Service Provision) of ISO 9001:2015 standard which states that production and service provision should be implemented under controlled conditions, including implementation of relevant monitoring and measurement activities.

5) CAR2019-05

Fact:

1) Found that there was no evidence of incoming material verification according to Quality Plan for incoming prime materials from overseas. There was no evidence of dimension checking and checking according to sampling size in Quality plan i.e. every bundle check 5 pieces.
2) Found that certain columns are left blank on the "Material Receiving List (MRL)" i.e. Heat No., Mill Cert No. and Material for all MRL issued since Aug 2018.

Evidence(s):

a) Inspection results not recorded in "Material Receiving List" dated 5th Dec 2018, material SS20C, size: 85mm x 6020mm.
b) "Material Receiving List" dated 19th Dec 2018, DO No. 119811, material hollow bar HB.

Charge Against: Clause 7.0 Quality Plan of "Inspection & Testing procedure (PR-07)" which states that warehouse or QA/QC personnel should perform verification of incoming materials. This can also be charged under Clause 8.6 of ISO 9001: 2015 standard which states that the company shall implement planned arrangements at relevant stages to confirm product or service requirements are in compliance.

6) CAR2019-06

Fact:

Location: Reject Area

1) Found that rejected items at "Reject Area" was not identified and labelled with product name, code, size, CCR No. and/or Sales Order No.
2) Found that "Reject area" for defective FG and RM have yet to be identified and demarcated with proper signage.

Evidence(s):

Rejected items at reject area were not visually identified with label and boundary of reject area was not clearly defined with demarcation lines.

Charge Against: Clause 8.7 (Control of Nonconforming Outputs) of the ISO 9001:2015 standard which states that the organisation shall ensure that outputs that do not conform to their requirements are identified and controlled to prevent their unintended use or delivery.

7) CAR2019-07

Fact:

There was no evidence of monitoring, evaluation and analysis of below-mentioned quality objectives to determine the target achievement from Aug 2018 until to date:

1) Half yearly major stock count accuracy of 95% rating.

Evidence(s):

The stock count accuracy monitoring and analysis report for period of Aug 2018 until Dec 2018 have yet to be established.

Charge Against: Clause 9.1.1 (Monitoring, Measurement, Analysis & Evaluation, General Requirement) of the ISO 9001:2015 standard which states that the organisation shall retain appropriate documented evidence of monitoring, analysis and evaluation results.

8) CAR2019-08

Fact:

Location: Machine A06 and A02

Found that there was no clear identification of status of products i.e. inspected materials, materials pending inspection and balance materials, which were located in the same area at both machine A06 and A02.

Evidence(s):

Material seamless steel hollow bar OD 133mm x 20mm x 62mm which was pending QA/QC inspection was found located together with inspected item S4C 50mm x 355mm (30 pcs) at machine A06.

Charge Against: Clause 8.5.2 (Identification and Traceability) of the ISO 9001:2015 standard which states that the company shall indicate the status of outputs with reference to monitoring and measurement requirements.

The six observations (OBS) are:

ITEM	OBSERVATION
OBS#1	It is recommended Sales personnel to follow-up on three (3) outstanding customer survey feedback from active customer for Year 2018. PIC: Sales personnel
OBS#2	It is recommended that Sales personnel review and investigate customer's written feedback on "Customer Satisfaction Survey Form" on whether it is a genuine feedback i.e. Sin Lian Tat Hardware commented that the main problem the company experienced with Leon Fuat Hardware was 'wrong delivery issue" but actually this happened because customer order the wrong product. PIC: Sales personnel.

ITEM	OBSERVATION
OBS#3	It is recommended to use "Reject tag" for identification of non-conforming items. PIC: Production personnel
OBS#4	It is recommended to implement 5S and improve housekeeping at the Warehouse. PIC: Warehouse personnel
OBS#5	Suggest obtaining Safety Data Sheets from supplier for hazardous chemicals used at the workplace such as BHP Petrol. Secondary containment should also be allocated at the storage area to contain any accidental chemical spillage. PIC: Warehouse personnel
OBS#6	Suggest establishing lorry service/breakdown history record for every delivery lorry. PIC: Delivery personnel

Table 15 below indicates the number of non-conformances against the ISO 9001:2015 standard requirements.

Table 15: Number of Non-Conformance Against ISO 9001:2015 Requirements

No.	Clause (Req)	Description	No. of Non-conformance
4.0 Context of the Organisation			
1	4.1	Understanding the organisation & its context	Nil
2	4.2	Understanding the needs and expectations of interested parties	Nil
3	4.3	Determining the scope of the QMS	Nil
4	4.4	QMS and its processes	Nil
5.0 Leadership 5.1 Leadership and Commitment			
5	5.1.1	General	0 CAR

No.	Clause (Req)	Description	No. of Non-conformance
6	5.1.2	Customer focus	0 CAR
7	5.2.1	Establishing the Quality Policy	0 CAR
8	5.2.2	Communicating the Quality Policy	0 CAR
9	5.3	Organisational roles, responsibilities and authorities	0 CAR
6.0 Planning			
10	6.1	Actions to address risks and opportunities	1 CAR
11	6.2	Quality objectives and planning to achieve them	Nil
12	6.3	Planning of changes	Nil
7.0 Support 7.1 Resources			
13	7.1.1	General	Nil
14	7.1.2	People	Nil
15	7.1.3	Infrastructure	Nil
15	7.1.4	Environment for operation of processes	Nil
17	7.1.5	Monitoring and measuring resources	Nil
18	7.1.6	Organisational knowledge	Nil
19	7.2	Competence	Nil
20	7.3	Awareness	Nil
21	7.4	Communication	Nil
7.5 Documented Information			
22	7.5.1	General	Nil
23	7.5.2	Creating and Updating	Nil
24	7.5.3	Control of Documented Information	Nil
8.0 Operation			
25	8.1	Operation planning and control	1 CAR
8.2 Requirements for products and services			
26	8.2.1	Customer communication	Nil
27	8.2.2	Determining the requirements for products and services	Nil

No.	Clause (Req)	Description	No. of Non-conformance
28	8.2.3	Review of requirements for products and services	Nil
29	8.2.4	Changes to requirements for products and services	Nil
8.3 Design and development of products and services is not applicable for the case company as product design outputs are provided by customer.			
8.4 Control of externally provided processes, products and services			
30	8.4.1	General	Nil
31	8.4.2	Type and extent of control	Nil
32	8.4.3	Information for external providers	Nil
8.5 Control of production and service provision			
33	8.5.1	Control of production and service provision	2 CARs
34	8.5.2	Identification and traceability	1 CAR
35	8.5.3	Property belonging to customers or external providers	Nil
36	8.5.4	Preservation	Nil
37	8.5.5	Post-delivery activities	Nil
38	8.5.6	Control of changes	Nil
39	8.6	Release of products and services	1 CAR
40	8.7	Control of nonconforming outputs	1 CAR
9.0 Performance evaluation 9.1 Monitoring, measurement, analysis and evaluation			
41	9.1.1	General	1 CAR
42	9.1.2	Customer satisfaction	Nil
43	9.1.3	Analysis and evaluation	Nil
44	9.2	Internal audit	Nil
9.3 Management review			
45	9.3.1	General	Nil
46	9.3.2	Management review inputs	Nil

No.	Clause (Req)	Description	No. of Non-conformance
47	9.3.3	Management review outputs	Nil
10.0 Improvement			
48	10.1	General	Nil
49	10.2	Nonconformity and corrective action	Nil
50	10.2	Continual improvement	Nil

Source: (*ISO 9001:2015:Quality Management Systems-Requirements,* 2015)

Results from internal audit against ISO 9001:2015 requirements presented two (2) CARs from Clause 8.5.1, 1 CAR each from Clauses 6.1, 8.1, 8.5.2, 8.6, 8.7 and 9.1.1. Six (6) out of eight (8) non-conformances issued during internal audit are under Clause 8.0 (Operation).

Some of the findings that are considered a major breakdown of the QMS are:

a) There was no evidence of first piece and last piece inspections implementation as per required in the documented Quality Plan from Aug 2018 until Dec 2018;

b) Verification of incoming material have yet to be fully implemented as per required in documented Quality Plan from Aug 2018 until Dec 2018;

c) There was no proper identification, segregation and labelling of rejected products and/or materials for traceability and to prevent unintended use of defective products.

d) There was no clear visual identification and segregation of status of production outputs for products located near the production machines such as “Pending Inspection”, “Pass” or “Fail” or “Balance Materials”.

4.6 Summary of Results Before and After QMS Implementation

Table 16 below summarises the impact of QMS implementation on the case company.

Table 16: Summary of Results Before and After QMS Implementation

No.	Criteria of evaluation	5 months Before ISO 9001 (March until July 2018)	5 months After ISO 9001 (Aug to Dec 2018)
1	Standardise method of operations.	No standardisation in method of operations.	Documented procedures and/or work instructions have been established to standardise business operations.
2	Reduction in number of customers' complaints on product non-conformances.	**99** cases of customers' complaints.	**69** cases of customers' complaints.
3	Improvement in delivery performance.	**1,593** total cases of late delivery.	**994** total cases of late delivery.
4	QMS Internal Audit Results	Not applicable	**8** non-conformance and **6** observations.

The number of customers' complaints has been reduced by **30.30%** five (5) months after the implementation of the ISO 9001:2015 QMS. As for the total cases of late delivery, a reduction of **37.60%** has been observed.

4.7 Conclusion

In this section, the researcher has analysed the results of QMS implementation in the case company. An in-depth discussion on the findings are provided in the next chapter.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.0 Introduction

The researcher will deliberate on the findings in depth upon completion of data analysis. This chapter will therefore comprehensively deduce the results of the research, stipulate the limitations of the research and suggestions for future studies. A conclusion of the entire research will be provided at the end of this chapter.

5.1 Operations Implications of the Study

5.1.1 Customers' Complaints on Product Non-Conformance

It can be concluded that the amount of customers' complaints on product non-conformance has decreased **by 30.30%** after the effective implementation of ISO 9001:2015 QMS. Furthermore, the number of customers' complaints due to product length and width out of specifications, which is the vital few, has **reduced by 29.87%** since the effective date of ISO 9001:2015 implementation.

Referring to Figure 6, the first main cause of product non-conformance detected by customer was no proper enforcement on the system of first piece and last piece inspection. In implementing the proposed corrective action, the QMR has to perform monthly internal audits or checking on the implementation of first piece and last piece inspection. In view of the lack of resources in terms of manpower and time, the researcher would like to propose mechanising the whole inspection process.

The case company should invest in a software that can correspond received customer's drawings with the case company's inspection and test plan. First piece, in-process, final and last piece inspection on length and width could be automated using robotic arms and the results are captured by the software. The software could compare the inspection results against the product acceptance criteria indicated in the product drawing and determine whether the product is accepted or rejected. Rejected products or out-of-specification products are automatically segregated, diverted and placed into the bin or container for rejected items by the robotic arms.

The main return of investment in automating the whole inspection process is as follows:

a) Reduced cost of labour required to perform manual inspections;
b) Reduced deficit in the form of scrapped materials; and
c) Reduced wasted manufacturing time.

An automated system of inspection using integrated software and equipment can immediately highlight problems and minimise costs.

Some of the benefits of an automated inspection system compared to manual inspections are:

a) In contrast with manual inspections where operators have to divide their time over different manufacturing tasks, an automated inspection system only have one sole responsibility;
b) The high degree of accuracy allows automated systems to make their own savings over time;
c) They can operate and work the whole day without stopping; and
d) The company can concentrate their human capital on other business processes to make the entire operation more economical and well-organised.

With reference to Figure 6, the second root-cause of product non-conformance detected by customer was lacking of enforcement in incoming materials dimensional inspection and the third root-cause was lacking of enforcement in verifying that correct finished goods are loaded onto lorry. Instead of manual

checking and manual enforcement via monthly audits by the QMR or Assistant QMR, the case company could also utilise the above-mentioned automated inspection system to perform incoming inspections and outgoing inspections. By eliminating manual checking and enforcement, this will save the case company a lot of resources in terms of time and manpower.

Considering the cutting edge of an automated quality checking system, this researcher would like to propose to the Top Management of the case company to consider the below crucial factors when automating the inspection process:

1) There is a need to accurately define the product specifications and process specifications for every product or materials being inspected;
2) It is essential that the inspection system has the capability to collect and easily retrieve information or data such as identification of product name or code, their pass/fail status of inspection and traceability to production, sales and inventory records;
3) Ensure availability of suitable instruments/tools to perform quality inspections at the level required by the case company and its customer. Usage of unsuitable measuring and monitoring instruments can cause inferior products moving through the inspection process undetected;
4) The need to control the movement of materials or products. This means that the automated inspection system should have the capability to enact interlocks to stop material movement until a product passes the checking or has certain corrective actions taken on the defective product first;
5) Ensure proper interaction and flow of information between the quality control automated inspection system and the controller comprising the product and process specifications, along with the communication network of the system components.

The case company should take action to eradicate the other root-causes of customers' complaints once the three (3) main root-causes are effectively eliminated.

5.1.2 Delivery Performance

With reference to Figure 9, the three (3) main causes of cases of late deliveries are:

1) Manufactured part delay due to error in sales forecast when customers' orders were more than what was forecasted.
2) Raw material inventory corrections or adjustments at the Warehouse.
3) Poor planning functions where the delivery date committed to customer provided too short a lead time.

Discussed below are some suggestions for minimising or reducing the main root-causes of late deliveries.

1) <u>Improve Accuracy in Sales Forecast</u>

A) <u>Use Earlier Data</u>

This researcher would highly recommend that the sales personnel use the sales data from previous year when estimating sales forecast. The sales numbers of previous year make an excellent starting point for a new sales forecast for the approaching year. The previous data could be used as a baseline to itemise all the elements that might escalate this year's sales. For example, is the demand for the company's products or services increasing? Are there emerging trends related to the company's products? Are new market prospects available? If affirmative, the sales forecast should be increased.

Then, all factors that could reduce sales should be identified. For example, does the industry have new competition? Are there any changes to the regulations that might have an effect on the company's products? If so, the sales forecast should be reduced.

B) <u>Concentrate on Demand</u>

Do not concentrate on supply of company's products when preparing sales forecast. Concentrate on demand, then adequately make up for supply. By not underestimating or overestimating the supply, the company can save cost or even get some returns.

C) Update Sales Forecast in a Timely Manner

In order to retain its value, the sales forecast should be kept up-to-date. The sales process could be affected by any main changes in the company such as new business strategy, new marketing course, changes in company's goals and others. By updating the sales forecast in a timely manner, the company always have the most exact data available.

2) Improve Inventory Management of Raw Materials

In order to minimise raw material inventory corrections or adjustments, the case company should improve the inventory management system. Below are some suggested practices that will improve the efficiency of the case company's inventory management system:

A) Ascertain Critical Materials Using ABC Analysis

ABC analysis of classification is a method used to classify inventory items (i.e. raw materials) based on their yearly utilisation value. It is grounded on the theory of Pareto, which declares that "80% of the total value of consumption is centred on only 20% of the entire items" (Dhoka & Choudary, 2013). This solution enables the case company to monitor and focus their inventory management resources on those critical few items that are valuable and frequently consumed.

ABC analysis necessitates separating items into three (3) classes i.e. A, B and C.

- **A materials:** "20% of the materials accounts for 70% of the materials' yearly consumption value".
- **B materials:** "30% of the materials accounts for 25% of the materials' yearly consumption value".
- **C materials**: "50% of the materials accounts for 5% of the materials' annual consumption value".

"A" comprises the "most treasured materials" and "C" comprises the "least treasured materials", while "B" comprises materials in the range between "A" and "C" (Dhoka & Choudary, 2013).

According to Sudhir Mahagaonkar & Kelkar (2017), the advantages of practising "ABC Analysis" are:

a) It is a method to apportion the direct and indirect costs to the company's critical activities. This process better outlines the activities that are the source of the company's maximum profit.
b) It helps to tighten and improve inventory controls for crucial materials.
c) It reduces wastage of resources by focusing inventory control of materials based on its bearing on the end result.
d) By managing the materials efficiently, the goal is to achieve economy.
e) It upholds control for exorbitant items where large amount of money is devoted.
f) Stocks are maintained at the best possible level and administrative costs are significantly reduced.

B) Determine the Upper and Lower Limit Stock Levels and Reorder Points

For each material, determine the upper and lower limit stock level as well as reorder point. The upper limit is the border where quantity increment of any material is not permitted. The lower limit is the boundary where the inventory if any material is not permitted to reduce. The level of reordering is established between the upper and lower limit of stock. The purchasing process should commence when a material inventory touches this point. The level of reordering is slightly higher than the lower limit of stock to act as a buffer against abnormal use, abnormal supply delay and others.

C) Proper Identification of Materials/Products

All materials or products in the warehouse are properly classified, grouped, located at designated storage racks and identified. All raw materials are identified and labelled with product name, code, type, size, country of origin, heat number and received date to ease traceability. This will make it easier for Warehouse personnel to retrieve the required materials and thus reduce the time taken to retrieve materials.

This researcher would also like to recommend three (3) critical procedures to be implemented to improve the accuracy of inventory data:

a) **Establish standard processes for the receipt, storage, release and return of materials.** Distortion of data in inventory system may occur if employees are not firmly recording the inventory materials' movement. Hence, the case company should define that employees should record these changes in the inventory system immediately upon any material movement so that the data is as up-to-date as possible.

b) **Educate each individual concern on the documented standard practice.** Every person whose activities might impact inventory controlling should be trained to comply with the documented procedures, from warehouse personnel to managers.

c) **Define that employees are answerable for the proper implementation of the inventory procedure.** Just as employees will be held responsible for failure in completing their core job responsibilities, the case company should hold employees accountable for bad practices of inventory control. Make it apparent to employees that a crucial part of their work is inventory management, possibly by stressing the importance to avoid downtime to prevent any late delivery.

3) <u>Improve Planning Functions to Provide Sufficient Lead Time for Production Activities</u>

In order to improve the accuracy of delivery date committed to customer, the case company should first establish a multi-disciplinary "Product Quality Planning Team", whose members comprises of representatives from Sales, Production Planning, Production, Quality Assurance and Purchasing department.

Secondly, the team members could establish a shared internal portal where online discussions with regards to planning could be conducted and results of production feasibility studies could be shared.

Thirdly, once the shared internal portal is established, the team members should conduct a production feasibility study for every new order received in terms of "4M" i.e. "Machine", "Material", "Man" and "Method" prior to committing a delivery date to customer. In order to keep the feasibility study short and simple, Sales personnel shall key-in any new customer orders daily into the shared portal. Once new orders are added into the portal, Production Planning personnel shall be

alerted by the database system of incoming customers' orders that need to be planned. Production personnel shall then conduct a feasibility study in terms of "Man", "Material", "Machine" and "Method".

a) "Man": Production personnel shall provide inputs to Production Planning personnel on the number and availability of machine operators to perform the required cutting job using the same shared portal.
b) "Machine": Production personnel shall also provide inputs to Production Planning on the capacity and current utilisation rate of the production cutting machines.
c) "Material": Production planning should check the ERP system on the stock availability of raw materials required for the particular job. If stock level are at the reorder point, purchasing process should be initiated.
d) "Method": Production personnel should provide inputs to Production Planning on whether any additional Work Instructions are required for the particular Sales Order using the portal. Under normal circumstances, additional Work Instructions for cutting process will not be required for standard products as the "Cutting Work Instructions" have already been under the ISO 9001:2015 QMS.

Based on Production's inputs on the availability and current utilisation status of "machine" and "man"; and the availability of raw materials in ERP inventory system, Production Planning personnel should estimate the duration required to produce the products required by a particular Job Order. By conducting a feasibility study for every sales order, Production Planning could recommend to the Sales personnel a viable expected delivery date to customer. This will drastically reduce the number of cases of late deliveries caused by poor planning.

5.1.3 QMS Internal Audit Results

The relevant process owners have taken the below actions on the eight (8) non-conformances issued during internal audit:

a) analysed the root-cause(s) of the non-conformance;
b) proposed immediate action(s) to solve and correct the problem;
c) handle the after-effects in the most practicable manner; and

d) proposed corrective action(s) to eradicate the root-cause(s) of the problem to avert any future recurrence of the non-conformance.

According to the company's internal audit procedure, the person responsible has to reply the "Corrective Action Request (CAR)" with the root-cause(s) and proposal of rectification action(s) and corrective action(s) within one (1) week from the date of CAR or NCR. The timeframe for implementation of corrective action(s) proposed is within two (2) to three (3) weeks from the date of CAR.

Details and replies of the eight (8) non-conformances are attached as **Appendix C** in this report.

Referring to the "Corrective Action Request (CAR)" in **Appendix C**, it can be deduced that "insufficient training was provided to the personnel responsible and/or implementing the QMS business processes" as the main root-cause of all the eight (8) non-conformances issued during internal audit. This is due to the fact that the QMS has just been newly established with 1st August 2018 as its effective date of implementation. Thus, staff awareness on the requirements of ISO 9001:2015 standard and company's QMS documented requirements needs to be further increased.

The internal auditor (i.e. this researcher) has reported to the Top Management of the case company on the internal audit findings during the audit closing meeting on 19th March 2019. The internal auditor has suggested to the management of the company to arrange an in-house training on "Understanding ISO 9001:2015 Requirements and Company's QMS Documentation Requirements" for all key personnel to increase the awareness level of staff members. The corrective action to provide the training will effectively eliminate or reduce the root-cause of all the non-conformances found during the internal audit.

The Top Management has agreed to the proposal by the internal auditor and a one-day training on "Understanding ISO 9001:2015 Requirements and Company's QMS Documentation Requirements" has been arranged on 23rd March 2019. The

"Training Attendance List dated 23rd March 2019" is attached in **Appendix D** of this research paper.

The "Observation Sheet" or "Suggestions for Improvement" raised during the internal audit are also attached in **Appendix C**. According to the company's internal audit procedure, the timeframe for implementation of necessary action(s) on "Observations" is within two (2) to three (3) weeks from the date of Observation Sheet issuance. The internal auditor has checked and verified the action(s) taken on the six (6) Observations issued and closed the observations on 12th April 2019.

5.2 Change Management

Firstly, the researcher strongly recommends adding more manpower to the Quality Assurance/Quality Control (QA/QC) section to ensure the sustainability of the QMS because currently, this section has only two (2) personnel. This section should be expanded into a department and the main focus of this department should be on quality assurance, centred on improving processes in order to satisfy quality needs. Quality Control, which is more focused on product testing or inspection to determine whether they are within product specifications, should be fully delegated to production personnel in a gradual manner. This change in responsibilities will hold the production personnel wholly accountable for the quality of the products produced by them. Hence, the production personnel and/or machine operators should be in charge and entirely responsible for product in-process and outgoing inspections. This will significantly reduce the dependency on QC personnel to detect any in-process or outgoing defective products and production personnel will not have the option to consider QC personnel as the last line of defence. The quality assurance department, once established, could concentrate on advanced quality planning to minimise risks, process trouble-shooting, continual improvement of QMS processes to increase its efficiency, improving quality procedures and serve as a stimulus for transformation and enhancement.

Secondly, the researcher would recommend establishing a multi-disciplinary risks management team to identify, assess and propose control measures to address any associated process and/or product risks. This team could assist the Top Management to encourage risk-based thinking within the company. The team will also be responsible to appraise the effectiveness of control measures to deal with any risks identified. Risk-based approach allows the case company to identify potential failures in its quality system and/or processes and establish preventive actions to preclude such failures from occurring. Hence, the case company becomes more proactive in avoiding or minimising negative outcomes and endorses continual enhancement.

5.3 Managerial Implications of the Study

In order to continually improve the effectiveness of the quality management system, the top management should focus on promoting and generating a customer-focused culture within the organisation. With a customer-focused culture, the performance of a division or department shall not only be based solely on financial performance. Non-financial performance such as staff motivation, satisfaction level of customers, product quality, staff retention, learning and growth and others will also be taken into account. This will motivate departmental/divisional managers to work towards the interest of the company as a whole instead of thinking only about the interest of their respective division or department.

In order to cultivate a customer-focused culture within the organisation, the Top Management should firstly establish a company's vision that states the experience your employees should provide to the company's clients. Hence, the current company's vision of "To be the market leader in metal trading and processing in existing and new markets" should be revised for more emphasis on a customer-focused organisation. As an example, the company's vision could be revised to "Delivering delight to customers, staff and suppliers".

Secondly, the Top Management should establish a company's mission statement that summarises the method (the how) to achieve the vision. Thus, the current company's mission of "To create value to our customers by adopting best management practices and empowered workforce" could be amended to something like "To provide high quality products and services that exceed the expectations of our customers", which is clearly more customer-centred.

Thirdly, the Top Management should constantly communicate the company's vision and mission to all level of employees. All employees should be aware of the company's vision and mission so that everyone is working towards achieving the company's goals. The Top Management could organise a daily 10 minutes morning assembly to communicate the company's vision and mission so as to make the communication process more personal instead of using emails, memorandum or notice boards.

Fourthly, a good example must be set by the Top Management. They should act as role models and treat all staff with politeness and respect, just as they would have treated their customers.

Fifth, the Top Management should protect the customer-focused culture. Top Management should keep employees in line with the company's vision. This denotes that every decision made should be gauged against the company's vision and mission.

Lastly, if all is working well and the QMS is achieves its expected outcomes, the Management should reward the employees concern. Rewards and recognition are excellent motivating factors and will inspire all employees to maintain their focus. Anything that is rewarded and strengthened will stay as part of the company's internal practices.

5.4 Limitations of the Study

The researcher has acknowledged a few limitations associated with this research. Firstly, the key limitation in this research is that the researcher is the sole internal auditor to perform the QMS internal audit and time-constraint as the audit duration permitted by the case company is 2 to 2.5 man-days. Considering only one internal auditor is performing the QMS internal audit for all processes in the company and time-constraint, it was impractical to use statistical sampling method for all processes. The audit duration permitted by the case company was between two (2) to two and a half (2.5) man-days. The sampling size required using statistical sampling is too large to be covered by a sole auditor within the stipulated audit duration. Thus, the internal auditor could only use the more practical method of judgement-based sampling. Hence, audit findings are not supported by statistical estimate of the effect of uncertainty.

Secondly, the internal audit should minimise any disruptions to the business operations of the case company. The internal auditor could not spend too much time auditing an activity. Only one or two representatives for each activity or process could attend to the audit to reduce any disruptions to their normal operations. Hence, some audit findings may not signify the awareness, understanding and opinions of all employees in the company. In view of this, it may not be suitable to assume that the audit results represented the awareness, understanding and views of all employees in the company.

Thirdly, the case company established the Quality Management System from a clean slate and just implemented the system effective from August 2018. As with any system, the QMS will need some time to mature and show some effective results. Due to the time constraint of this research project, the researcher could only assess the effectiveness of the QMS during the initial five (5) to six (6) months implementation. Thus, the results of this research is only able to describe the effectiveness and efficiency of the QMS at a particular point of time, which is at the beginning stage. The research results are not suitable to reflect the effectiveness and efficiency of the QMS at maturity stage.

5.5 Recommendations

So that one may get the better of those limitations identified, the researcher hereby recommends a few suggestions. Firstly, a team of internal auditors is required to perform the QMS internal audit to ensure the audit could be completed within the stipulated duration using statistical sampling method. Using a team of internal auditors, a larger sampling size could be covered compared to only using a sole auditor.

Secondly, the QMS internal audit could be scheduled during off-peak period where demand is low so as to minimise any disruptions to normal business operations. This could ensure that more employees could participate in the internal audit process.

Lastly, the duration of the research project could be extended to around two (2) to three (3) years. This will provide sufficient time for the researcher to assess the effectiveness and efficiency of the QMS at its maturity stage instead of only beginner stage. If the performance of the QMS could be assessed until the maturity stage, more accurate conclusions could be obtained from the study.

5.6 Suggestions for Further Study

Researcher would like to offer some recommendations to other researchers interested in conducting a similar research topic. Hence, the research gap could be minimised or closed in future.

Firstly, due to time-constraint, this research only covers five months before and after QMS implementation in the case company. Hence, this researcher would like to recommend that future researchers can study the effectiveness of the QMS until the company obtained the ISO 9001:2015 certificate. With this, the results of the certification audit by a third party auditor could be included in the study as well to provide a more balanced view of the QMS implementation.

Secondly, future researchers could further investigate what are the factors that significantly contributes to the effectiveness and efficiency of QMS implementation in a case company. With this, future researchers can determine a significant or non-significant relationship among the factors that contribute to the effectiveness and efficiency of QMS implementation in a case company.

5.7 Conclusion

This research is centred on whether the QMS implementation can standardise the operations, reduce customers' complaints and improve delivery performance in a case company. A QMS internal audit was also conducted by the researcher to determine the effectiveness of QMS implementation against ISO 9001:2015 requirements. The Managing Director of the case company can apply the outcome of this study to enhance the performance of its business operations in order to provide quality products and services to their customers. Importantly, this research has proven that the effective implementation of has managed to decrease occurrences of customer's grievances and total cases of late delivery.

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APPENDICES