RELATIONSHIP BETWEEN TOTAL QUALITY MANAGEMENT, ORGANIZATIONAL LEARNING AND TECHNOLOGICAL INNOVATION AMONG MALAYSIAN MANUFACTURING FIRMS

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DEDICATION

In loving memory of my brother I’ll meet in heaven, Jason Lee Voon Yen.

I dedicate this project to my beloved parents, Lee Soo Mee and Lim Soo Lean, for relentlessly lending me their support, for inspiring me the determination and fortitude to believe in my dreams, and for turning them into a reality.

To God, who has been my everything.

ABSTRACT

RELATIONSHIP BETWEEN TOTAL QUALITY MANAGEMENT, ORGANIZATIONAL LEARNING AND TECHNOLOGICAL INNOVATION AMONG MALAYSIAN MANUFACTURING FIRMS

Lee Voon Hsien

The six total quality management (TQM) practices in Malcolm Baldrige National Quality Award (MBNQA) model, organizational learning and technological innovation are examined for their relationships in this present study. An extensive literature search was carried out before the hypotheses development regarding the TQM practices, organizational learning and technological innovation. A conceptual framework is constructed to explore the tridimensional relationship between the three main constructs. 190 sets of survey data were found usable from the Malaysian manufacturing firms that have been granted ISO certification. Applying the use of Partial Least Square-Structural Equation Modeling to examine the research framework, results from the analysis revealed that higher level of customer focus, human resource management, process management, information analysis, and strategic planning will lead to higher levels of organizational learning; while the presence of strategic planning and customer focus induces a higher level of technological innovation. Furthermore, organizational learning is also found to mediate between the following: strategic planning and technological innovation, and customer focus

and technological innovation. The conceptual framework of this study acts as a diagnostic instrument for the top level management of the Malaysian manufacturing firms to manage the company's organizational learning and technological innovation by leveraging on the present TQM dimensions, and to fine-tune the appropriate characteristics to increase the desirability of organizational learning and technological innovation. The results of this study have empirically confirmed the significance and the applicability of the best practices modeled in MBNQA on the Malaysian manufacturing sector, further strengthening the state-of-the-art in TQM. Theoretically, a comprehensive conceptual model relating to the six MBNQA-TQM practices, organizational learning elements, and technological innovation dimensions was developed, serving as a valuable reference for future researchers. The inclusion of organizational learning as a mediating variable in this study is an essential aspect that other studies have rarely considered, filling a gap in the literature of TQM. Considering the significance of the three constructs, future studies can be carried out to focus on other industry sectors to develop a more comprehensive TQM framework to meet the needs of the Malaysian industries in their drive towards achieving success and sustainability.

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APPROVAL SHEET

This thesis entitled "**RELATIONSHIP BETWEEN TOTAL QUALITY MANAGEMENT, ORGANIZATIONAL LEARNING AND TECHNOLOGICAL INNOVATION AMONG MALAYSIAN MANUFACTURING FIRMS**" was prepared by **LEE VOON HSIEN** and submitted as partial fulfilment of the requirement for the degree of **Doctor of Philosophy** at Universiti Tunku Abdul Rahman.

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SUBMISSION OF DISSERTATION

It is hereby certified that **Lee Voon Hsien** (ID No: 09ABD09192) has completed this dissertation entitled "RELATIONSHIP BETWEEN TOTAL QUALITY MANAGEMENT, ORGANIZATIONAL LEARNING AND TECHNOLOGICAL INNOVATION AMONG MALAYSIAN MANUFACTURING FIRMS" under the supervision of **Prof. Dr. CHOONG CHEE KEONG** (Supervisor) from the Department of Economics, Faculty of Business and Finance and **Dr. WONG KEE LUEN** (Co-Supervisor) from the Department of Commerce and Accountancy, Faculty of Business and Finance.

I understand that the University will upload softcopy of my dissertation in PDF format into UTAR Institutional Repository, which may be made accessible to UTAR community and public.

Yours truly,

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(LEE VOON HSIEN)

DECLARATION

I LEE VOON HSIEN hereby declare that the thesis is based on my original work except for the quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

(LEE VOON HSIEN)

Date: 30 September 2016

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LIST OF ABBREVIATIONS

AVE	Average Variance Extracted
BEM	Business Excellence Model
CF	Customer Focus
CMB	Common Method Bias
CR	Composite Reliability
CWQC	Company-wide Quality Control
DV	Dependent Variable
E&E	Electrical and Electronics
EFQM	European Foundation for Quality Management
EQA	European Quality Award
FMEA	Failure Mode and Effect Analysis
FMM	Federation of Malaysian Manufacturers
GDP	Gross Domestic Product
HRM	Human Resource Management
IA	Information and Analysis
IT	Information Technology
IV	Independent Variable

ISO	International Organization for Standardization
JUSE	Japanese Union of Scientists and Engineers
KM	Knowledge Management
LD	Leadership
LO	Learning Organization
M	Mediator
MBNQA	Malcolm Baldrige National Quality Award
MOSTI	Ministry of Science, Technology and Innovation
OL	Organizational Learning
PDSCA	Plan-Do-Study-Act
PLS	Partial Least Square
PM	Process Management
PMQA	Prime Minister's Quality Award
R^2	Coefficient of Determination
R&D	Research and Development
RO	Research Objective
RQ	Research Question
SEM	Structural Equation Modeling
SME	Small Medium Enterprise

SP	Strategic Planning
SPC	Statistical Process Control
TI	Technological Innovation
TIC	Technological Innovation Capabilities
TQC	Total Quality Control
TQM	Total Quality Management
VIF	Variance Inflation Factor

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Total quality management, also known as TQM, has been well known to be a famous management belief in the world of business, up till the present day. William (2005) defined that TQM demands continuous effort from each employee in the firm to achieve improvements in quality at the same time attain the satisfaction of its customers. According to Golhar and Ahire (1994), the tools and techniques used by TQM were examined upon seriously since the mid-1980s and were widely adopted by organizations in particularly from the west. As opined by Prajogo and Hong (2008) and Idris (2011), the adoption of TQM is inevitable and essential to ensure the company survive and succeed in the international marketplace.

With the immense benefits that TQM brings, TQM has also been found to promote learning (Ooi, 2012; 2014) and enhanced one's competitive advantage, as illustrated by Martinez-Costa and Jimenez-Jimenez (2008). When quality management is practiced as a set of philosophy and techniques, such as planning, doing, checking and acting (Garvin, 1993), it serves as a mechanism so that learning can take its place in an organization, also known as organizational learning (OL). Additionally, TQM cultivates and nurture an environmental culture that is conducive for innovation, as supported by Hoang, Igel, and Laosirihongthong (2006) and Lee, Ooi, Tan, and Chong (2010b). TQM is built on the principle that firms should support their staff in exploring new ideas continuously. In this regard, it has been recognized in McAdam (2004) and Molina, Llorens-Montes, and Ruiz-Moreno (2007) studies that teamwork, a TQM construct, plays an integral role in innovation. In short, TQM can be summarized as an essential factor for both learning and innovation.

On the other hand, innovation plays a vital role in securing the sustainability of a firm in the present market (Prajogo & Sohal, 2003a). As the lifecycles of products become shorter and that new products are produced every single day at a rapid pace, technological innovation (TI) has become a requirement in the turbulent marketplace (Prajogo & Sohal, 2003b). Bontis, Crossan, and Hulland (2002) and Nonaka and Takeuchi (1995) further make mention that in order to survive and sustain an edge over competitors during such unpredictable times, one needs to continuously learn to innovate. According to Deming (1986), learning can stimulate innovative activities (Lee, Leong, Hew, & Ooi, 2013), and the key factor to determine a company success is “quality”. Subsequently, by consistently reproducing products and managing quality, an enterprise can maintain a competitive advantage (Hung, Lien, Yang, Wu, & Kuo, 2011).

1.1.1 Manufacturing Sector Overview in Malaysia

In general, manufacturing can be described as encompassing goods or items produced using machinery, equipment, and labour force. The term manufacturing is applicable to processing industrial production, whereby raw materials are processed and transformed to become finished products that are ready to be sold. It varies from making simple handicraft items to manufacturing high-tech technology gadgets.

The manufacturing sector plays an important part in the economy of Malaysia, together with agriculture sector. This industry is intensive in its labour and harvest a strong chance for investment. Located in a strategic location in South East Asia, it definitely offers a lucrative and productive environment that is appropriate for business investors to develop their offices, plants or corporations to manufacture and produce products that is of a high quality for the export market. Furthermore, the plentiful well-trained workforce and the well-developed infrastructure became also the reasons that foreign investors are attracted into the country. In addition, the seven international seaports, with five state-of-the-art international airports coupled with air-cargo facilities make it easier for investors to enlarge and prosper their business in both local and international markets.

This particular sector aims to grow at around 5.6 per annum during the period of the Third Industrial Master Plan in accordance to Lean (2008) and to contribute approximately 28.5 percent to Gross Domestic Product (GDP) when the year 2020 approaches. In order to attract Foreign Direct Investment, there is a need for Malaysia to adopt a more focused approach. To address the challenges and facilitate the target achievements for investments, eight strategic thrusts have been set. To increase competitiveness and productivity among both manufacturing and service sectors; to position Malaysia as a manufacturing and services hub in the international supply chains; and to position the different sectors so that all could gain from bilateral, regional and multilateral agreements in connection to investment potentials are some of the thrusts to name a few (Lean, 2008).

1.1.2 Challenges ahead for the manufacturing industry

Based on the yearly survey conducted by the Department of Statistics Malaysia of the manufacturing sector, a decline for some of the main indicators in 2009 was recorded. A decrease of 10.7 percent was reported on the gross output value. Intermediate input also decline by 10.4 percent in the same period. The same trend was followed by value added and employment, with a dropped of RM18.6 billion and 78,177 persons in the year 2009. In 2009, the share of manufacturing industries to GDP was reported at 25.5 percent (Department of Statistics Malaysia, 2010).

Nevertheless, it still remains an important sector where the main contributors of the manufacturing groups to the gross output were (1) manufacture of refined petroleum products (RM91.9 billion), followed by (2) manufacture of vegetable and animal oils and fats (RM86.3 billion) and (3) manufacture of electronic components and boards (RM75.2 billon). The sector also contributes significantly to the total employment by group in year 2009, in which the manufacture of electronic components and boards reported the highest number of employees with a total of 183,579 workers (10.8 percent), followed by manufacture of plastic products with a total of 114,914 persons (6.8 percent) and manufacture of rubber products which reported at 83,392 persons (4.9 percent) (Department of Statistics Malaysia, 2010).

1.2 Problem Statement

For the last 50 years, developing countries such as Malaysia have gone through a significant economic transition, shifting from a resource-based economy (e.g. land and labor) to a production and service-oriented economy, in which labor, infrastructure and capital are the main components. From one that is mainly focused on the production of raw materials, such as rubber, tin and palm oil, Malaysia has transitioned itself to one of the world leading exporters for electronics during the 1980s and 1990s. In accordance to Ministry of Science, Technology and Innovation (MOSTI) (2007), the electronic and electrical industry was the main force for export growth during the transformation period and is also presently the nation's leading industrial sector in employment, value added, investment and exports.

Ever since Malaysia achieved independence, the country has been experiencing robust growth from national resources like petroleum, and commodities such as rubber, palm oil, and manufacturing. The success that the nation reaps today has been primarily due to the traditional drivers of growth such as land, cost-competitive labor and capital. However, it is not sufficient to be just expert practitioners or assemblers of old methods as the world is slowly overtaken by cheaper labour, in which this remains one of the reasons that FDI is being diverted to other Asian nations. In other words, Malaysia runs the risk of being “stuck in the middle” between India and China, the two emerging giants and industrial nations. Hence, it is essential to move from merely a resource-based and production-based economy to one that is sustainable, in which ‘know-how’ and knowledge will turn out to be the main factors that drive economic growth. The nation has to advance into an innovation-base economy in order to move higher (MOSTI, 2007).

Investment into the R&D by both the public and private sectors has been steadily increasing. For example, significant allocations have been made to increase knowledge flows under the 8th Malaysia Plan (2001-2005), which incorporate the expansion of the MSC flagship projects to include a network of cyber cities, the continuous upgrade of Malaysia’s IT infrastructure and telecommunications, and the computerization of several agencies and ministries (Tuah, Nadaraja, & Jaafar, 2009). Moreover, there are also some key institutions that are responsible to implement innovation initiatives. They are the Malaysia Science, Technology, and Innovation Ministry (MOSTI- Institution), Ministry of International Trade and Industry (MITI – Market), Ministry of Finance (MOF – Funding), the Ministry of Higher Education (MODE- Human Capital), and SME Corporation (SME), to name a few. Apart from that, the Malaysian Knowledge-Content (MyKe) Model was also developed by the Economic Planning Unit in 2005 to monitor the knowledge content in some selected sectors and to identify the leading and lagging sectors in efforts to move up the value added chain (Shapira, Youtie, Yogeesvaran, & Jaafar, 2006).

However, many firms were still hesitant to invest in knowledge-based activities despite clear evidence of positive returns, citing the lack of skills, the lack of English proficiency, the lack of funds to enhance knowledge capabilities, and the uncertainty as to benefits of the said investments as constraints for firms to move up the value added chain. Furthermore, the national level of innovation remains wanting, despite the various policy initiatives and support from institutions to move Malaysia towards an innovation-led economy. This is mainly due to shortage of technically skilled manpower to engage in R&D. Therefore, there is still a need for the government to continue subsidizing in both training and knowledge-based upgrading activities to spur industries and the economy at large to the desired goal of a truly knowledge-based economy.

Academically, numerous past studies have proven that TQM can indeed improve an organizational performance. Many writers such as Terziovski and Samson (2000), Hendricks and Singhal (2001a), Martinez-Costa and Jimenez-Jimenez (2008), and Hung et al. (2011) opined that TQM serves as a vital instrument to cultivate learning and improve an enterprise’s competitiveness. However, insufficient literature still exists as to whether TQM practices can enhance organizational learning and technological innovation, in particularly to the Malaysian manufacturers, seeing its importance. Lam, Lee, Ooi, and Lin (2011) have in the past look into the tridimensional relations among TQM, market performance and learning orientation, using the Malcolm Baldrige

National Quality Award (MBNQA) framework. However, their focus was only on the Malaysian service organizations. In addition, Ang, Lee, Tan, and Chong (2011) did an empirical study researching the correlations between TQM on both organizational learning and customer orientation, but their focus was on the small service organizations in Malaysia. Even though the manufacturing firms in Malaysia were empirically researched before, the study of Lee, Lam, Ooi, and Safa (2010a) mainly assessed the structural relationship between MBNQA-TQM, customer satisfaction and innovation. It is also worth mentioning that many of the past empirical studies that used MBNQA as their TQM framework do not test the MBNQA dimensions individually, rather it was tested as a whole.

Specifically, Barrow (1993) opined that organizational learning serves as the main outcome of TQM achievement within a firm. However, most of the research studies found to support the proposition of TQM affecting organizational learning were mainly conducted in the west such as Australia (Sohal & Morrison, 1995) and Spain (Martinez-Costa & Jimenez-Jimenez, 2009; Molina et al., 2007; Lopez, Peon, & Ordas, 2006). Even though research conducted in this area was also found in Malaysia (e.g. Chong, Ooi, Lin, & Teh, 2010; Ooi, 2009; Ooi, Teh, & Chong, 2009), the studies mentioned are mainly conceptual studies, where models developed are yet to be empirically tested. Nevertheless, these conceptual papers contributed significantly in advancing the TQM research literature.

Furthermore, as markets are changing rapidly and product lifecycles are getting shorter, the competitiveness of firms gets threatened, and according to researchers such as Prajogo and Sohal (2003b) and Hung et al. (2011), this requires firms to be technologically innovative. A number of past research studies have shown that TQM does positively influence the performance of firms, in which innovation performance is included as a measurement for firm performance (Prajogo & Sohal, 2003a), but these studies were mainly carried out in a western culture. An empirical study conducted by Lee et al. (2010b) investigating on the structural relation between MBNQA-TQM and product innovation was found to be conducted in Malaysia. However, the target population for the study was narrowed down to the electrical and electronics firms and specifically focused on product innovation instead of technological innovation as a whole.

Meanwhile, Corbin, Dunbar, and Zhu (2007); Hall and Andriani (2003); Hu, Horng, and Sun (2009); Hung, Lien, and McLean (2009); Weidenfeld, Williams, and Butler (2010) have also indicated in their studies that organizational learning can promote innovation. All these studies come to prove that TQM not only affect both organizational learning and innovation; organizational learning also promotes innovation. In other words, organizational learning is proved to be an intervening variable between TQM and innovation performance of a firm (Chen & Huang, 2009; Linderman, Schroeder, Zaheer, Liedtke, & Choo, 2004; Hung et al., 2011). As mentioned by Chen and Huang (2009), there is a possibility that firms may influence the development of its human capital in order for the creation of new products and services to take place. However, according to Ericsson and Charness (1997), to garner such expertise is a complex issue and it might require the intervention of deliberate practices to ensure favorable results are achieved. Such deliberate practices need to ensure that individuals execute the tasks and make efforts to improve performance. TQM is thus believed to be such practices to exert the willingness and motivate its organizational members to engage in performing such duties to achieve business objectives, such as innovation performance (Lee et al., 2010b). As TQM allows organizations to realize and utilize knowledge and expertise within the firm, such practices are believed to be conducive to innovative activities. However, the firm may still need to possess good capabilities to manage their knowledge to ensure the effective use of human capital to develop its organizational expertise for innovation.

Generally speaking, the management of knowledge may still influence the relations between TQM and innovation performance. However, little research has been conducted on the tridimensional relationship between these three constructs, in particularly with organizational learning being the mediator between TQM and technological innovation. To the best understanding of the researcher, only Hung et al. (2011)'s study analyzed such a relationship so far. However, Hung et al. (2011)'s study focused on the high-tech industry in Taiwan. In other words, no empirical studies can be found examining the structural relationship between TQM, OL and TI from the context of manufacturers in Malaysia, aside from the one carried out by the author herself, which is Lee, Choong, Wong, and Ooi (2013a). Hence, manufacturing firms that are certified with an ISO certification will be the focal population of this research. Such companies are chosen as they are believed to conform to the quality standards set. However, this does not entirely mean that the products manufactured by these firms are of high quality. It merely means that such companies follow a well-defined procedure that ensures quality products are produced. Hence, this research serves to be an interesting one where it determines to narrow the literature gap by diving into the analysis of the three main constructs from a developing nation's point of view, zeroing the attention to Malaysian manufacturers.

1.3 Research Questions and Objectives

In accordance to the current issues being discussed, this research study purports to respond and fulfill the following research questions (RQ) and research objectives (RO).

1.3.1 Research Questions

RQ (1) Do MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) relate significantly with organizational learning in the Malaysian manufacturing firms?

RQ (2) Do MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) relate significantly with technological innovation in the Malaysian manufacturing firms?

RQ (3) Is the relationship between MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) and technological innovation performance mediated by organizational learning in the Malaysian manufacturing firms?

1.3.2 Research Objectives

In accordance to the research questions, the objectives of this study have been proposed as follows:

RO (1) To determine the relationship between MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) and organizational learning in the Malaysian manufacturing firms.

RO (2) To investigate the relationship between MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) and technological innovation performance in the Malaysian manufacturing firms.

RO (3) To ascertain the mediating role of organizational learning between MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) and technological innovation for the Malaysian manufacturing firms.

1.4 Scope of the Study

The scope of the research study is explained in this section. It acts as a guideline for the discussion in the coming chapters.

a. This research employs a quantitative and cross-sectional research approach to assess the tridimensional relationship between TQM, OL and TI, with the mediator being OL.
b. This research uses survey questionnaire as a research tool to collect data. Self-administered approach was carried out to gather the data.
c. The unit of analysis for this study is the ISO certified manufacturing firms in Malaysia, gathering responses from the managerial personnel of these firms.
d. The theoretical framework constructed for this study is consistent with that of the MBNQA framework for the TQM practices; consistent with Lopez et al. (2006) and Tippins and Sohi (2003) for organizational learning dimensions; and consistent with Chuang (2005), Cooper (1998), and Damanpour and Gopalakrishnan (2001) for the elements of technological innovation.

1.5 Research Stages

Conducted using a hypothetico-deductive method, this research purports to find a solution to the problem identified above. This systematic approach includes the few research stages listed and discussed in Table 1.1.

Table 1.1 Research Stages

Research Stages	Description
Identifying the problem statement	The research problem that there is a scarcity of literature focusing on the relations between TQM, OL and TI, in particularly on the Malaysian manufacturers have been identified.
Defining the research questions and objectives	The research problem is then translated and restated in both question and objective forms, in which it will be the focus of the researcher's attention to accomplish at the end of the research.
Developing hypotheses	In this stage, the variables are investigated as to explain whether a significant relationship occurs between the three variables. The linkages identified among the constructs needs to be theoretically woven. In addition, the hypothesis formulated must also be testable and falsifiable. For this study, it is hypothesized that there is a significant relationship between the three concepts of TQM, OL and TI.
Designing the research project	The research design is a blueprint that lay out the methods and techniques to gather and analyze the required information in order to respond to the research questions and fulfill the research objectives. In other words, it works as an action plan for the research study. Primary data collection method will be adopted in, whereby a survey will be self-administered personally.
Determine a sample	The target population that is needed to answer the measurement question is determined. A sample of Malaysian manufacturing firms will be carefully selected to represent the population for this study.

Research Stages	Description
Data collection and preparation	Data related to each variable in the hypothesis will be gathered. In the case of a survey method, the data will be edited to ensure consistency across target respondents and located for omissions to ensure that analysis is made possible.
Analyzing, interpreting and reporting the results	Data will be analyzed and findings will be interpreted in light of the researcher's question and to determine if results are consistent to hypothesis formulated and theories established.

1.6 Significance of Study

In light of this research, the outcome of this study could add significantly to both theoretical and practical contributions. The following subsections discuss the contributions in each of these areas.

1.6.1 Theoretical Contributions

Given the significance of both organizational learning and technological innovation towards a firm's survival, many past research have endeavor to search for the most successful methods to enhance both learning and innovative activities in an organization. Despite the many attempts by the past researchers to link MBNQA-TQM, OL and TI, the past empirical research studies scarcely focused on the tri-dimensional relationship of the three constructs, or researched OL as a mediator between MBNQA-TQM practices and TI, or they would solely relate one variable to another. Strictly speaking, past studies investigating on the three constructs are rare. Questions as to whether the MBNQA model, widely used in the Western culture, can affect OL and TI in a South-East Asian context; and whether the four elements of OL proposed by Lopez et al. (2006, p. 218) and Tippins and Sohi (2003) can mediate the relation between MBNQA-TQM and TI, are still yet to be established from the Malaysian perspective. The theoretical framework shown in Chapter 3 (refer Figure 3.1) provides valuable insights to the future researchers on the relationships between these three constructs, a contribution to the literature bank of TQM, OL and TI. TI is developed from both the constructs of MBNQA-TQM and OL, as suggested in the research framework of this study. Additionally, the research model provides a conceptual basis that observes in detail the multidimensionality of MBNQA-TQM on both OL and TI. Following the reviews of past literatures and the development of the conceptual model in this study, the main hypotheses were formulated, where the implementation of MBNQA-TQM practices can enhance the level of both OL and TI; and that OL is an important mediating factor between MBNQA-TQM and TI. In other words, results from this research may also provide better comprehension of the effect of mediator on the relationship between MBNQA-TQM and innovation performance. The mediating variable which is organizational learning will hopefully serve as a positive indirect relationship between TQM and technological innovation and at last provide a new theoretical contribution. The ultimate goal of this study is to inspire more researchers to explore the relationships between these three concepts. Therefore, this research intends to achieve such objective purpose, so that a clear relation between MBNQA-TQM, OL and TI be established among both academics and TQM practitioners.

1.6.2 Practical Contributions

In the present modern day's society, a learning and an innovative organization is one that is unbeatable and able to succeed during good and bad times. As such, many firms encourage their employees to learn relentlessly and productively involve themselves in innovative activities. This research study mainly contributes to organizations that purport to nurture a learning environment and grow its innovative capabilities, so that they will be able to get a clearer picture of the effects TQM can bring on OL and TI. Practically, this research could provide valuable knowledge to the top management of the Malaysian manufacturing firms with the overarching goal to refine quality management practices that subsequently foster both OL and TI. When knowledge is acquired (Garvin, 1993; Lien, Hung, Yang, & Li, 2006), shared and transferred, employees will be given an avenue to learn from each other, spurring the creation of knowledge, in which such a knowledge can be used when innovating a product and transferred internally among organizational members, hence creating knowledge workers, as mentioned by Tsai (2000). Hence, it is vital that TQM practices be implemented thoroughly in businesses, couple with the concept of OL, to spread out the influence of TI. The top management can then use this model as a guideline to determine the effects of TQM in promoting effective learning, which indirectly affects innovation in a firm. Furthermore, it also guides managers to ascertain the specific TQM practices they should focus on when OL takes on the mediating role between TQM and TI. In general, this theoretical model is alleged to provide practitioners with a clear guideline to continue to implement the right TQM practices that are useful and effective for firms to achieve greater heights in both OL and TI. Hence, the proposed conceptual framework is deemed valuable to be analyzed on the Malaysian manufacturing firms.

1.7 Limitations of Research

The first limitation of this study is that only Malaysian manufacturers are focused upon. It is recommended in future to widen the research by incorporating the service sector or the manufacturing firms from other countries for purpose of conducting a comparative study. Secondly, the present study collects its data using a cross-sectional approach and hence it is difficult to determine the time sequence of the correlations between these three constructs. It is proposed to extend the present research by collecting data with the use of a longitudinal approach. The use of a survey questionnaire as an instrument to collect data serves to be the third limitation of this study, as some of the items in the survey might not be clear to some of the participants, resulting in response biases. A case study approach is thus beneficial to overcome such limitation, in which exploratory interviews or field observation can be carried out to gain more insights from the participants themselves. The fourth limitation would be the consideration of a moderating factor. As this study focused solely on the mediating factor of OL, future studies can also consider incorporating moderating factor(s) or a combination of both moderating and mediating effects, to gain further clarity on the relationship between the three constructs.

1.8 Outline of the Study

Chapter 1 briefly explains the research topic. Background of this study, followed by the research problem, research purpose and questions are discussed in line with the subject matter. Scope of study, the different research stages employed and the significance of this research is further illustrated and explained. Lastly, some of the important terms used in this study is briefly defined in this chapter.

Chapter 2 presents the concepts of quality from both product and service, the evolution of quality management, a general review on the concept of TQM based on the philosophy of six quality gurus (namely Deming, Juran, Crosby, Ishikawa, Feigeinbaum, and Groocock), the three quality awards (namely MBNQA, the Deming Prize, and the EQA), and other researchers that have conducted their research in the TQM field. Furthermore, a review on the six constructs of TQM practices, four concepts of organizational learning and two elements of technological innovation and the reasons these dimensions are adopted are illustrated in this chapter.

Chapter 3 explains the model of the study, where it systematically linked the variables of TQM, OL and TI together. By properly managing the TQM practices in a company, it is believed that such a move can help firms to attain a greater level of learning ability and innovation performance, in which both are essential components that guarantees the healthy development and sustainability of firms. Following that, a series of past empirical research studies are shown to support all the hypotheses developed.

Chapter 4 covers a discussion on the research methodology employed in this study. Following a discussion on the research design, the population, the sampling design and the sample size is identified. Data collection method will discuss on both primary and secondary data collection method adopted in this study. The questionnaire items relating to the three major variables of MBNQA-TQM, OL and TI are explained in the variables and measurement section. Lastly, the data analysis techniques used in this study will be elucidated to obtain clarity of the subject matter.

Chapter 5 analyzes and tests the data in detail. A statistical analysis of the relations between MBNQA-TQM, OL and TI, and the effect of OL as the mediator between the variables of TQM and TI is illustrated. The demographic information of the target respondents will be further analyzed and described. Following that, Partial Least Square-Structural Equation Modelling (PLS-SEM) method with the version Smart-PLS 2.0 was used to assess the relations among MBNQA-TQM, OL and TI. The measurement model will be first examined in this research with the testing of its reliability, convergent validity, and discriminant validity, which is then followed by the assessment of the structural model.

Chapter 6 interprets the results of the analyzed data. A detail discussion based on the major findings of the relationship between the three variables will be explained in detail. Implications of the study are also explicated in this chapter. Limitations of the study, together with future recommendations are also provided. The main conclusion summarized the overall findings with reference made to the research questions, ensuring that the research objectives for the study are met.

1.9 Definition of Terms

1.9.1 Total Quality Management

The introduction of TQM played an essential part in the advancement of modern management (Prajogo & Sohal, 2003a). TQM, as defined by Saha (2008) is a quality-focused, customer centered, management process to achieve the strategic goal set out by the organization through a continuous improvement process. The TQM dimensions represented in this study are adopted from the MBNQA model. They are top management support, customer focus, strategic planning, process management, human resource management, and information and analysis (Poon & Tong, 2012).

1.9.1.1 Leadership

Leadership (LD) dimension refers to how the leaders of a firm personal action guide and sustain a firm (Zhang, Waszink, & Wijngaard, 2000).

1.9.1.2 Strategic Planning

Strategic planning (SP) examines how a firm's strategic objectives and action plans are developed. If circumstances required, it also investigates how the firm's chosen strategic objectives and action plans are executed and changed as well as measuring its progress (Prajogo & Sohal, 2006).

1.9.1.3 Customer Focus

Customer focus (CF) refers to how a firm engages its customers to succeed in the marketplace for the long-term. Such an engagement strategy incorporates how a firm hears its customers out, develop customer relationship, and uses the information obtained from customers to improves itself and identify opportunities for innovation (Zhang et al., 2000; Sohail & Teo, 2003).

1.9.1.4 Human Resource Management

Human resource management (HRM) examines a firm's ability to assess the capability and capacity of its workforce and build a working environment that is conducive for high performance. It also assesses how a firm involves, manages, and develops its people to its full potential to align with the firm's overall mission, strategy and business plans (Prajogo & Sohal, 2006).

1.9.1.5 Process Management

Process management (PM) examines how a firm plans, manages, and enhances its work processes and work systems in order to deliver value to its customers and attain organizational success and sustainability (Sohail & Teo, 2003).

1.9.1.6 Information and Analysis

Information and analysis (IA) covers how a firm chooses, collects, examines, manages, and improves its information, data, and knowledge assets, and how information technology of the firm is being managed. It also examines how a firm improves its performance using review findings (Sohail & Teo, 2003; Teh, 2010; Samson & Terziovski, 1999).

1.9.2 Organizational Learning

Organizational learning can be defined as a process of creating new knowledge (Argyris & Schon, 1978; Crossan, Kane, & White, 1999; DeGeus, 1988; Dodgson, 1993; Huber, 1991; McGill & Slocum, 1993; Lei, Hitt, & Bettis, 1996; Levitt & March, 1988; Snell, Youndt, & Wright, 1996).

The construct of organizational learning incorporates the four main elements of knowledge being acquired, disseminated, interpreted, and stored (Crossan et al., 1999; Day, 1994; Dean & Snell, 1991; Dixon, 1992; Huber, 1991; Nevis, Dibella, & Gould, 1995; Romme & Dillen, 1997; Sinkula, 1994; Slater & Narver, 1995; Snell et al., 1996).

1.9.2.1 Knowledge Acquisition

Knowledge acquisition integrates the acquisition of information externally and internally (Lopez et al., 2006).

1.9.2.2 Knowledge Dissemination

Knowledge dissemination refers to how information is passed among members within a firm (Lopez et al., 2006).

1.9.2.3 Knowledge Interpretation

Knowledge application is described as the business processes which facilitate a firm to have right and ease to use knowledge through effective storage and retrieval mechanisms (Lin & Lee, 2005). Knowledge application allows the organization to translate knowledge and expertise of organization into embodied products (Lopez et al., 2006; Madhoushi, Sadati, Delavari, Mehdivand, & Mihandost, 2011; Martinez-Costa & Jimenez-Jimenez, 2009).

1.9.2.4 Organizational Memory

Knowledge storage, as described by Massa and Testa (2009), is a process of organizing and storing knowledge. This is the stage where knowledge is formalized and will be utilized whenever possible. Knowledge storage is similar to organizational memory as it reflects the capability of storing knowledge by which it enables people to store, integrate, and reuses the information and knowledge (Lai, Huang, Lin, & Kao, 2011; Lopez et al., 2006). Once knowledge is developed, it needs to be properly kept in organization for consequent use by the employees in various departments (Storey & Kelly, 2002). Thus, refined and stored knowledge enables employees' retrieval and dissemination of the knowledge conveniently, which is valuable for organization (Gold, Malhotra, & Segars, 2001).

1.9.3 Technological Innovation

According to Becheikh, Landry, and Amara (2006), technological innovation can be divided into two dimensions namely process innovation and product innovation.

1.9.3.1 Product Innovation

Product innovation refers to the creation and introduction of new products and services, whereby the dimension of innovation is associated with the speed of innovation (i.e. the time required to develop the new product), the ability to replace products frequently with improved versions faster than competitors, and the ability to introduce new products to the new markets, also known as first mover advantage (Prajogo & Sohal, 2006).

1.9.3.2 Process Innovation

Process innovation refers to the adoption of new and improved production and delivery methods, incorporating a change in tools, software and/or methods used (Bi, Sun, Zheng, & Li, 2006). Similar to product innovation, process innovation incorporates the speed of adopting the latest technology, and how early the firm adopts a new technology emerging in the industry (Prajogo & Sohal, 2006).

1.10 Chapter Summary

An overview of the PhD dissertation is provided in this chapter. Concepts relating to TQM, organizational learning and technological innovations were discussed. The justifications for selecting the Malaysian manufacturing firms for this study were also provided, followed by the development of the research questions and research objectives. This chapter also presented the significance of the study, in terms of both theoretical and practical contributions. A summary of the methodology used in this research was also discussed. Lastly, an outline for the remaining chapters has also been presented in the current chapter.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

Chapter 2 discusses mainly on the concept of quality management, famously known as TQM. In section 2.2, both product and service quality concepts will be discussed. The evolution of quality management is explained in section 2.3. In section 2.4, the reviews of some of the well-known quality gurus are presented. This will be followed by the discussion on the quality award models in section 2.5. Lastly, in section 2.6, the concept of TQM and the review of TQM practices will be brought in. The reviews for organizational learning and technological innovation are discussed in 2.7 and 2.8 respectively in this chapter.

2.2 Quality Defined

It is essential that one needs to understand the true meaning of quality before one can fully comprehend the meaning of total quality. With the increasing intensity of competition, both local and international, as well as the ever increasing customer demands, and stricter legal requirements, business enterprises have no grounds to stay complacent in today's business environment. Higher quality products and services are demanded of organizations while at a reasonable price. Quality is considered to be essential due to reasons such as (1) reducing cost, (2) minimizing throughput time, (3) enhancing flexibility/responsiveness, and (4) it is the prime buying argument for the end consumers (Dale, 2003, p.14-15). In the words of Zink (1997), quality simply determines survival.

Quality, given its significance, is an ambiguous and multi-faceted term. In other words, there is no universally accepted definition of this term – quality. It has been defined differently by different scholars and organizations. The following table illustrates the different definitions pertaining to the term quality, as conveyed by various quality scholars and researchers.

Table 2.1 Definitions of Quality

Scholars	**Definition**
Crosby (1979)	"Conforming to own organization's quality requirement" (p.17).
Ishikawa (1985)	Product quality, work quality, service quality, information quality, process quality, division quality, people quality (e.g. workers, engineers, executives, managers), system quality, company quality, objectives quality etc (p.45).
Deming (1986)	Exceeding customer requirements/expectations.
Feigenbaum (1986)	Product or service quality that meet customer expectations.
Groocock (1986)	The level of conforming to all the required product specifications to fulfill all the aspects of a customer's reasonable expectations.

Scholars	**Definition**
Taguchi (1986)	The loss (i.e. breakdowns, fail to achieve ideal performance, meet customer's expectations, harmful side effects caused by products) transmitted to the society at large from the time the product is being produced. Hence, the aim is to lower the total costs imparted to the society (i.e. cost reduction).
Goetsch and Davis (1997)	"A dynamic state associated with products, services, people, processes and environments that meets or exceeds customers' expectations".
Juran (1999)	"Those features of products which meet customer needs and thereby provide customer satisfaction" (p.2.1). "Providing more and/or better quality features usually requires an investment and hence usually involves increases in costs. Higher quality in this sense usually 'costs more'" (p.2.1). "Freedom from deficiencies – freedom from errors that require doing work over again (rework) or that result in field failures, customer dissatisfaction, customer claims, and so on" (p.2.2). "The meaning of quality is oriented toward costs, and higher quality usually 'costs less'" (p.2.2).
Spencer (1994)	Quality is an "attribute of the product or service of the work itself, and of the processes and systems surrounding the work" (p.463), thus delighting and satisfying the customers.
Reeves and Bednar (1994)	Quality is providing value, excellence, conforming to specifications, meeting or exceeding the expectations of customers.

In general, quality can be viewed from two perspectives – the internal and the external. Conforming to own firm's quality requirement can be considered as viewing quality from an internal perspective. Meanwhile, viewing quality from customer perspective can be considered as an external approach. Such a definition, according to Juran, Gryna, and Bingham (1974) can be applied to all organizations, be it a manufacturing firm, service company, profit or non-profit organization. However, given the nature of TQM programme as a whole, the TQM practice fulfills the requirements of both the management and customer. Hence, for this research, the concept of quality can be defined from both the internal and external perspectives.

The two main dimensions of quality, which are product and service quality, will be further defined and illustrated in the following sub-sections. To satisfy the management requirements as well as the expectations from customers, both these quality concepts must be understood and clarified.

2.2.1 Product Quality

According to Dunk (2002), the quality of a product has become a main concern for many firms, to the degree that it has become a competitive prerequisite rather than a competitive advantage. To improve on a product is to invest on its quality. Product quality, as viewed by Veldman and Gaalman (2014), incorporates design quality (i.e. the characteristics of product such as performance, durability, and reliability) and conformance quality (i.e. whether the product is able to meet its specifications). Products with high quality are believed to enhance the reputation of a firm within its industry (Çiflikli & Kahya-

Özyirmidokuz, 2012). As claimed by Flynn (1994), the designing and manufacturing stages of the product are essential to enhance the quality performance of the product, so that customer expectations can be met. In fact, managers are rewarded by firm owners via incentives for process improvement and product quality in the name of profit maximization (Veldman & Gaalman, 2014). The ability to understand and detect the characteristics that surround a defective product, and make the necessary changes during the manufacturing process, ensures quality improvement of the product being manufactured (Çiflikli & Kahya-Özyirmidokuz, 2012). When the failure rate in the manufacturing stage is controlled, product quality, according to (Li, Xu, & Li, 2013), can be improved. Decision making has also been applied in several manufacturing applications to increase the level of product quality (Charaniya, Le, Rangwala, Mills, Johnson, Karypis, & Hu, 2010; Ferreiro, Sierra, Irigoien, & Gorritxategi, 2011).

Eight elements of product quality namely performance, reliability, features, durability, conformance, serviceability, aesthetic, and customer perceived quality were proposed by Garvin (1987) and later supported by Russell and Taylor (2006) and Hitt, Hoskisson, and Ireland (2007). Performance is defined as the basic operating characteristic of the product; feature is the add-on functions that is attached to the product basic characteristics; reliability refers to the probability of the product being able to function with any fault within a specific time; conformance describes the extend which the product meet the predetermined standard, while durability is referred to as the use quantity that can be gained from the product before it depreciates; serviceability refers to the ease and speed of repairs; aesthetics is referred to a personal judgment of a product's appearance, sound, smell, or taste. Finally, perceived quality is pertaining to the reputation of the provider, e.g. brand name and advertising. However, these dimensions were questioned by researchers to have different levels of intensity. Idyllically, it remains that conformance should be added as one of the dimensions for product quality (Wacker & Sheu, 1994). It was included and empirically tested in Prajogo (2007)'s study of the association between competitive strategies and product quality, where reliability, performance, durability and conformance to specification were dimensions that represent product quality.

2.2.2 Service Quality

Service quality, as defined by Wang, Lo, and Hui (2003), is the difference between what customers expect to receive and their perceptions of the service actually received. In other words, the state of difference is also known as "disconfirmation". Service quality remains vital as high expectations of a superior service remain the core emphasis of customers in the service industry (Cheah, 2008). Superlatively, it would be exceptional if the quality of service could be in line with customer requirements and expectations. Such an element would be a value-added factor for service firms to position themselves in this competitive marketplace (Mehta, Lalwani, & Han, 2000). There is a sizeable literature suggesting that service quality is a main driver to retain customer, improve market share, and build a company's reputation. One of which is Zhao and Di Benedetto (2013), who has proven that service quality is linked to new venture survival. Service quality was also found to be linked with customer loyalty, with customer satisfaction being the mediator at six Macau casinos (Shi, Prentice, & He, 2014). The topic about service quality was also widely discussed in the airline industry, such as service quality provided by the low-cost carriers (Wittman, 2014), measuring the quality of service among the major US airline companies (Waguespack & Rhoades, 2014), and establishing a hierarchical model of service quality (Wu & Cheng, 2013) in the airline industry.

The characteristic of a service firm has been defined by Lakhe and Mohanty (1995) as such:

1) Tangible or intangible services are produced and delivered to the customers directly.
2) A mutual direct contact is established with the customer when delivering the service.
3) It needs to be in a state of being 'eveready' as service needs to be delivered as and when required.
4) The services need to be successfully completed within a stipulated time period that is acceptable by the customer.
5) Services cannot be stored or transferred.

With this unique characteristic, many researchers tried to establish a model in order to measure the quality of service. With reference to Camison (1998) research work, the service quality is categorized into two school of thoughts. The first is the 'Nordic School, while the second is the 'North American School'.

Led by Gronross (1988) and Gummesson (1988), the 'Nordic School' differentiates service quality using two elements, the technical as well as the functional. The technical side governs if the main benefits of a service is properly produced; whereas functional refers to the way a service is delivered (Gummesson, 1988).

The second school of thought, who is led by Parasuraman, Zeithaml, and Berry (1985; 1988) categorized service quality into five behavioral dimensions – tangibles, reliability, responsiveness, empathy, and assurance. In 1985, ten elements namely tangibles, responsiveness, reliability, communication, security, competence, credibility, courtesy, understanding the customer, and access were reported (Parasuraman et al., 1985). To improve the reliability of the instrument, the ten dimensions were reduced to five. Following the Gap Model, SERVQUAL is developed (Parasuraman et al., 1988) and has then been used by various researchers to gauge the level of service quality in the service industry. Such examples can be seen from Dotchin and Oakland (1994), Frost and Kumar (2000), and Yang, Jun, and Peterson (2004).

2.3 The Evolution of Quality Management

As early as the 1800s, the word "Quality" existed. Following many reviews and discussions, TQM has been agreed to be the result of four main areas of development. Through the refinement stages of inspection, statistical quality control, quality assurance, and strategic quality management, the approaches to quality have slowly evolved.

2.3.1 Quality Inspection Stage

One of the first stages of management evolution is the quality inspection stage, where the origins of quality inspection dated back to the olden days. In the 1800s, mass production was widely applied in the manufacturing sector and this is the time when formal inspection procedures emerges (Bounds, Yorks, Adams, & Ranney, 1994) and were greatly required. With the rapid increase in labor productivity, quality was not up to speed and very often, customers had to settle with defective goods. Hence, to lessen customer aggravation, the problem was resolved by replacing the faulty product with a new one (Dale, 1994). However, conducting such a procedure required generating considerable cost. To reduce the extreme cost acceleration, the position of a controller is introduced, where he is assigned to carry out inspections, ensuring that the greatest possible number of good products leave the factory gate (Dale, 1994).

Quality inspection errors, according to Khan, Jaber, and Ahmad (2014), is an essential aspect that requires due attention in both inventory and supply chain management related research. Khan et al. (2014) went on to explain the impact of inspection errors on cost (Bennett, Case, & Schmidt, 1974), and on the decision-making in the production, quality and maintenance stages (Ben-Daya & Rahim, 2003). Additionally, Khan et al. (2014) also cited Raouf, Jain, and Sathe (1983)'s model, which was developed to ascertain the optimal number of repeat inspections during the quality inspection process, with Duffuaa and Khan (2002) further extending Raouf et al. (1983)'s model by including rework and scrap to represent imperfect items.

Since then, an entity's characteristics is assessed by checking, measuring, examining, testing the activities and comparing the results with a set of requirements to ascertain consistency is attained (Dale & Plunkett, 1999). Inspectors or specialized personnel who are responsible for one of the processes in the process function framework are in charge of the inspection process (Cheah, 2008). As and when the raw materials or components, unfinished or finished products do not conform to the specification set will be rejected, and the process of rework and modification would have to be done.

The most essential and toughest part of the inspection process would be the gauging process, hence inspectors who are in charge of the gauging process are greatly valued for their positions. In the 1920s, the description of quality has been further refined by G.S. Ranford from the conformation to established requirements, and given emphasis to inspection (Bounds et al., 1994). Furthermore, with the close coordination of different departments, costs can be successfully lowered and throughput be increased.

In Robotis, Boyaci, and Verter (2012)'s recent study of remanufacturing used products, the relative importance of inspection capabilities and technologies were strongly emphasized when comes to remanufacturing a product due to quality uncertainty. The inspection that is needed to reveal a used product's quality condition may vary depending on the product, and hence the cost that is required to remanufacture a product also differs.

It was further explained earlier by Dale and Bunney (1999) that the inspection program does not involve the participation of both suppliers and customers as it is an in-house system. In summary, the inspection system is a process that compares the company with a set of predetermined requirement where quality control is not taken into account.

2.3.2 Statistical Quality Control Stage

According to Shewhart (1980), a book entitled “Economic Control of Quality of Manufactured Product” was published by Walter A. Shewhart, where the emphasis was on examining the problems related to quality. This was when statistical quality control came into place. The control for quality incorporates operational activities and methods which are utilized to accomplish the quality requirements (Dale & Bunney, 1999). Proper paperwork and procedures control system, raw components and intermediate stage product testing, the logging of basic process performance data, and the feedback of process information to the right person in charge should be in place for a company that apply a proper quality control system (Slack, 1997). To ensure that quality is in control and the occurrence of non-conformance by entities being reduced to a bare minimum, a screening process coupled with a proper set of system tools and methods were utilized by employees.

Quality is difficult to be measured in numbers. As such, Shewhart (1980) recommended quality to be split into a few variables that can be numerically measured. As an example, a product’s ingredients can be used to measure quality of a food product, in terms of its healthiness. Nowadays, there are numerous quality control tools that companies can use to measure the degree of quality control to help them make the right quality decisions (Cheah, 2008). Coming from the area of statistics, these tools are helpful in assisting firms to identify problems relating to quality in both the production process and the product itself (Cheah, 2008). Two widely used statistical quality control techniques are the Pareto analysis and Statistical Process Control (Boudreau, Carmody, & Cheetham, 1999; Krumwiede & Sheu, 1996; Lim & Niew, 1995).

Introduced by Juran, a famous quality guru, Pareto analysis is a statistical method managers used in the course of their decision making process, as by using such analysis, employees are able to decipher the variables that can significantly influence the measurement of end results (Boudreau et al., 1999). At the same time, Statistical Process Control (SPC) incorporates the examination of a random sample of the output during the production process, in which a decision is made on whether the process produces products with characteristics that fall within a determined range (Lim & Niew, 1995). In other words, it provides answers to whether a process is functioning properly. Such statistical package was believed to have been created by statistical experts, in the likes of Shewhart, Dodge, and Roming in the 1930s (Krumwiede & Sheu, 1996), in which the main purpose is to allow both managers and staff to determine whether an operation is out of place or high variations are detected. If so, rehabilitation steps will be taken as the next measure.

Introduced in the 1920 by W. Shewart, made popular by W.E. Deming in the 1950 in the Japanese manufacturing industry, and widely adopted by the western manufacturing industry in the 1980 (Srikaeo, Furst, & Ashton, 2005), SPC is well known as one of the most powerful techniques. The employment of such statistical technique became significant in the manufacturing, and eventually in the food industry. The use of statistical quality control is mainly applied in the packaging process, where food producers consistently encounter problems to decrease the process variations and detailing accurate net weight (Lim, Antony, & Albliwi, 2014). In other words, the application of SPC in the production process will allow for reductions in variability, preventing product defects from occurring earlier in the process to achieve process stability. As such, SPC holds an important advantage over inspection mechanism when comes to quality control (Paiva, 2013).

In recent years, issues associated with the quality control in food supply chain management have drawn widespread attention. In the food industry, quality control is closely associated with safety (microbiological), technology, chemical make-up, sensory (colour, flavor, smell, taste, and texture), physical attributes, and nutritional value (Edith & Ochubiojo, 2012). The greatest concern for food producers, consumers and the government according to researchers such as Loader and Hobbs (1999), and Luning and Marcelis (2006), are issues relating to food poisoning or microbiological outbreaks, which somehow has shaped consumer behavior to being more concerned with the issues relating to the quality of their food. An exploratory case study was conducted by Chen, Zhang, and Delaurentis (2014) to assess issues pertaining to the 2008 adulterated milk incident that happened in China, which led to the conclusion that the main cause of the adulterated milk incident is due to Sanlu’s weak supply chain control.

Inexperienced milk farmers and milk collection agents were hired without a background check, basic quality control training was lacking, and the monitoring process of business partners was poor were some of the reasons that led to the failure in Sanlu's supply chain control, allowing the adulterated milk to go through the inspection points and quality control with ease and eventually reached its customers.

2.3.3 Quality Assurance Stage

The initial two stages of the quality management evolution are based on detecting the problem before it happened. Hence, the quality assurance stage emphasizes on prevention (Dale, 1994). It is indeed a common perception that prevention is better than cure. As of this stage, the emphasis should be on advanced quality planning, enhancement in design, processes and services, and the enhancement of process control (Dale & Bunney, 1999). It incorporates managing the quality of raw materials, assemblies, components and products, services that are connected to production, management, and production, as well as inspection processes (Lim & Niew, 1995). Hence, non-conforming products can be stopped before it reaches the customers provided if managers were to concentrate on the source activities, as stated by Dale and Plunkett (1999). In other words, it is a set of activities, planned and executed in the quality system to make certain that quality requirements of a product or service are met. Costs of quality, total quality control (TQC), reliability engineering, and an achievement of zero defects are the four main components that exist in this stage (Bounds et al., 1994).

2.3.3.1 Cost of Quality

To win sufficient orders and to gain the loyalty of customers in the modern complex business environment, quality has turned out to be one of the key strategies for all manufacturing and service firms. Past literatures have confirmed the rise in cost of product or service when quality improvement programs are adopted. Feigenbaum (1991) categorized costs into (1) costs of control/ conformance and (2) costs of failure of controls/ non-conformance, which is then adopted by researchers such as Burgess (1996) and Purgslove and Dale (1995). The failure of a product can bring a huge impact on a company as the firms have to bear the failure in both total cost and reproduction cost. In this instance, the costs of quality can be separated into two costs: costs of attaining good quality and the costs of poor quality (Russell & Taylor, 2006).

Introduced by Crosby (1979), cost of quality can be best understood as the total of costs of conformance and the costs of non-conformance. There are several costs that need to be reduced to the lowest amount. Firstly, the prevention cost, which is incurred to prevent defects from occurring in both products and services; secondly, the appraisal cost, consisting of measuring, testing, and assessing the products and services to ensure conformity to quality standards and performance requirements (Russell & Taylor, 2006). Besides that, the internal failure cost, which is also known as traditional costs by Goetsch and Davis (2013), is considered as an unfavorable cost that involves scrap, rework, and process failures, in which such failures occurred during a company's operation or prior to the delivery of the product or services. Additionally, the external failure cost, also known as hidden costs by Goetsch and Davis (2013), is a cost that happened after the delivery of the product or services. It incorporates customer returns, processing customers' complaints, product recalls and warranty claims. Hence, a proper quality cost planning should be in place.

To quantify the cost of quality, Omar and Murgan (2014) has recently developed an improved mathematical model through the use of real-life industrial data, in which such simulation model examines how cost of quality can be impacted by certain quality control level plans. Findings from this study show that when non-conformance expenditure is low, the reduction of failure costs can be achieved. In another related study, it was found that when the cost of poor quality is reduced, both labor productivity and profitability can be increased. The research was conducted from the perspective of construction projects (Mahmood, Ahmed, & Panthi, 2010).

2.3.3.2 Total Quality Control

Considered as the oldest system, TQC has its root planted into the earliest statistical research conducted by Shewart (1939). When the Second World War ended, the TQC principles were further developed in Japan. The purpose of TQC should not only be for detecting defects or problems, it should also be used at the beginning stage of production or service until the final stage where the customer interacts with the products or services. The following statement on total quality control was made by Armand Feigenbaum in 1956 (as cited in Bounds et al., 1994),

“ The underlying principle of this quality view…is that, to provide genuine effectiveness, control must start with the product design and end only when the product has been placed in the customer’s hands who remains satisfied”.

TQC was also again defined by Feigenbaum (1961, p.6) (as cited in Chiarini, 2011) as:

“ A network of the management/control and procedure that is required to produce and deliver a product with a specific quality standard”.

In other words, it demands a comprehensive control on production, cost, safety, delivery, environmental protection, and any other activities relating either indirectly or directly to performance quality, to ensure products and service quality is met. Every individual from every department (e.g. research and development, materials, production, engineering, and sales) is required to be quality minded and be in the know of the statistical approach that ensures TQC is exercised to its maximum efficiency. Hence, TQC is considered to be essential for any company continued survival (Dale, 1994).

Recently, Chiarini (2011) carried out a comparative study on six important management systems – (1) Japanese Total Quality Control, (2) Deming’s system of profound knowledge, (3) TQM, (4) Lean Thinking, (5) Business Process Reengineering, and (6) Six Sigma, which are all oriented to improving quality and operations. In Chiarini (2011)’s paper itself, the principle of TQC was illustrated in detail, where TQC was emphasized as one that ensures quality assurance, optimizing cost-effectiveness and usefulness, ensuring customers' requirements are satisfied at the same time (Ishikawa, 1985). Mainly due to Ishikawa (1985) influence, TQC in Japan developed into company-wide quality control, leading TQC to become the well-known Japanese TQC.

2.3.3.3 Reliability Engineering

A system utilized by a manager or staff to perform statistical or probability functions under a certain situation and for a specific time is termed as reliability engineering (Cheah, 2008). In other words, reliability engineering is also known as a unique discipline under systems engineering. Statistics, probability theory, and reliability theory are heavily relied upon by reliability engineers to set requirements, measure reliability and give advice on how to improve reliability performance (Dale, 1994). Failure Mode and Effect Analysis (FMEA) is one of the most famous methods that engineers use to perform reliability testing (Dale & Plunkett, 1999). It is a process that examines the possibility of failure within a system caused by system downtime, spares costs, the repairing of equipment, personnel and warranty claims, and from there determines the possibility of other alternative designs for engineers to implement (Bounds et al., 1994). FMEA is often used in the design of an automotive driver seat (Kolich, 2014), in the selection of new suppliers in the supply chain risk environment (Chen & Wu, 2013), on aircraft engine rotor blades (Su, Deng, Mahadevan, & Bao, 2012), and in the processing of edible bird nest (Jong, Tay, & Lim, 2013).

2.3.3.4 Zero Defects

As cited in Chiarini (2011) of Piercy and Morgan (1997), intense rivalry has been focused on factors such as zero defects, relevant customization, price, and on-time delivery. Zero defects is described as a performance standard that emphasizes on the prevention of defects sooner instead of just detecting and fixing it (Lim & Niew, 1995). Adopted primarily within industry supply chains, its application lies mainly where large volumes of components are purchased, items such as nuts and bolts. It was posited by Evans and Dean (2000) that zero defects is not just a mere motivational program as comprehended by many researchers. It is a standard set to be followed, beginning from the product designing stage to the final stage of the process. Hence, companies should not fail to deliver what was promised from time to time. A requirement is always attached to every product and service: a description of what the customer needs; and if the particular product or service meets the set of requirements, it is considered a quality product (Goetsch & Davis, 2013). Such a term also falls under "Phillip Crosby 14 steps of Quality Improvement Process" as the seventh step.

2.3.4 Strategic Quality Stage

As the final stage of the quality management evolution, the strategic quality stage was introduced in the 1980s, representing the quality era that incorporates all the essential components from the three stages mentioned above (Cheah, 2008). Top management began to take into consideration that the product or service quality can become a competitive advantage when comparing this era to the previous ones. Managers are financially rewarded when their firm performance improved. The use of financial incentives for improvement has been widely practiced in many production firms (Veldman & Gaalman, 2014). Today, competition is getting more intense with companies competing at local, regional, national, and international level. Organizations need to produce world-class quality only then can they contend globally. Practically, it is extremely essential for a country's businesses to have the ability to contend globally, as jobs will be lost and quality of life deteriorates correspondingly for that country if they could not (Goetsch & Davis, 2013). Hence, the strategic quality stage is added into the planning process that put into focus the customers' perspectives and supplier values (Dale & Bunney, 1999). Furthermore, a new paradigm shift has emerged within firms. It was illustrated by Dale and Bunney (1999) that the total quality management should be practiced in each branch and department of a firm.

2.4 Review of Quality Gurus

The fundamental concepts and ideas developed by leading quality management experts with regard to quality are discussed in this section. It is essential for both practitioners and readers in general to understand their thoughts to better comprehend the current quality management. Deming, Juran, Crosby, Ishikawa, Feigenbaum, and Groocock are examples of some of these scholars, in which each of them has contributed in a significant manner the knowledge and TQM development as an academic discipline. Nevertheless, it is important to note that many of the modern organizations tend to adopt the mix-and-match or customized approach to quality management instead of depending on one specific quality scholar (Hunt, 1995).

2.4.1 Deming's Approach to TQM

The focal point of Deming's approach to TQM is to craft out an organizational system that encourages cooperation and learning, in which it can assist the discharge of management practices that will lead to the enhancement of company processes, products, and employee fulfillment, all of which are vital to the satisfaction of the customers and eventually, survival of the firm (Anderson, Rungtusanatham, & Schroeder, 1994; Zhang, 2000b). Alternatively, Evans and Dean (2000), as well as Motwani (2001), posited that Deming's philosophy is targeted at improving both products and services with the reduction in variation and uncertainty in the design and manufacturing stages. High disparity can result in inconsistencies in performance, which will eventually lead to poor quality. Hence, a reduction in variation is critical in TQM and it is believed to be a major building block of the concept (Sit, 2008).

Deming was one of the main proponents of quality management and has been well-known as the "Prophet of Quality" or the father of the TQM movement (Kelada, 1996). He is famous for his Plan-Do-Study-Act (PDSA) Cycle, 14 points and the 7 Deadly Diseases. Deming's PDSA Cycle was created to align the production of a product with the needs of the consumers; and to align the resources from various departments (i.e. research, design, production, and marketing) in a joint effort to attain those needs. Deming's PDSA Cycle flows are as such (Chiarini, 2011; Goetsch & Davis, 1997, p.20):

1. Plan: To conduct a research on consumer and use it for the planning of a product.
2. Do: To produce the product.
3. Check: To do a thorough check on the product to ensure that it is produced according to plan.
4. Act: To market the product.
5. Analyze: To analyze whether the product is well received in the marketplace in terms of its cost, quality, and other criteria.

Furthermore, Deming's philosophy was organized into fourteen points that are widely utilized, where businesses are transformed and revitalized into a new perspective with regards to management perspective (Deming, 1986, p.23; Fisher, Elrod, & Mehta, 2011; Rampersad, 2005; Rungtusanatham, Ogden, & Wu, 2003). The fourteen points were:

1. "Create constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs" (p.23).
2. "Adopt the new philosophy" (p.23).
3. "Cease dependence on mass inspection to achieve quality" (p.23).
4. "End the practice of awarding business on the basis of price tag" (p.23).
5. "Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs" (p.23).
6. "Institute training on the job" (p.23).
7. "Institute leadership" (p.23).

8. “Drive out fear, so that people may work effectively for the company” (p.23).
9. “Break down barriers between departments” (p.24).
10. “Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity” (p.24).

11a. “Eliminate work standards (quotas) on the factory floor” (p.24).

11b. “Eliminate management by objective” (p.24).

12a. “Remove barriers that rob the hourly worker of his right to pride of workmanship” (p.24).

13. “Institute a vigorous program of education and self-improvement” (p.24).
14. “Put everybody in the company to work to accomplish the transformation” (p.24).

While the 14 points generalizes what a company should do in order to nurture a healthy transition from a normal business to a world-class-quality, Deming’s seven Deadly Diseases summarizes his views on factors that could hamper such transition. The seven Deadly Diseases are as such (Goetsch & Davis. 1997; Rungtusanatham et al., 2003):

1. Lacking in the consistency of purpose to plan for products and services that have a market adequate enough to sustain the company in business and to supply jobs.
2. Focusing on profits in the short run; having short-term thinking that is mainly caused by fear of takeover and pressure asserted by stakeholders to produce dividends.

3. Performance evaluations, ratings based on merit, and annual review of performances.
4. The mobility of managers.
5. Running a company mainly based on visible data and information alone.
6. Unwarranted medical expenses.
7. Unnecessary liability and warranty costs, fueled by lawyers that work on contingency fees.

2.4.2 Juran's Approach to TQM

The theoretical essence of Dr Joseph Moses Juran's approach to TQM is his emphasis on top management commitment, empowerment, and employees' participation; in that he strongly believes that the main problem to attain quality is caused by management (Juran, 1988). The significant contributions devoted by Juran towards TQM were his focus on the definitions of quality, quality costs, and the originating idea of the quality trilogy (Sit, 2008). Quality, for Juran, is identical with "fitness for use", rather than complying to specifications (Kelada, 1996). His definition of quality incorporates the features that will result in the nonexistence of defects, and product satisfaction. Rather than emphasizing on the technical aspects, it takes into consideration customer intentions for use of the product (Sit, 2008).

To implement quality management, Juran introduced the Quality Trilogy (a registered trademark under Juran Institute), in which quality can be managed via quality planning, control, and improvement (Dean & Bowen, 2011). Quality planning was defined as "the activity of establishing quality goals and developing processes and products needed to meet those goals" (Juran, 1995, p.402). Quality control was described as "the development and the maintenance of operational methods that assures processes work according to how they are designed to work and that target levels of performance are met" (Juran, 1995, p.401). He was the first to widen the knowledge of quality control and got his first edition of Quality Control Handbook published in 1951, which highlights the importance of the managerial aspect (Mahmood et al., 2010). The control of quality became so pertinent till present day, where quality control is applied in food supply chain management (Chen et al., 2014) and in the planning of scrap prevention. (Bettayeb, Bassetto, & Sahnoun, 2014). Quality improvement was "the discipline that concerns itself with the improvement in the level of process performance" (Juran, 1995, p.402). He articulated that in a proper planning process, problems are traceable and will be delivered through a quality control process where a specific issue will be executed, leading to quality improvement process (Zhang, 2000a). A summary of the three managerial processes are summarized in the Table 2.2 (below):

Table 2.2 Universal Processes for Managing Quality

Quality Planning
1. "Establish quality goals". 2. "Identify and discover customers' needs". 3. "Develop product and process features that respond to the quality needs". 4. "Develop systems and process control that allow organization to produce these features". 5. "Deploy the plans to operational levels".

Quality Control
1. "Choose control subjects and the units of measurement". 2. "Establish goals". 3. "Create a sensor". 4. "Measure quality performance". 5. "Compare performance with goals and interpret the difference". 6. "Take action on the difference between performance and goals".
Quality Improvement
1. "Develop the infrastructure necessary to make annual quality improvements". 2. "Identify specific areas in need of improvement and implement it". 3. "Establish a project team with responsibility for completing each improvement project". 4. "Provide the resources, motivation, and training needed by the teams to diagnose the causes, stimulate establishment of remedies, and establish controls to hold the gains".

Source: Zhang, 2000b, p.12

Juran also takes credit in developing the concept of the cost of quality. Rather than assessing quality on the basis of subjective evaluations, such a concept allows firms to assess their quality based on monetary terms (Sit, 2008). Such a concept is especially essential and valuable to the improvement of quality. As proposed by Juran, the four quality costs are summarized in Table 2.3 as follows (Zhang, 2000b):

Table 2.3 Four categories of Quality Costs

Internal failure costs	**External failure costs**	**Appraisal costs**	**Prevention costs**
Costs that are related with defects detected before the transferring of product to the customer. For example, rework, scrap, failure analysis, etc.	Costs that are related with the defects found after the product is sent to the customer. For example, warranty charges, returned material, allowances, complaint adjustment, etc.	Costs that are incurred to determine the percentage of conformance to quality requirements. For example, incoming, product quality audits, in-process, maintaining accuracy of testing equipment, and final inspection and testing, etc.	Costs that are incurred to keep failure and appraisal costs to a minimum. For example, quality planning, quality audits, training, supplier quality evaluation, new product review etc.

Source: Zhang (2000b, p.11)

2.4.3 Crosby's Approach to TQM

Best known for the concepts of "Do it right first time" and "Zero defects" (Pun, 2001), Crosby claims that mistakes are normally due to (1) the lack of knowledge, and (2) the lack of attention (Rampersad, 2005). As cited in Zhang (2000b), training and education play an essential role to eradicate the first mistake; whereas to personally commit to zero defects and attention to detail are vital to eliminate the second mistake.

Crosby (1979) also emphasized the significance of management role in achieving successful quality improvement (Benson, Saraph, & Schroeder, 2008). The essential key item to quality improvement is to transform the mindset of top management so that they do not tolerate with defects and mistakes, as this could jeopardize work expectations and standards. It is essential that they take leadership in the process, be involved in quality improvement teams and actively participate in quality councils. Tari (2005) further pointed out that top commitment from the top management, quality measurement and corrective action, assessment of quality costs, training, a zero-defect philosophy, objective setting, and acknowledging employees' efforts are essential practices in Crosby's TQM approach.

To achieve quality, four fundamental quality management principles are required (Rampersad, 2005):

1. Quality is described as conforming to requirements, rather than "goodness" or "elegance".
2. Quality system is about prevention, not appraisal.
3. The performance standard is to achieve zero defects instead of 'that's close enough'.
4. Quality measurement is measured by the price of nonconformance rather than indices.

Besides that, a 14-step program (Badri, Davis, & Davis, 1995) was offered by Crosby as a guide for firms to pursue quality improvement. This is illustrated in Table 2.4 below:

Table 2.4 Crosby's 14-Step to Quality Improvement

No.	**Practices**	**Explanations**
1	Management commitment	"To make it clear that management is committed to quality in the long run".
2	Quality improvement	"Form quality improvement teams with senior representatives from every department to run the quality improvement program".
3	Quality assessment	"To identify where the current and potential quality problems exist in a way that allows objective evaluation and corrective action".
4	Cost of quality	"To define and evaluate the cost of quality and explain its use as a management tool".
5	Quality awareness	"To provide a way to raise the quality awareness and personal commitment of all employees in the company towards the product and service conformance and the quality reputation of the company".
6	Corrective action	"To provide a systematic method of rectifying problems identified through previous action steps".
7	Zero defects day	"To establish a zero defects program that will make all employees realize that there has been a change, to monitor and enhance the quality improvement process".
8	Supervisor training	"To train supervisors to actively carry out their responsibilities in the quality program".
9	Zero defects day	"Hold a quality event day by which all employees are aware that there is a new direction and a change has taken place".

No.	Practices	Explanations
10	Goal setting	"Encourage employees and supervisors to establish improvement goals to bring about continuous improvement".
11	Error causal removal	"A communication process by which the employees are encouraged to communicate to the management the difficulties they faced in achieving the improvement goals".
12	Recognition	"Recognize and appreciate the employees who participated in the quality schemes".
13	Quality Councils	"Implement quality councils to bring about a focused approach to business quality regime".
14	Do it over again	"Quality improvement is a never ending process that requires doing it all over again".

Source: Zhang (2000b, p.12-13); Rampersad (2005, p.9-10)

2.4.4 Ishikawa's Approach to TQM

An expert in quality, Ishikawa addressed TQM as Total Quality Control (Mahmoud & Rice, 1992). As Kanri (in Japanese) is used to describe both "management" and "control", this implies the linguistic uncertainty between "quality management" and "quality control" (Boaden, 1997). A quality tool expert, Ishikawa participated and developed the seven basic tools of quality as listed below (Ishikawa, 1985). Such tools are useful especially in solving problems related to quality (Lagrosen & Lagrosen, 2005):

1. Pareto chart
2. Cause and effect diagram (Ishikawa diagram);
3. Stratification chart;

4. Scatter diagram;
5. Check sheet;
6. Histogram;
7. Control chart

Quality, to Ishikawa, does not only include the quality of a product. It goes beyond that of the after sales service, the quality of the management, the quality of each individual, and the company itself (Rampersad, 2005). Ishikawa (1985) emphasized that every individual in the company should be involved in promoting quality control, which includes top executives, the various divisions in the company, and every employee (Ishikawa, 1985). Kruger (2001) further emphasized the statement made by Ishikawa, in that to achieve TQM, it is not confined to the quality department alone, it requires the participation of all departments (Gupta, McDaniel, & Herath, 2005). Ishikawa's TQM concept comprises of six fundamental principles. They are:

1. Quality and not short-term profits should be emphasized first by firms.
2. Customer-oriented and not producer-oriented should remain as the main focus for firms.
3. The barrier of customers' selectionalism should be broken by firms.
4. Facts and data, such as the utilization of statistical techniques should be used by firms to make presentation.
5. Humanity should be respected as a management philosophy, and management participation should be promoted in firms.
6. Cross-functional management should be cultivated in firms.

With the proper implementation of Ishikawa's six fundamental principles, the following outcomes are believed to occur (Rampersad, 2005):

1. Attaining improvements in product quality and achieving uniformity; reducing defects.
2. Enhancing the reliability of products.
3. Reducing costs.
4. Enhanced in production efficiency (i.e the increase of outputs), making it possible to make rational production schedules.
5. Reducing rework and wasteful work.
6. Improvement in the establishment of techniques.
7. Reduction in expenditure with regards to inspection and testing.
8. Rationalizing contracts between vendor and vendee.
9. Expanding the sales market.
10. Cultivating an improved relationship and coordination between departments.
11. Reducing mistakes and errors in data reporting.
12. Conducting discussions in a more democratic and open manner.
13. Meetings are conducted in a more efficient manner.
14. Repairing and installing of equipment and facilities are carried out in a more rational manner.
15. Improving the relations between humans.

2.4.5 Feigeinbaum's Approach to TQM

As cited in Feigenbaum (1986) and Feigenbaum (1991), TQM is defined as an effective system that integrates the efforts of quality-development, quality-maintenance, and quality-improvement from different groups in a firm, to facilitate design, engineering, production, inspection, marketing, shipping, accounting, and service to be functioning at the most economical manner, allowing for customer satisfaction to be fully achieved, also known organization-wide total quality control (Badri et al., 1995). An effective quality management, as acclaimed by Feigenbaum (1991) comprises of four main stages. They are:

1. To determine quality standards.
2. To assess conformance to these standards.
3. To take action when standards are not achieved.
4. To plan to make improvement in these standards.

Feigenbaum (1998) also proposes the idea of a quality-value chain, which begins with recognizing customers' requirements and finishes as and when the product or service is transferred to the customers, by which the customer still remained satisfied (Ya'acob, 2008). Hence, all functional activities in the likes of designing, manufacturing, installing, inspecting, purchasing, shipping, and servicing etc, are involved in influencing the achievement of quality (Ya'acob, 2008). The ability to identify customers' requirements is an essential starting point for quality attainment. In accordance to his approach, an effectual TQM entails a high level of inter-functional integration of information, people and machines, for total quality control to work effectively (Zhang, 2000b).

As emphasized by Feigenbaum (1991), efforts towards prevention of poor quality should be made instead of detecting such problems after the occurrence of event. As claimed by him, quality is a vital element in the daily work of the line staff, and the operatives of a firm. Two determinants – technological factor (i.e. materials, machines, and processes) and human factor (i.e. operators, foremen, and other firm personnel), can indeed affect the quality of a product. With the comparison of both these factors, the human factor outweighs the technological factor. The commitment of top management, participation of employees, supplier quality management, information technology, assessment, communication, the usage of quality costs, and statistical technology are vital components of TQM (Zhang, 2000b). Employees should be awarded for any recommendations pertaining to quality improvement as quality is everyone's responsibility. Furthermore, he also emphasized that three main concepts, namely quality attitudes, quality knowledge, and quality skills need to be in place for employee training and education to be effective (Feigenbaum, 1986).

2.4.6 Groocock's Approach to TQM

Given his industrial experience, Groocock (1986) argued that quality is vital in any organization since the superiority of product quality can help a firm improves its competitive advantage. In line with Deming (1986) and Feigenbaum (1986), it has also been acknowledged by Groocock (1986) that quality needs to be improved continuously to effectively meet the expectations of customers that often changes (Groocock 1986; Porter & Rayner, 1992). According to Groocock (1986), "quality to the customer" remains the first measure of quality (Silvestro, 1998).

To satisfy and fulfill customers' expectations, the concept of 'chain of conformance' need to be practiced throughout the life of the product, from the designing stages of the product, to its purchase of raw materials, manufacturing process, and lastly the marketing of the end product (Ya'acob, 2008). The ideal 'chain of conformance' is in line with that of the ideal interdepartmental integration as proposed by Feigenbaum (1986). However, to implement a comprehensive quality costing system, according to Groocock (1986), is "a task of daunting difficulty". Top management commitment, involvement of employees and training activities that support the quality activities remain the main emphasis of Groocock (1986).

2.4.7 Reviews on TQM Concepts by Quality Gurus

A brief comparison between each quality guru's prescriptions is discussed in this section. This subsection highlights the similarities and the differences between them. Despite the different views each guru has on the TQM concept, there remains a similar and a common idea, which is quality improvement. For a company to be successful, continuous improvement in quality is a necessity. To date, the theories developed by the quality gurus are well received by many organizations worldwide. Deming's PDSA cycle and his "14-point" quality management approach, Crosby's 14 steps to quality improvement, Juran's Trilogy, Ishikawa's cause-and-effect diagrams, Feigenbaum's four stages of quality management, and Groocock's concept of "chain-of-conformance" are extensively used to explicate the foundation of TQM.

Deming (1986)'s philosophy on quality is offered in his famous "14 Points", where these 14 points served as a guide to facilitate companies to achieve quality improvement. It is emphasized in his philosophy that quality improvement can be accomplished starting with the top management being committed to quality, and at the same time involving all employees and suppliers in an effort to support a dramatic organizational change. In other words, top management holds great responsibility for most of the quality issues that arises in the company.

Juran (1995, 1999), on the other hand, emphasized on the significance of both technical and managerial aspects, and later identified the three-step approach to implement quality management. Also known as the Quality Trilogy, it incorporates three processes, which are quality planning, quality control, and quality improvement. In line with Deming's idea, Juran believes that management are the main cause of quality issues, not the workers. Like Deming, Juran also shares a dislike towards 'campaigns' of motivation to do 'perfect work' or attain 'zero defects', as such approach is unreasonable to achieve and fails to help company set specific goals.

Fourteen steps for quality improvement was introduced by Crosby (1979), which incorporates the zero defects philosophy, management commitment and participation, quality costs' assessment, quality measurement, setting objective, implementing corrective action, providing employee training, and giving employee due recognition and etc. Given that Deming's approach is somewhat academic and theoretical for his intended audience, while Juran' focuses on shopfloor in terms of 'defect rates', Crosby's way of approaching TQM directly addresses the top executives of a company.

As for Ishikawa (1985)'s philosophy towards TQM, his theoretical essence stressed that the use of quality tools (i.e. histogram, cause-effect diagrams, control charts, etc) for problem solving, training, and quality circles are vital to accomplish continuous improvement (Tari, 2005) with the focus on implementing a company-wide quality control. Sharing a similar view with Feigenbaum and Groocock, he strongly supports the deployment of 'quality circles'. Like other gurus, the importance of education is emphasized by Ishikawa. Quality, according to him, starts and ends with education.

Feigenbaum (1986; 1991)'s approach to an effective quality management comprised of four main stages, which are to set quality standards, to evaluate compliance to the standards, to take actions when standards are not achieved and to plan for future improvements in these standards. Prevention rather than detection of poor quality was emphasized in his philosophy, and he believed that two factors, which are the technological factor and more importantly the human factor, can affect a product's quality. In line with other scholars, top management commitment and participation of employees are vital attributes that can drive TQM to a higher level. Like most other gurus, he considers education and effective staff training should be provided continuously as it is an essential element in subject of TQM.

Groocock (1986) emphasizes on the importance of satisfying customers' expectations. He recognizes that continuous improvement in quality is essential to meet the changing needs of customers. In order to do so, he argued that the concept of 'chain of conformance' needs to be practiced throughout the product life-cycle, from the initial stage of designing to the final stage of delivery. Similarly, top management support and employee participation remains vital in support of the qualities activities being implemented. In accordance to Groocock's experience in the industry, he argues that quality is required to be made a firm's priority as the superiority of a product quality improves competitiveness.

After reviewing the TQM approaches of the six quality gurus, it is clearly understood that each guru has their own distinguishing approach. Nonetheless, the TQM principles and practices suggested by the said quality gurus gave readers an improved understanding of the TQM concept. In other words, their thoughts and insights on TQM provide a firm foundation when carrying out this study. Although their TQM approaches are not entirely similar, they share some common grounds such as:

- The responsibility lies in the management to provide leadership, dedication, authority, encouragement, and adequate support to both human and technical processes. At the same time, it is the responsibility of the management to ascertain the environment and framework in which a firm operates. It is of vital importance for management to encourage the participation of employees in quality improvement as well as culture for quality by altering their perception and attitudes towards quality.

- The stress on the importance of the policy, strategy as well as organization-wide evaluation activities.
- Education and training to change an employee’s beliefs, behavior, and attitudes as well as improving an employee’s capacity to carry out his/her duties are emphasized.
- Rewards and recognitions should be awarded to employees for their quality improvement efforts.
- It is of vital importance that processes be controlled; and that both product design and quality system be improved. In other words, prevention instead of inspection of product defects is emphasized.
- Quality improvement efforts involved all functional activities (e.g. design, purchasing, engineering, manufacturing, inspection, shipping, marketing, installation, service, and accounting). In short, quality involves everyone, from suppliers to customers, a systematic company-wide activity.

With the comparison of every quality prescription by the different quality scholars, it can be generalized that the different methods to quality are by nature, situational and contingent, and hence the theories proposed by the gurus should not be applied in a rigid and inflexible manner (Ghobadian & Speller, 1994). It has been proven from previous empirical findings that for TQM to be a success, it needs to be implemented according to an organization’s characteristics, structure, and environment (Llorens Montes & Verdu Jover, 2004; Yasin, Alavi, Kunt, & Zimmerer, 2004).

Nevertheless, the approaches instigated by these gurus have its limitations. Various gaps have been commented by Garvin (1987), Chase and Aquilano (1989) in these approaches to quality. Such limitations comprise the lack of a theoretical model and of a ‘sound instructional methodology’ to assist firms of various types and sizes to assess quality, especially to recognize which facets of quality matter, how much is required, and how to fulfill customers’ demands satisfactorily. Even though gurus such as Deming, Crosby, Juran and others have been strong on what is generally required, which includes the detailed techniques, they did not offer much guidance of instant and direct value or relevance to the present firms. In other words, it remains a challenge to link the general quality ideas and concepts to the unique situations of an organization, such as to its management practices, its workforce, and its markets. Every approach to quality proposed by the gurus or others are appropriate, depending on the situation. It is essential that the firms do not apply the quality approaches suggested by the gurus in a rigid and formulaic way. In other words, these quality approaches cannot be taken simply at face value, and implemented solely as an ‘off the shelf’ quick fix solution to solve the firm’s problems. It is vital they assess the methods and match them accordingly to the specific requirements of their firms.

2.5 Review of Quality Award Models

Companies throughout the globe are striving to attain TQM, which is considered to be a dynamic target; and they are using Business Excellence Models (BEMs) as frameworks to attain this almost impossible target

(Rampersad, 2005). The receipt of such quality awards, in which some are on these BEMs, is often used as a standard to examine the successful implementation of TQM. Many firms have started adopting these BEMs as they recognize that such award models encourage the adoption of the best practices that facilitate in the attainment of quality strategy, benchmarking against best practices, continuous improvement, and self-assessment (Sampaio, Saraiva, & Monteiro, 2012). Researchers in the likes of Hendricks and Singhal (1997; 2001a) have researched on the possibility that the implementation of an effective quality management programs enhances a firm's operation performance. Their empirical research has provided strong evidence that firms winning these quality awards surpass those that did not in terms of operating income-based measures. Furthermore, Hendricks and Singhal (1996; 2001b) provided strong empirical evidence that winning the quality award also improves the stock market value of firms. In the world today, there exist several Quality Awards that are well known and commonly used around the world. For example in Japan, there is the Deming Prize; in Europe, the European Quality Award; and in United States of America, the Malcolm Baldrige National Quality Award. The main purpose of such awards is to (Ghobadian & Woo, 1996):

- Increase TQM's awareness due to its significant contribution to attain superior competitive advantage;
- Promote an organized self-assessment system, comparing against established criteria and market awareness concurrently;
- Encourage organizations to collaborate on an extensive range of non-business sensitive topics;

- Encourage knowledge sharing and transfer with regards to successfully deploying quality practices and on the advantages derived from adopting such practices;
- Enhance the understanding of the requirements to attain quality excellence and the successful adoption of “quality management”; and
- Motivate firms to initiate a continuous “quality management” improvement move.

Every quality award model is based upon a perceived TQM model. They do not mainly emphasize on the perfection of product or service or the traditional quality management techniques. It takes into consideration a huge array of management activities, behavior, attitude, and processes that can affect the quality of the final results (Zhang, 2000a). Such award models provide useful audit framework, where firms can assess their TQM practices, seek for better opportunities and end results. As famously reported in the literature, many organizations have been found to construct their own TQM systems based on the assessment criteria from the key national quality awards (Tari, 2005; Black & Porter, 1996). It is also believed to be the best way to assess organizational capability and competence. In addition, many TQM researchers such as Samson and Terziovski (1999) and Ooi, Lin, Tan, and Chong (2011) are using the national quality award models as a basic model for their studies. Hence, it is essential to briefly describe the related national quality awards and their criteria in this section.

2.5.1 Malcolm Baldrige National Quality Award

In 1987, the Malcolm Baldrige National Quality Improvement Act was approved by the US Congress and hence created a yearly quality award in the US. Their main goal of is to promote TQM among firms in America to improve on their quality of products and services, satisfying customers, and thus enhancing the firm's overall performance and capabilities (Rampersad, 2005). Firms can use the MBNQA model framework to evaluate and assess their recent quality management practices and compare against major competitors and world class standards on their performance, improving their relationship with both customers and suppliers (Zhang, 2000b).

Most of the frameworks from other nations, such as Singapore Quality Award, Sri Lanka Quality Award, New Zealand Quality Award, and Hong Kong Management Association's quality award are modeled after MBNQA (Lai, Weerakon, & Cheng, 2002). Furthermore, the MBNQA model has also been adopted and used by several researchers as an operational model in their research work. Researchers in the likes of Dean and Bowen (1994) adopted the model to assess the linkage between the TQM principles and management theories, and Black and Porter (1996) have used it to construct their survey questions pertaining to TQM.

In summary, seven key categories namely leadership, strategic planning, customer focus, information and analysis, human resource focus, process management, and business results (See Table 2.5) were covered under the

Malcolm Baldrige National Quality Award (1999) and each category comprises of their own evaluation criteria.

Table 2.5 Evaluation criteria of MBNQA

No.	Elements	Sub-elements
1	Leadership	a) "Organizational leadership" b) "Public responsibility and citizenship"
2	Strategic planning	a) "Strategy development" b) "Strategy deployment"
3	Customer focus	a) "Customer and market knowledge" b) "Customer satisfaction and relationships"
4	Information and analysis	a) "Measurement of organizational performance" b) "Analysis of organizational performance"
5	Human resource focus	a) "Work systems" b) "Employee education, training and development" c) "Employee well-being and satisfaction"
6	Process management	a) "Product and service processes" b) "Support processes" c) "Supplier and partnering processes"
7	Business results	a) "Customer-focused outcomes" b) "Financial and market outcomes" c) "Human resource outcomes" d) "Supplier and partner outcomes" e) "Organizational effectiveness outcomes"

Source: Zhang (2000b, p.22)

The MBNQA (1999) framework has been extensively used by famous researchers, from past to present, to signify their TQM practices. Samson and Terziovski (1999) have chosen these six TQM practices to test its effectiveness on firm's operational performance. Gathering data from 1200 manufacturing from across Australia and New Zealand using a cross-sectional approach, the linkage between TQM and organizational performance was found to be significant, with leadership, customer focus, and people management being the strongest predictors. Similarly, Prajogo and Sohal (2003b) used the six TQM practices to examine its relationship with innovation performance among 194 Australian firms. Using structural equation modeling (SEM) analysis, the relation between TQM and innovation performance was found to be positive and significant. Prajogo and Hong (2008) later on carried out an empirical study on 130 Korean manufacturing firms to investigate the effectiveness of these six TQM practices on R&D performance which is signified by product quality and product innovation. Also by using SEM analysis, TQM was proven to be significantly related to R&D performance.

In the local context, the six TQM practices based on the MBNQA (1999) model were extensively used to measure its effectiveness on role conflict and role ambiguity (Teh, Ooi, & Yong, 2008; Teh, Yong, Arumugam, & Ooi, 2009), knowledge management (Ooi, 2009), business performance (Arumugam, Chang, Ooi, & Teh, 2009), customer satisfaction in the service industry (Sit, Ooi, Lin, & Chong, 2009), customer satisfaction and service quality (Ooi et al., 2011), learning organization and customer orientation (Ang, Lee, Tan, & Chong, 2011), learning orientation and market performance (Lam, Lee, Ooi, & Lin, 2011), innovation performance (Lee et al., 2010b; Ooi, Lin, Teh, & Chong, 2012) market orientation and service quality (Lam, Lee, Ooi, & Phusavat, 2012), and organizational learning and technological innovation (Lee et al., 2013a; Lee, Ooi, & Choong, 2013b). As the six MBNQA-TQM practices have proven itself to be popular and significant, both local and internationally, past and present, this study decides to adopt the MBNQA framework of 1999, which comprised of leadership, strategic planning, customer focus, information and analysis, human resource focus, and process management.

2.5.2 European Quality Award

In 1991, the European Quality Award was officially launched. In 1992, Europe's most prominent award for organizational excellence - the EQA award, which is now known as the European Foundation for Quality Management (EFQM) Excellence Model, was established (Rampersad, 2005). The main purpose of this award is to systematically enhance the competitiveness of the European firms by continuously supporting, encouraging, and recognizing the development of effective TQM practices (Zink, 1997). Generally, it is to honor exceptional European businesses. There are two parts to this model, namely the enablers (i.e. what the organization does) and results (i.e. what the organization attains). Referring to Figure 2.1, leadership, people management, policy and strategy, resources, and processes are the five enablers that drives the business and assists in transforming inputs into outputs. People and customer satisfaction, impact to the society, and business results (the measure of output level achieved by firms) are the results (Sampaio et al., 2012). The EFQM 2010 model comprised of nine main elements, is broken-down into several secondary elements. Listed in Table 2.6 below are the primary and secondary elements:

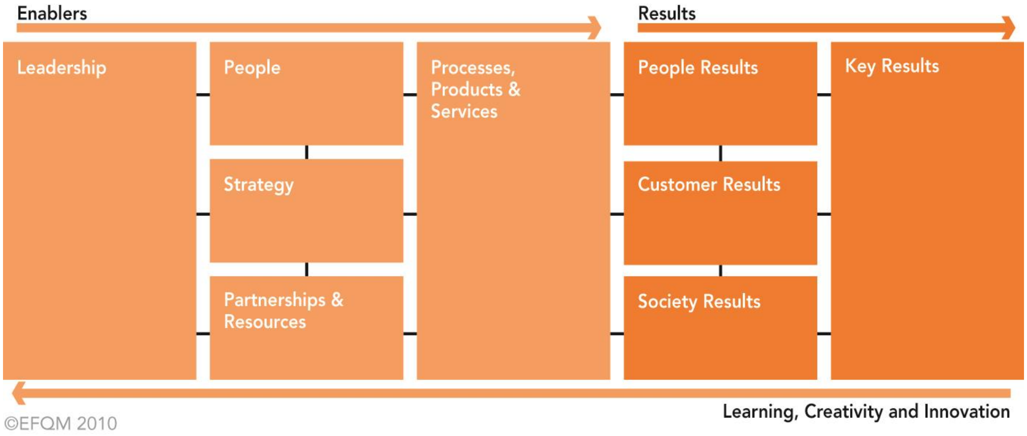
Table 2.6 Evaluation Criteria of EFQM Model

No.	**Primary elements**	**Secondary elements**
1	Leadership	a) "Visible involvement in leading total quality" b) "A consistent total quality culture" c) "Timely recognition and appreciation of the effects and successes of individuals and teams" d) "Support of total quality by provision of appropriate resources and assistance" e) "Involvement with customers and suppliers" f) "Active promotion of total quality outside the organization"
2	Strategy	a) "How policy and strategy are based on the total quality concept" b) "How policy and strategy are formed on the basis of information that is relevant to total quality" c) "How policy and strategy are the basis of business plans" d) "How policy and strategy are communicated" e) "How policy and strategy are regularly reviewed and improved"
3	People	"How continuous improvement in people management is accomplished" "How the skills and capabilities of the people are preserved and developed through recruitment, training and career progression" "How people and teams agree on targets and continuously review performance"

No.	Primary elements	Secondary elements
		"How the involvement of everyone in continuous improvement is promoted and people are empowered to take appropriate action" "How effective top-down and bottom-up communication is achieved"
4	Partnership and resources	a) "Financial resources" b) "Information resources" c) "Material resources and fixed assets" d) "The application of technology"
5	Processes, products and services	a) "How processes critical to the success of the business are identified" b) "How the organization systematically manages its processes" c) "How process performance measurements, along with all relevant feedback, are used to review processes and to set targets for improvement" d) "How the organization stimulates innovation and creativity in process improvement" e) "How the organization implements process changes and evaluates the benefits"
6	Customer results	a) "Results of customers' perception, measures of products, service and customer relationships" b) "Internal performance indicators"
7	People results	a) "Results of people's perception of the company" b) "Internal performance indicators"
8	Society results	a) "Results of society's perception of the organization" b) "Internal performance indicators"
9	Key results	a) "Key performance outcomes (both financial and non-financial)"

No.	Primary elements	Secondary elements
		b) "Key performance indicators of likely future outcomes"

Source: Rampersad (2005, pp.39-42); Zhang (2000b, p.21)



Source: European Foundation for Quality Management (2010), available at http://www.efqm.org/en/tabid/392/default.aspx

Figure 2.1 The 9 criteria of EFQM Excellence Model

2.5.3 Deming Prize

Established by the Board of Directors of the Japanese Union of Scientists and Engineers (JUSE) in the year 1951, in honour of the late Dr. William Edwards Deming, the Deming Prize is recognized as one of the most prestigious awards for quality improvement in the world (Rampersad, 2005). Its primary aim is to preach the quality gospel by acknowledging that company performance can be improved following the successful implementation of statistical based quality control techniques on company-wide approach (CWQC or TQC), according to Ghobadian and Woo (1996). It has been proven to be an effective tool to increase the awareness of TQM philosophy among the Japanese firms. In Deming Prize itself, it comprises of mainly four award categories, which are (Rampersad, 2005):

1. Deming Prize for Individuals:

   Awarded to individuals who have contributed to (a) the TQM study; (2) the use of statistical methods; (3) in the distribution of TQM.

2. Deming Application Prize:

   Awarded to any company and/or autonomous division that have attained outstanding improvements in performance through TQM implementation.

3. Quality Control Award for Operations Business Units:

   Awarded to individual business units instead of the whole organization or division.

4. The Nikkei Quality Control Literature Prize:

   Awarded to Japanese authors who have written and published articles on the development and progress of quality control and quality management.

As shown in Table 2.7, ten primary components are found in the Deming Prize Award, which is further divided into various secondary factors. The emphasis of this checklist is primarily on establishing good leadership among top management; implementing TQM to accomplish the set objectives and goals; and to measure the effectiveness of the TQM practices' (Rampersad, 2005). Besides that, Table 2.8 also shows a checklist for assessing the performance of senior managers. This checklist encompasses two essential functions. One, is the emphasis of top management's active commitment towards quality improvement programs; secondly is to supply top executives with a checklist that they are required to fulfill (Ghobadian & Woo, 1996).

Table 2.7 Deming Application Prize: Evaluation Items and Checklists

No.	Elements	Checklists
1	Policies (Hoshin)	a) "Quality and quality control policies and their place in overall business management" b) "Clarity of policies (targets and priority measures)" c) "Methods and processes for establishing policies" d) "Relationship of policies to long-and short-term plans" e) "Communication (deployment) of policies, and grasp and management of achieving policies" f) "Executives and managers leadership"
2	Organization	a) "Appropriateness of the organizational structure for quality control and status of employee involvement" b) "Clarity of authority and responsibility" c) "Status of interdepartmental coordination" d) "Status of committee and project team activities" e) "Status of staff activities" f) "Relationships with associated companies (group companies, vendors, contractors, sales companies, etc.)"
3	Information	a) "Appropriateness of collecting and communicating external information" b) "Appropriateness of collecting and communicating internal information" c) "Status of applying statistical techniques to data analysis" d) "Appropriateness of information retention" e) "Status of utilizing information"

No.	Elements	Checklists
		f) "Status of utilizing computers for data processing"
4	Standardization	a) "Appropriateness of the system of standards" b) "Procedures for establishing, revising and abolishing standards" c) "Actual performance in establishing, revising and abolishing standards" d) "Contents of standards" e) "Status of utilizing and adhering to standards" f) "Status of systematically developing, accumulating, handing down and utilizing technologies"
5	Human resources	a) "Education and training plans and their development and results utilization" b) "Status of quality consciousness, consciousness of managing jobs, and understanding of quality control" c) "Status of supporting and motivating self-development and self-realization" d) "Status of understanding and utilizing statistical concepts and methods" e) "Status of QC circle development and improvement suggestions" f) "Status of supporting the development of human resources in associated companies"
6	Quality assurance	a) "Status of managing the quality assurance activities system" b) "Status of quality control diagnosis" c) "Status of new product and technology development (including quality analysis, quality deployment and design review activities)" d) "Status of process control"

No.	Elements	Checklists
		e) "Status of process analysis and process improvement (including process capability studies)" f) "Status of inspection, quality evaluation and quality audit" g) "Status of managing production equipment, measuring instruments and vendors" h) "Status of packaging, storage, transportation, sales and service activities" i) "Grasping and responding to product usage, disposal, recovery and recycling" j) "Status of quality assurance" k) "Grasping of the status of customer satisfaction" l) "Status of assuring reliability, safety, product liability and environment protection"
7	Maintenance	a) "Rotation of management (PDCA) cycle control activities" b) "Methods for determining control items and their levels" c) "In-control situations (status of utilizing control charts and other tools)" d) "Status of taking temporary and permanent measures" e) "Status of operating management systems for cost, quantity, delivery, etc" f) "Relationship of quality assurance system to other operating management systems"
8	Improvement	a) "Methods of selecting themes (important activities problems and priority issues)" b) "Linkage of analytical methods and intrinsic technology" c) "Status of utilizing statistical methods for analysis" d) "Utilization of analysis results"
9	Effects	a) "Tangible effects (such as quality, delivery, cost, profit, safety and environment)"

No.	Elements	Checklists
		b) "Intangible effects" c) "Methods for measuring and grasping effects" d) "Customer satisfaction and employee satisfaction" e) "Influence on associated companies" f) "Influence on local and international communities"
10	Future plans	a) "Status of grasping current situations" b) "Future plans for improving problems" c) "Projection of changes in social environment and customer requirements and future plans based on these projected changes" d) "Relationships among management philosophy, vision and long-term plans" e) "Continuity of quality control activities" f) "Concreteness of future plans"

Source: Zhang (2000b, p.16-18); Union of Japanese Scientists and Engineers (JUSE) (1997)

Table 2.8 Deming Application Prize Checklist (For Senior Executives)

No.	Elements	Checklists
1	Understanding and enthusiasm	a) "Are the objectives of quality control and enthusiasm introduction and promotion clearly defined and well understood?" b) "How well do they understand quality control, quality assurance, reliability, product liability, etc.?" c) "How well do they understand the importance of the statistical way of thinking and the application of quality control techniques?" d) "How well do they understand QC circle activities?"

No.	Elements	Checklists
		e) "How well do they understand the relationship of quality control and the concepts and methods of other management activities?" f) "How enthusiastic are they in promoting quality control? How well are they exercising leadership?" g) "How well do they understand the status and the characteristics of their company's quality and quality control?"
2	Policies, objectives and targets	a) "How are quality policies and quality control policies established? Where and how do these policies stand in relation to overall business management?" b) "How are these policies related to short-and long-term plans?" c) "How are these policies deployed throughout the company for their achievement?" d) "How do they grasp the status of policy achievement? Are they taking appropriate corrective actions when needed?" e) "How do they grasp priority quality issues (priority business issues)? Do they make effective use of diagnostic methods such as top management diagnosis?" f) "How well are targets and priority measures aligned with policies?" g) "What kind of policies do they employ for establishing cooperative relationships with associated companies?"
3	Organization and systems	a) "How is the company organized and managed so that human resources can effectively and efficiently practice quality control?" b) "How are the authorities and responsibilities in the organization established?"

No.	Elements	Checklists
		c) "Is the allocation of human resources suitable for the organization?" d) "How do they strive to make employees happy and satisfied?" e) "How do they grasp and evaluate employees' capability and motivation levels?" f) "How do they strive for interdepartmental cooperation? How do they utilize committees and project teams?" g) "How do they relate to associated companies?"
4	Human resources	a) "How clear is the philosophy for hiring, developing and utilizing human resources?" b) "How appropriate are the employee education and training plans? Are the necessary budget and time allocated?" c) "How do they communicate the policies for quality control education and training and how do they grasp the status achieving their policies?" d) "How do they provide education and training specific to the company's business needs?" e) "How well do they understand the importance of employee self-and mutual-development? How do they support this effort?" f) "How do they strive to develop QC circle activities?" g) "How interested are they in developing human resources in associated companies?"
5	Education, dissemination and through implementation	a) "What kind of measures do they have for the evaluation, and effective and efficient implementation, of quality control?" b) "How well is the overall coordination of quality control and other management systems?"

No.	Elements	Checklists
		c) "How do they grasp the status of improvement in the business processes and the individual steps of these processes so as to provide products and services that satisfy the customer needs? Are they taking necessary corrective actions?" d) "How well are the systems for developing new products and services, new technologies and new markets established and managed?" e) "How well are the necessary resources secured and allocated for establishing and operating management and information systems?" f) "How do they grasp the effects and contributions of quality control to the improvement of business performance?" g) "How do they evaluate their employees' efforts?"
6	Corporate social	a) "Is the company structured to ensure appropriate profits for a long time?" b) "How well do they regard employee well-being (wage levels, working hours, etc.)?" c) "How well do they regard employee self-realization?" d) "How well do they strive for co-existence and co-prosperity with associated companies?" e) "How well does the company contribute to the local community?" f) "How well does the company exert efforts to protect the environment?" g) "How well does the company positively impact the international community?"

No.	Elements	Checklists
7	Future policies, plans and measures	a) "How do they assure the continuity of, and future plans for, quality control?" b) "How do they anticipate and cope with changes in surrounding business environment and progress in science and technology?" c) "How do they grasp and cope with changes in customer requirements?" d) "How do they consider their employees and help them achieve happiness and satisfaction?" e) "How do they consider and manage relationships with associated companies?" f) "How do they plan for the future to cope with the items above?" g) "How do they utilize quality control to achieve the future plans?"

Source: Zhang (2000b, p.18-20); Union of Japanese Scientists and Engineers (JUSE) (1997)

2.5.4 Comparing the Quality Award Models

The three quality award models have provided a universal framework to assess the different facets of TQM practices in an organization. These models also provided a framework to identify an array of tangible and intangible processes that can affect the implementation as well as the end results in a firm.

Even though every award model possesses its own distinctive features and categories, there are some common areas among them. One is that every award model has two parts to it, which are the enablers (i.e. TQM implementation) and the end results. The implementation of TQM enables the overall business result to happen. Secondly, the significance of top management support, human resource focus, employee involvement, education and development, strategy and policy, process management, information and analysis, supplier quality management, and customer focus are strongly emphasized in these three award models.

Apart from that, the three models also present firms with ways to measure and benchmark their position against universal standards, and to discover their strengths and weaknesses in TQM principles and business results. In other words, their main aim is to establish guidelines and set the evaluation and improvement criteria that facilitate firms towards attaining organizational excellence, both at the national and international levels (Sampaio et al., 2012). Furthermore, these models also provide a deeper understanding into the practical ways to apply TQM, and establishing a firm foundation to this research study, as well as providing the authors a more comprehensive understanding on the TQM concept.

As stated by Hackman and Wageman (1995), the winners of the Baldrige Award can be safely assumed to have adopted and implemented the TQM package fully. Hence, in accordance to their statement, it is safe to assume that TQM is fully implemented by the three award models.

2.6 TQM Concept

TQM is specifically discussed from the perspective of adoption by companies with the purpose of attaining a distinctive business proposition. On the other side of the coin, the academicians and researchers are attempting to find out the ultimate TQM practices that will give the best results. It is known as a management philosophy that brings different meaning to different people (Hackman & Wageman, 1995). Various terminologies in the likes of "total quality leadership", "total quality control", "total quality service" and "total quality improvement program" are terms that are used interchangeably to describe TQM (Karia & Asari, 2006). Many researchers in the likes of Ahire, Landeros, and Golhar (1995), Badri et al. (1995), Fynes (1998/1999), Dayton (2003), Motwani (2001), Shenawy, Baker, and Lemak (2007), Thiagarajan and Zairi (1997a; 1997b; 1997c), Sila and Ebrahimpour (2002), Tari (2005), and Yong and Wilkinson (1999) have made several attempts to study, review, identify, justify, and examine the critical success factors that made up TQM strategy, which will be illustrated in the succeeding paragraphs.

A sum of 226 overview, empirical, conceptual, analytical, simulation articles and case study gathered from TQM related refereed journal, published between the years 1970 and 1993 using the MBNQA criteria as a framework was studied and analyzed by Ahire et al. (1995). Generally, the authors concluded that the TQM related articles reviewed were mainly an overview, conceptual, and anecdotal. Hence, there was a dearth on the publication of empirical studies. As there were many unexplored and unresolved TQM issues, and given its popularity and wide acceptance as a promising field of research, authors are highly encouraged to conduct more scientific studies to fill the literature gap of TQM.

In the same year itself, eight constructs of TQM were identified, tested and validated through an empirical research conducted by Badri et al. (1995) on 424 manufacturing and service companies in the United Arab Emirates, a developing nation rich with oil located in the Middle East. Among the important factors were top management awareness pertaining to quality improvements, product/service design, quality data and reporting, process management, employee participation, training, a good co-ordination between quality department and other divisions, and supplier quality management.

In line with Ahire et al. (1995), the literature of TQM that uses the same criteria that of MBNQA and EQA was also being reviewed by Thiagarajan and Zairi (1997a; 1997b; 1997c). Nevertheless, case studies papers, coupled with discussion on the different issues associated to TQM implementation prescribed by quality scholars such as Deming and Feigenbaum, remain the focus point in their research.

Thiagarajan and Zairi (1997a; 1997b; 1997c) further suggested that the vital success factors of TQM could be classified into 'soft' element and 'hard' element. Soft elements can be referred to as intangible factors and one that is hard to measure (e.g. commitment and participation of top management, communication, empowerment, teamwork, training and development, and a system that recognizes and appreciates quality efforts). The hard elements, on the other hand, incorporate systems, tools and techniques. For example, quality control tools and techniques, benchmarking, management by process, supplier and customer management, and documented quality management systems. In any form of TQM implementation, the authors stressed that both soft and hard elements are essential to exist together. The influence of soft and hard TQM elements were later investigated on organizational performance (Rahman & Bullock, 2005), small and medium firms (Lewis, Pun, & Lalla, 2006), quality management results (Fotopoulos & Psomas, 2009) and knowledge management (Daud & Yusof, 2011), to name a few.

As for Fynes (1998/1999)'s review on TQM literature, 20 empirical research studies that tested and confirmed the critical TQM factors were examined. Seven critical TQM factors identified by Flynn, Schroeder, and Sakakibara (1994) were adopted by Fynes (1998/1999) in his study as a conceptual model to be further examined empirically. The factors were namely support from top management, quality information, process management, product design, work management, supplier involvement and customer participation.

In another review of TQM literature, 15 articles arguing the advantages and disadvantages TQM can bring to firms were reviewed by Yong and Wilkinson (1999). The studies mainly evaluated by the authors were carried out in different countries to examine the relation between TQM and performance. Their conclusion was two-fold, in which researchers in the likes of Volmohammadi and Roshanzamie (2014) share the same view. While there were some past studies that reveal the positive relationship between TQM and performance, there were also many past studies revealed the unsuccessfulness of TQM implementation. The failure of TQM implementation was predicted to be caused by the partial implementation of the quality management practices. Simply said, TQM in these firms was not implemented and executed completely. As argued by many TQM proponents, quality management has to be implemented fully, and not on a pick and mix basis. Motwani (2001) further illustrated that the commitment of top management, process management, quality measurement and benchmarking, the design of the product, empowering employees and providing training, supplier quality management, and being customer focus are essential key practices to drive a company performance.

A more recent and comprehensive review of 347 empirical studies carried out in various countries and published between the years of 1989-2000 was done by Sila and Ebrahimpour (2002). Through the examination of 76 empirical studies that adopted a holistic approach to TQM, it was shown that there were 25 TQM practices that happened to be the most extracted determinants across these studies. Out of these 25 factors, the authors revealed that there are seven TQM factors that are most frequently mentioned in the literature. They are leadership, employee training, employee participation, teamwork, customer focus, continuous improvement, as well as quality information and performance measurement. The authors proposed to use survey research to investigate on the five factors of TQM (i.e. product and service design, strategic planning, employee appraisal, rewards and recognition, and communication and social responsibility) is essential due to the limited information on them. Furthermore, they also highlighted that only four studies were conducted in Malaysia among the 347 research papers reviewed, which is only a mere 1.2 percent.

On the other hand, ten critical success TQM factors, which are managing people and customers, partnering with suppliers, communication, customer focus, external interface management, teamwork, strategic quality management, quality improvement measurement systems, operational quality planning, and corporate quality culture were identified by Dayton (2003) while performing an empirical study to identify the vital success TQM factors based on US companies. Derived from the models of both MBNQA and Black and Porter (1996), the elements that received the strongest coverage and ranked as the most significant TQM factors in the survey literature are strategic quality management (i.e. visible support and commitment from top management) and corporate quality culture.

The TQM literature, which was being reviewed by Tari (2005), synthesized nine TQM factors. Included in them are leadership commitment, management based on facts, strategic planning, human resource focus, learning process management, continuous improvement, cooperation with supplier, customer focus approach, and organizational awareness on social and environmental issues.

Using a meta-analysis approach, Shenawy et al. (2007) on the other hand, investigates the effects of TQM on firm’s competitive advantage. Five major

TQM practices namely leadership commitment, culture, teams, training and education, and the efficiency of a process have been identified. Essentially, these TQM dimensions are grounded in the theory of Deming and deduced from Reed, Lemak, and Mero (2000)'s model, who systematically review the TQM principles suggested by the quality gurus and observed five TQM elements. The five dimensions are top management commitment, teamwork, training and development, culture, and customer focus.

After a thorough review of the TQM literature, six TQM dimensions originated from the MBNQA model (i.e. leadership, strategic planning, human resource focus, customer focus, process management, and information and analysis) were chosen to signify the TQM dimensions in this research (Arumugam, Ooi, & Fong, 2008; Miranda, 2003; Lam et al., 2011; Lam et al., 2012; Lee et al., 2010b; Lee et al., 2013a; Lee et al., 2013b; Lee, Ooi, Sohal, & Chong, 2012; Ooi, Lee, Chong, & Lin, 2011; Prajogo & Hong, 2008; Prajogo & Sohal, 2003b; Teh et al., 2008; Teh et al., 2009). The reasons these six elements were chosen will be illustrated in the next section.

2.6.1 Review of TQM Practices

Recognized as a holistic package of management values, TQM is capable of assisting firms in its everyday management, helping a firm to attain its organizational goals and objectives, fulfilling the expectations of customers, improving the performance, efficiency and effectiveness of a firm, achieving a desired business outcome (Ooi, Safa, & Arumugam, 2006). Brown (1997)'s case study also revealed that it is TQM that set the enlightened (high performing) manufacturing firms from the traditional (low performing) firms and due to the immense benefits TQM can bring, the high performing manufacturing plants remain dedicated to it. The distinctive characteristics of the enlightened firms is that they pursue quality continuously, satisfying customers relentlessly, having senior manufacturing personnel who are committed to quality improvement, and having in place the right manufacturing strategies that helps translate the requirements of customers into internal operational approaches. Brown's research in 1998 also further confirmed that the enlightened plants would be alike "world class" or "lean" plants as TQM is not just a "programme", but it is a way of living. In the world-class plants, the manufacturing managers were actively involved in strategy process, the business manufacturing strategies were in place and that there is a higher tendency for strategic decision content areas to be incorporated in business strategy for the high performing firms (Brown, Squire, & Blackmon, 2007). Thus, they surpass the low-performing ones when it comes to world class manufacturing.

2.6.2 Advantages of TQM Practices

There are many advantages to TQM. Generally, it enhances both performance and competitiveness of an enterprise (e.g. Dow, Samson, & Ford, 1999; Hendricks & Singhal, 2001a). It also bring about a positive effect on a firm's financial profit (Hendricks & Singhal, 2001a) as well as non-financial outcome (Dow et al., 1999), leading to an increase in the stock market value of the firm (Hendricks & Singhal, 1996; 2001b).

Specifically, TQM has been found to reduce a firm's cost of production (Garvin, 1983), improve employees' work-related attitudes (Ooi, Arumugam, & Teo, 2005), boosting workers' level of job satisfaction (Ooi, Arumugam, Safa, & Bakar, 2007a), and increasing their level of job participation (Ooi, Bakar, Arumugam, Vellapan, & Loke, 2007b). Ultimately, the overall business performance of a firm will be improved (Arumugam et al., 2009; Samson & Terziovski, 1999). Hence, due to such reasons, organizations of all sorts, be it SMEs, manufacturing or the service firms, have been seen implementing the TQM practices.

For TQM adoption to be a great success, it requires a combined effort from every individual in the company, be it the top managers or the lower level employees, as stated by Deming (1986), Feigenbaum (1980), Juran and Gyrna (1988) and Luthans (1995). In other words, top management is to provide adequate training programs, tools and materials; whereas employees are encouraged to equip themselves with such tools and assist company in achieving its quality objectives (Luthans, 1995). By doing so, a positive and friendly atmosphere can be created between top management and employees, encouraging people to work at their best.

Crosby's 14 steps, Juran's breakthrough strategy and Deming's 14 points, as mentioned by Morrow (1997), are a few of the models relating to TQM. However, Cole (1993) opined that such frameworks are not specified enough for companies to start their journey with TQM, thus the introduction of the MBNQA framework. Coincidentally, the Quality Management Excellence Award which was instituted for the private sector in Malaysia also encompass similar standards as MBNQA (National Productivity Centre, 1993; Ministry of International Trade and Industry, 1998).

2.6.3 MBNQA as TQM Practices

The MBNQA model was chosen in this research for the following reasons (Lee et al., 2013a, b):

1. Several renowned researchers such as Samson and Terziovski (1999), and Ooi et al. (2011) have adopted the six practices to signify their TQM dimensions in their theoretical framework to further their studies in empirical work.
2. The hard and the soft aspects of TQM are incorporated in the MBNQA model, in which soft practices consisting of leadership, human resource management, and customer focus are described as concepts and principles relating to management. Meanwhile, hard practices which comprised of strategic planning, management in process, and information and analysis, refers to quality improvement devices and instruments (Thiagaragan, Zairi, & Dale, 2001; Vouzas & Psyhogios, 2007).
3. As described by Hendricks and Singhal (1997; 2001b), firms (i.e. both private and public) that adopt the MBNQA dimensions will use such practices to assess, examine, and manage their management practices in a more efficient and effective manner, improving their economic performance, which eventually will lead them to attain a long-term

sustainable competitive advantage (Terziovski, Howell, Sohal, & Morrison, 2000).

4. The MBNQA dimensions are widely adopted by both the developing and developed countries (e.g. European countries, United States, Japan, and Australia).
5. The six MBNQA practices are found to be the main TQM practices for both manufacturing and service sectors (Hoang et al., 2006; Zhang et al., 2000)

Hence, this highly sophisticated and complex framework will be adopted in this research.

2.7 Review of Organizational Learning

2.7.1 Learning in an organization

A company is made out of its people, and not the typical bricks and mortar (Chang & Sun, 2007). Continuous improvement can occur only when the people in the organization learn. As Saylor (1992) puts it, it is the behavioral characteristic of its people that pose a positive or negative effect on a company. Only when its people learn through the experimentation of new techniques and methods (Garvin, 1993), only then can the organization be labeled as one that learns (Nonaka, 1994). Via teamwork and employees' participation, the learning ability of a firm can be improved (Gomez, 2004), ensuring that talented staff are retained, and new staff who are determined to generate and disseminate information will be attracted (Thite, 2004). Learning has been continuously emphasized as “bridge between working and innovation” (Brown & Duguid, 1991, p.41), as “a crucial resource for a firm and a source of competitive advantage” (Linderman et al., 2004, p.593). To remain competent, a learning organization should not only comprise the characteristics to learn, but to learn continuously (Lee et al., 2012).

In spite of its significance, there are still conceptual differences pertaining to learning in organization, which focused on the issues of (1) learning outcomes (i.e. cognitive or behavioral changes) and (2) the subjects of learning (i.e. individuals, groups, or organizations) (Crossan, Lane, White, & Djurfeldt, 1995; Friedman, Lipshitz, & Popper, 2005).

In accordance to many past literature related to learning, learning outcomes can either be considered as (1) a learners’ behavioral change (Argyris & Schon, 1978; Stata, 1989), (2) cognitive change (Fiol & Lyles, 1985; Levitt & March, 1988), or incorporating both elements (Crossan et al., 1995; Crossan et al., 1999). From the behavioral viewpoint, the objective of learning is to change one’s behavior or action toward a desired outcome. Scholars in the likes of Stata (1989, p.64) has viewed learning as “a process by which individuals gain new knowledge and insight and thereby modify their behavior and action”; while Argyris and Schon (1978, p.116) look at learning as “a process of detecting errors and correcting errors”. This perspective is somewhat similar to that of a stimulus-response mechanism, as proposed by March (1991), in which an individual change in behavior is in response to a stimulus. As an example, an organization learns when its strategies, systems and routines are affected/changed by contextual stimuli such as a new invention, technology or competitive pressures (Arthur & Aiman-Smith, 2002; Bresnan, Goussevskaia, & Swan, 2005). In other words, organizations learn through the modification of their routines and systems when affected by internal and/or external stimuli, as argued by Daft and Weick (1984) and Stata (1989).

Unlike the behavioral perspective, the cognitive aspect emphasizes that learning can take place via internal mental processes which includes a learner's insights, information, and memories, (Fiol & Lyles, 1985; March, 1991; Senge, 1990). Such a perspective mainly stresses on how a learner makes meaning from their experience and how he/she personalize their experience. In accordance to this perspective, some scholars have termed organizations as an information or knowledge processing system. As asserted by Huber (1991), organizations have an internal learning process, which are acquiring, distributing, interpreting and retaining knowledge in firm. He continued by emphasizing that such learning processes can contribute to a firm in that firms can expect changes in their employees' potential behaviors. It was also stressed by Kim (1993) in that mental processes lies within a firm, in that individual learning is linked with organizational learning. To further illustrate this point, it means that both individuals and organizations share their experiences through mental models, enabling them to establish the "not only how to make sense but how to take action" (Senge, 1990, p.175). In line with this is Nonaka (1994)'s process of creating knowledge in organization, where the creation of knowledge stems from the active interactions between different persons' value systems and highlights the mental models where the process of knowledge conversion revolves around tacit and explicit knowledge.

It is indeed hard to attain a clear concept on the term organizational learning as learning in organizations relies on many facets of the management processes. Nevertheless, this study shares the following perspectives occurred in past literature. Primarily, learning is “a process of change in cognition and behavior”, as opined by Crossan et al. (1995, p.353). Secondly, learning can happen at various levels, such as individual, group and organization. Individuals, according to Argyris and Schon (1996), learn and act as the principle units in an organization; while groups, according to Senge (1990), facilitate learning by sharing what one has learnt. Meanwhile, as mentioned by Casey (2005) and Crossan et al. (1999), organizations cultivate their learning abilities by disseminating information to their members, at the same time storing new knowledge into their routine. Thirdly, learning also gives rise to performance enhancement. Even though learning may not directly affect an organizational performance, learning will naturally and eventually align itself to an organization’s performance, as proposed by Bontis et al. (2002), Bapuji and Crossan (2004) and Lopez, Peon, and Ordas. (2005).

2.7.2 Definitions of Organizational Learning

Organizational learning (OL) has been developed in many ways throughout the years to reflect the commonalities in learning as stated in the previous section. Simply said, OL is a procedure where new knowledge is developed (Huber, 1991). OL, as described by Lopez et al. (2006), is a process to improve the development of a firm with the application of new ideas, for example from the aspects of production, technology, or business. Typically, it is regarded as detecting and correcting errors, where the differences between what members in a firm desire to accomplish and what they actually accomplish is defined as an error (Argyris & Schon, 1978; Van Grinsven & Visser, 2011). In the words of Huber (1991) and Templeton, Bruce, and Snyder (2002), the processing of information to attain organizational change is termed as OL; while Kim (1993), Nonaka (1994) and Casey (2005) termed it as a system for sharing experience, an essential measure for organizational renewal (Crossan et al., 1999; Crossan & Berdrow, 2003), and the ability for an organization to improve on its performance (Dibella, Nevis, & Gould, 1996; Lopez et al., 2005; Sinkula, 1994).

Crossan et al. (1995) categorized OL into three stages, which are 'individual', 'group', and 'organizational' learning. It is where individuals obtain the capability and the inspiration to carry out the company daily activities, and from there share the knowledge acquired with each another; and finally aligning the systems and strategies into the company culture. Although some may argue that learning starts its roots in individual learning, it also relies on cooperative circumstances when creating knowledge (Nonaka, 1994). From such viewpoint, it can be assumed that OL is more than the sum of individual learning, as argued by Argyris and Schon (1978). Apart from that, the dynamic process of OL also results in heterogeneity of learning outcomes as they originate from different knowledge bearing entities (Huber, 1991), hence implying that the concept of OL takes place at different levels which are individual, group and organization. This was further supported by Bontis et al. (2002), Crossan et al.

(1999) and Crossan and Berdrow (2003), in that learning for a firm happens at multiple levels (i.e. individual, group and organizational) and OL is attained when the outcomes of learning at each level are transferred to the other levels (e.g. from individuals through groups to organizations or vice versa) through four social and psychological processes (i.e. intuiting, interpreting, integrating, and institutionalizing). It was emphasized that the learning stocks at different levels and how learning flows to other level(s) are crucial dimensions of OL, which consistently affect organizational ability to exploit what firms already learned or to explore new forms of learning. According to Nonaka and Takeuchi (1995), a company filled with individuals who learn would produce a company with the capabilities of OL.

2.7.3 Dimensions of Organizational Learning

As knowledge, regardless of whether it is developed tacitly or explicitly (Nonaka, 1994) through knowledge acquisition, distribution, application or storage with a firm (Huber, 1991), is a commodity that is very difficult to model. In other words, it serves as an intangible resource for any firm to prosper in this uncertain environment. OL capabilities have been expressed to bring about a significant impact on organizational effectiveness and improve firm's ability to innovate and grow (Banutu-Gomez, 2004). It was further added by Chiva and Alegre (2009) that OL capabilities plays an essential role in innovation and this was proven empirically by Tohidi, Seyedaliakbar, and Mandegari (2012) in that OL impact on innovation positively. The significance of OL was highlighted and empirically proven that it could help firms remove its barriers and achieve sustainability (Smith, 2012; Smith & Sharicz, 2011; Wasdell, 2011). As such, there are many research studies that have focused on ‘knowledge-based view’ theory (Nonaka, 1994), which recognizes that knowledge is elemental to the operations of a firm. OL, according to Huber (1991), Lopez et al. (2006), Tippins and Sohi (2003), and Lee et al. (2013a, b), can be viewed from four different aspects:

1. The acquisition of knowledge, both internally and externally;
2. The dissemination of knowledge, where the transferring and distributing of knowledge occurs among members in a firm;
3. The application and interpretation of knowledge, in which facets of individual knowledge that are shared are integrated, thereby accomplishing a common understanding and coordinated decision making; and
4. The storage of knowledge, also known as organizational memory, where knowledge is kept in the company databases to be used in future.

Based on the explained definitions above, OL can be summarized as the four constructs of acquisition, dissemination, application, and storage (e.g. Tseng & McLean, 2008; Huber, 1991), which makes up the OL for this study. These four constructs of Huber (1991) stresses quite significantly on the information system of an organization. Four main reasons to adopt the four concepts: Firstly, it is vital that organizations attain information from both internal and external sources so that the product and service quality can be ensured to have continuous improvement (Yang, 2008), impacting on organizational performance (Sinkula, 1994). In accordance to Crossan and Hulland (1996), the dimension of information acquisition has been recognized as the most developed among the four constructs. Five sub-constructs which are congenital learning (i.e. knowledge that resides at the organizational birth), experiential learning (i.e. to learn from the experiences of each other within an organization), vicarious learning (i.e. to learn from other organizations' experience), grafting (i.e. to bring learning through the acquisition from other organizations), and searching and noticing (i.e. to scan both the internal and external environment) form the dimension of knowledge acquisition. Given the present situation of a rapid change, the external environment as a significant contribution is being emphasized on. A clear correlation has been empirically studied and confirmed by Schultz (2001) between the external information and competitive advantage. Moreover, it has also been empirically established by Ancona and Caldwell (1992) in Akgun, Lynn, and Reilly (2002) that the active observation of the external environment can enhance a team performance and learning.

Secondly, the necessity in sharing information throughout the organization is also known as the information distribution structure. Through the sharing, transferring and disseminating of information among employees only then can the highest quality be ascertained, maintained and maximized, as iterated by both Hsu and Shen (2005) and Yang (2008). According to Gardiner and Whiting (1997), it is necessary to communicate to ensure a learning organization's success. In order to foster such open access to information, the underlying value is trust between management and employees (Gardiner & Whiting, 1997).

Thirdly, it is essential that the information be interpreted. When organization responds to the knowledge acquired by applying it in the products they produced, the company's overall performance can be improved, thus enhancing the competitive edge of the firm in the marketplace (Darroch, 2003).

Lastly, organizational memory recognizes the importance to store knowledge/learning and that a variety of individuals can retrieve it. When such knowledge is kept in databases within the firm, the 'learning" firms will have advantage over others in response to market demands (Tippins & Sohi, 2003). In other words, knowledge that is well kept in an organization plays a vital role when integrating an organization's resources to fit with the external environment, in that the firm will be more agile to take advantage of the opportunities in a competitive, unpredictable and turbulent environment. Moreover, as mentioned by Barney (1991), due to its rareness and inimitability, it enables a firm to enhance on its competitiveness as such attribute provide firms with such a great uniqueness that other competitors cannot easily imitate.

To sum it up in the words of Garvin (1993) and Brockmand and Morgan (2003), the short and long run of a firm can be improved when an organization learns, thus enabling them to carve out for themselves a sustainable comparative edge that never fails.

2.7.4 Organizational Learning as a Reflective Model

OL is validated as a reflective measurement model, drawing from the existing literatures that includes both theoretical and empirical considerations. It is important to distinct between formative and reflective measures as proper specification of a measurement model is required to provide meaningful relationships in the structural model (Anderson & Gerbing, 1988). In order to holistically capture the necessary theoretical and empirical aspects, an organized framework to assess and validate a reflective model is provided and summarized by Coltman, Devinney, Midgley, and Venaik (2008).

The first consideration is that the latent construct is existing (Borsbom, Mellenbergh, & Heerden, 2004), in which latent constructs is determined as a combination of its indicators. OL is termed as a process of creating, acquiring, and integrating of knowledge (Huber, 1991; Lopez et al., 2006; Chiva & Alegre, 2005) which has been proven by past literatures that it is existing. Furthermore, OL construct is determined as a combination of its indicators, which are made out of four indicators - knowledge acquisition, dissemination, interpretation and storage.

The second consideration is the characteristics of items that are used to measure the construct. It is mentioned by Jarvis, Mackenzie, and Podsakoff (2003) that the items define the construct. In other words, the items must share a common theme, are interchangeable, and that to add or drop an item does not change the conceptual domain of the construct. Referring to some of the questionnaire items of OL shown in Table 2.9, the questionnaire items share a common theme, which is OL. Furthermore, the items are interchangeable and to add or drop an item will not change the conceptual domain of the OL construct.

Table 2.9 Sample items of OL

OL items	Sample of questionnaire items	Source
KA4	"New ideas and approaches on work performance are experimented continuously".	Lopez et al. (2006, p.238)
KD5	"There are individuals responsible for collecting, assembling and distributing internally employees' suggestions".	
KI4	Our organization "offers other opportunities to learn (visits to other parts of the organization, internal training programme, etc) so as to make individuals aware of other people or departments' duties".	
OM4	All the employees in our "organization have access to the organization's databases".	

The third consideration, according to Bollen and Lennox (1991), is the direction of causality between items and latent construct, in which the causality is from construct to items. From the original article in which OL was adopted in this study, Lopez et al. (2006) also formed OL as a reflective model, where the variation in the OL construct causes the variation in the item (i.e. acquisition, distribution, interpretation, organizational memory) measures; and that the variation in these four items measures does not cause the variation in the OL construct.

With these three theoretical considerations taken into account, it can be concluded that OL is thus validated as a reflective model. The empirical considerations will be further discussed in section 5.7.1.

2.8 Review of Technological Innovation

2.8.1 Innovation defined

The concept of innovation has been described in various ways in the literature. Innovation was viewed by Rosenberg (1982), Nelson and Winter (1982) and Dosi (1982) as an improvement process that may resemble as a problem solving activity (i.e. a new method). Innovation, as defined by Freeman (1982), is the utilization of new knowledge to provide a new product or service that satisfies customers' wants, which simply means that innovation is an invention and commercialization. Tidd, Bessant, and Pavitt (1997) on the other hand, regarded innovation as a process that incorporates commercial use (i.e. a new business), in other words, turning opportunities to practical usage. Scholars in the likes of Daft (1982), and Rothwell and Gardiner (1985) integrate the process of incremental improvement in existing technology and turning it into commercial use.

Innovation, as defined by Van de Ven (1986), is developing and implementing new ideas by people who over time participate in transactions with others in an institutional context. On the other hand, innovation as described by Porter (1990), is simply a new method of getting things done that is commercialized, in which the newness is associated with technology or market. Meanwhile, Rogers (1983)'s definition of innovation is the adoption of new ideas to the adopting organization. According to Betz (1993), technological innovation is inventing new technology, developing and introducing the processes, products, or services that are based on this new technology to the marketplace. An examination of various definitions of innovation provides one main element, which is the element of novelty with an attached commercial worth.

2.8.2 The History of Innovation

The concept of innovation and its significance towards the economic development of a country were originally acknowledged during the 1930s by an Austrian economist by the name of Joseph Schumpeter. Five types of innovations were identified by him. They are the (1) technological innovation of a product (i.e. new products or significant changes were made to the existing products); (2) technological innovation of a process (i.e. new process or methods of production); (3) new sources of resources; (4) new organizations; and (5) new markets (Schumpeter, 1982).

There are two principal ideas that made up the recent theories of innovation. The first principle idea is that innovation is developed as an evolutionary process, interacting among actors, which presents the various stages in an idea development. The evolutionary economic theory emphasizes on the need to experiment to identify the various solutions and means for choosing the most viable technologies. Outstanding revolutionaries' in the likes of Nelson and Winter (1982) and Dosi (1982) seek to describe the foundation of evolutionary theory, with routines, skills and learning as the main determinants of innovation. The second is the cycle among knowledge, learning and growth, and the synergy among these elements presents an important role for the developed economies (Arundel, Patel, Sirilli, & Smith, 1998).

Revolutionary change, according to Schumpeter (1982), is the main subject in the study of economic development, designated as "creative destruction". As the process of creation lies in one's hands, with the help of new combinations of productive factors, Schumpeter (1982) asserted that the entrepreneur is believed to be the underlying phenomenon of economic development.

In line with Schumpeter's view, Dosi (1982, 1988)'s work was established. He concluded that innovation is the outcome of interacting between both elements of technical and economic, in which it will refeed themselves so that it can position itself to the technological trajectory needed to be adopted in an environment marked by uncertainties and risks. His work is based on the development of the concept of "technological paradigm", which means a technological research programme based on models or patterns of solutions of certain problems, derived from principles and techno-scientific procedures.

Meanwhile, Nelson and Winter (1982) highlighted the point that firms are diverse in nature as not one is perfectly rational and that each possess various skills, learning and routines. For them, a firm is seen fitting to carry out an activity if firm possess the given skill. If not, it will need to acquire the new knowledge through the learning process. When a firm holds the abilities to perform a certain activity, it will be able to carry it out in accordance to a recommended sequence of actions and responses, which in due time, will be translated into a routine.

Moreover, technological innovation for Dosi (1988) began with the need to find an answer to a technological problem, as the available knowledge at that point in time is simply insufficient to resolve it. Apart from that, the author also sets a clause that the solution/answer needs to consider the criteria of both cost and commercialization. Hence, a technological problem induces the opportunity or a need for technological innovation to occur.

Freeman (1995), on the other hand, observes technological innovation in an organized way, affirming that such occurrence does not takes place on its own, as one detached event, but rather by a set of homogeneous, technically, and economically connected events.

By combining the concepts presented above, technological innovation can be considered as a phenomenon that emerged from the fulfillment of a technological need, in which it is commercialized after progressing through some steps. Furthermore, it is not made out of a discrete event that is independent of other occurrences, as it is affected by the interaction among the various parties of a society, which directly impact on the economy of nations and the performance of businesses.

2.8.3 Innovation and its Significance

In the words of Drucker (1995, p.17), every organization, not just businesses, needs one core competence: "innovation". Throughout history, innovation, in particularly technological, has been the core of economic activity. However, ever since the dawn of industrial revolution, innovation has increased in sophistication. The significance of technological innovation in increasing effectiveness and efficiency of economic activity, at the same time improving the productivity and quality of work done while cutting down the quantity of the manual labor needed to attain the output desired has been recorded as early as Adam Simth (1776, p.5-6).

An economist by the name of Schumpeter (1942), who was concerned in the business long cycles and the causes of divergence from perfect competition, acknowledged the importance of innovation that it can change the course of industry and termed it as "creative destruction". Such a proposition has seized both the practitioners and researchers' imagination at different times since. It was further described that entrepreneurship and innovation are closely related (Schumpeter, 1947).

Innovation and invention was also differentiated by Schumpeter in which the former includes bringing something of value to market, while the latter is described as generating new ideas/things that is not materialized in the social environment. Such a distinction is important as many inventions go to waste if they do not become feasible via the realization in the market through innovation. Sharing the same view as Schumpeter, Schon (1967) also distinguish innovation with invention, where he explains creating new technology is the task of inventors; while brining invention into use is the task of innovators.

Penrose (1959) (as cited in Cantwell, 2000/2001) on the other hand, built on the proposition that a firm's success in the long-term was based on innovation, on adapting and extending a firm's capabilities and resources, in particularly on the technological side. In the literature concerning innovation and intellectual capital as the foundation of a firm's resource view, Penrose (1959) was often cited as a prevalent theme in these research areas.

Innovation, as described by Nelson and Winter (1982), is an evolutionary processes. Their theory incorporates the elements as follows (Nelson, 1987, p.12-13): (1) "a mechanism that introduces novelties to the system…its workings…involve a significant random element," and (2) a means to select… "expanding the relative importance of some (entities) and diminishing that of others". Nelson also proposed the probability of introducing a radical new entity into the system that does not exist before.

In a fast changing and turbulent marketplace economy today, innovation is the elixir of a life of a firm, despite of its size or other characteristics. The importance of innovation has been widely recognized and appreciated by many researchers in the past as well as in the present, such as Gloet and Terziovski (2004), and Lundvall and Nielsen (2007). Generally, innovation refers to executing an idea or a conduct that is new for the firm (Damanpour & Gopalakrishnan, 2001), which can either be in product, service, or a process form, or a new management system, or a new program that is related to organizational members (Damanpour, 1991). The key to unlocking the doors to new markets and growth possibilities in present times, according to Lagrosen (2005), is innovation. A recent empirical finding confirmed that innovations in terms of product, process, and market are positively linked with firm's growth (Varis & Littunen, 2010). A firm's long term sustainability and success depends mainly on its innovative capabilities (Du Plessis, 2007; Ngo & O'Cass, 2013).

2.8.4 Dimensions of Technological Innovation

Literature describes and expounded the different classifications of innovation and these classifications can be categorized by type, extent, effect, efficiency, and ownership (Narvekar & Jain, 2001). Scholars in the past have identified several types of innovation. Damanpour (1992) classified innovation into six types, which consist of process, product, technical, administrative, incremental, and radical. Mavondo, Chimhanzi, and Stewart (2005) on the other hand, categorized innovation as three types – process, product, and administrative. Meanwhile, innovation in the form of process and administrative, according to Chuang (2005), has been acknowledged by several other researchers. In a recent journal article published by Varis and Littunen (2010), the different types of innovation incorporates product, process, market, and organizational.

TI serves as a mechanism in the development of new processes, products and management systems, or to continue providing old processes, products and management systems at a reduced costs (Ng, Lee, Foo, & Gan, 2012). It occurs whenever a new or changed process is used in business production, or when a new or changed product is introduced to the marketplace. The process of such innovation combines the efforts of research, design, market investigation, and the involvement of management to create an innovation production process or develop an inventive product (Gaynor, 2002; Ibrahim, Elias, Saad, & Ramayah, 2012).

In this research study, technological innovation is adopted, as opposed to any other forms of innovations listed in the preceding paragraphs. Product and process innovation are the two main forms of TI (Chuang, 2005; Cooper, 1998) and from the context of a manufacturing sector, this is a generally accepted description for technological innovation (Becheikh et al., 2006). Also known as product development, product innovation encompasses new products and services created to meet the requirements and expectations of the market (Damanpour & Gopalakrishnan, 2001). It is referring to a systematic working process to produce new materials, products, devices and prototypes, drawing from the knowledge obtained from past research and practical experiences (Hage & Hollingsworth, 2000). Varis and Littunen (2010) described it as the introduction of novel/genuine product innovations. Meanwhile, process innovation is the implementation of new and enhanced production and delivery methods, which encompasses a change to alternative techniques, tools or software (Bi et al., 2006). This definition differs from Shaw (1961), in which it was traditionally defined as a new method in putting together the physical inputs, such as manual labor, tools, and raw materials, to generate products or provide services. Process innovation is recently defined by Varis and Littunen (2010) as the introduction of novel process, which includes production methodology or technology. Several rationales for adopting TI are as follows (Lee et al., 2013a, b; Ng et al., 2012):

1. The manufacturing sector has been depending strongly on TI to produce quality products which are high-end (Bi et al., 2006).
2. TI involves the adjustment in current processes and products based on to the use of single or multiple technologies (Bi et al., 2006; Roberts, 2007).
3. TI, according to Cooper (1998), is able to improve performance, resolve problems, add value, and develop a competitive edge for a firm, thus it is well known as the most essential type of innovation.
4. TI contributes growth in terms of employment generation, sales turnover, and investment to the small medium enterprises (SMEs) (Bala Subrahmanya, Mathirajan, & Krishnaswamy, 2010). Hence, TI has the prospects to encourage growth of individual enterprises at both the micro and macro level.
5. TI is a critical factor to be considered by firms as it is strongly believed to improve the level of competitiveness in state and regional, drives the development in economy, and safeguards social stability (Bond, 2004; Sabir & Sabir, 2010) as well as gaining entry into the new markets (Becheikh, Landry, & Amara, 2006).
6. TI is believed to help a firm take on its climate responsibility by curbing carbon emissions further (Jin, 2012).

Due to the reasons stated above, both product and process innovations have been viewed as two vital elements that formed TI (Chuang, 2005; Lee et al., 2013a, b; Cooper, 1998; Ng et al., 2012; Damanpour & Gopalakrishnan, 2001).

2.9 Relationships between TQM, Organizational Learning, and Technological Innovation

The relation between TQM and organizational performance is a recurring topic in several branches of management, in particularly operations management, and it is of utmost interest to both practicing managers and academic scholars alike. TQM has gained wide spread popularity around the globe due to the impact it brings and the interrelationships of various main TQM drivers/practices on key business results (Sabella, Kashou, & Omran, 2014). In this section, the interrelationships between the three main constructs which are TQM, OL and TI is explained in general.

2.9.1 Interrelationship between TQM and OL

Organizations with successful TQM implementation tend to learn more, in that these organizations can easily develop a culture of sharing and transferring of knowledge. OL is replicated and promoted by the employees when the top management instigated TQM in organizations (Hung et al., 2011), hence some researchers believed that OL is an expected outcome of TQM (Yusr, Mokhtar, & Othman, 2013; Akgun, Incem Imamoglu, Keskin, & Kocoglu, 2014). Many researchers have investigated and discussed the importance of TQM in

OL. For example, Yusr et al. (2013) empirically studied 139 manufacturing firms in Malaysia and concluded the significant and positive relationship between TQM and OL. At the same time, Akgun et al. (2014) confirmed that TQM significantly affect OL capabilities among 193 firms in Turkey. In the meantime, Iyer, Saranga, and Seshadri (2013) proposed that if the core practices of TQM are executed successfully, it will induced learning in a firm, which will subsequently result in productivity improvement and sustainable quality. As TQM creates an organizational culture of trust, employee would be more involved in OL (Yazdani, Attafar, Shahin, & Kheradmandnia, 2016). However, past literature on the issue of TQM and OL fails to establish a clear relation between these two in the context of the Malaysian manufacturers. Some past studies consider TQM as a single factor that influences OL and empirically concluded the relation between them to be a positive one (Lam et al., 2011; Yusr et al., 2013; Jimenez-Jimenez, Martinez-Costa, Martinez-Lorente, & Rabeh, 2015). A more comprehensive study need to be carried out to analyze which TQM dimension in the form of MBNQA model will have more impact on OL, or whether some of these dimensions posed as a barrier to it. Following this, this research adopts a multidimensional approach of TQM to investigate the relations between MBNQA-TQM on OL in a more comprehensive context among the Malaysian manufacturers.

2.9.2 Interrelationship between TQM and TI

TQM creates a favourable and fertile environment or platform for innovation to occur. TQM has provided firms with the required impetus and commitment to establish a climate of unending innovativeness. Empirical evidence provided by Zeng, Phan, and Matsui (2015), and Kim, Kumar, & Kumar (2012) validates this positive effect. They concluded that the hard aspects of TQM are strongly correlated to the higher novelty of product innovation. For example, Kim et al. (2012) study argued that with the implementation of quality management tools, it can help a firm to recognize the probable innovation areas, come up with the proper innovation plans, and with that innovate the relevant processes and products accordingly. However, there are conflicting arguments on the relationship between TQM and innovation (Prajogo & Sohal, 2001), claiming that the principles and philosophy of TQM are incompatible with innovation. One group of arguments asserted that continuous improvement emphasizes on incremental change, requiring formalization and standardization to establish stability and control (Jha, Noori, & Michela, 1996), yielding rigidity and inhibiting innovation. Process management practices, which generally aims to eliminate waste and improve efficiency could be damaging to innovation according to Sadikoglu and Zehir (2010) as it diminishes slack resources that are needed to fertilize innovation. Furthermore, customer focus, which is an element of TQM, have been criticized as a source of innovation. Authors like Slater and Narver (1998) contended that focusing on customer could lead the organization to be “narrow-minded” to the present product and services instead of further exploring into customers’ needs. Nevertheless, positive viewpoints contends that firms embracing TQM in their culture and system can provide a healthy ground for innovation growth. “In many ways TQM can be seen as laying the foundation of a culture environment that encourages innovation”, as contended by McAdam, Armstrong, and Kelly (1998, p.141). Three subject areas - customer focus, flexible organizational structure, and innovative staff, which are in line with the

TQM practices, are important for innovation, according to Pfeifer, Siegler, & Varnhagen (1998). TQM supports customer orientation, which also stresses the importance of satisfying customers, and thus orientating towards customers' needs can motivate a firm to be creative (Prajogo & Sohal, 2003a). TQM implementation could also cause changes to a firm's structure, making it flexible, and this would produce a positive effect on innovation. Thus, it can be concluded that TQM create the right atmosphere and culture for ongoing innovations and ultimately radical innovations to occur (Santos-Vijande & Alvarez-Gonzalez, 2007). Even though there has been an increasing number of empirical literature studying the relation between TQM and TI, results remain inconsistent and thus inconclusive. Thus, it is essential to confirm and establish the relation between each MBNQA practice with TI in the context of the Malaysian manufacturers.

2.9.3 Interrelationship between OL and TI

The impact of OL on a firm's performance was first proven by the learning curve model from the perspective of an industrial organization's economics. In some instances, firms having the greatest experience when comes to manufacturing a product or service will incur the lowest cost in an industry, thus gaining a cost-based advantage (Barney, 2007), which is beneficial to the manufacturing firm. Meanwhile, from the resource-based view, it posits that organizations are able to gain sustainable competitive advantage through the exploitation of its resources and capabilities (Barney, 2007), in which OL is believed to assist firms to do so. In line with this, OL has been identified as a concept by Karash (2002) as a resource-oriented approach that is based on firm's abilities to transform standard resources that are made available into competences that are distinctive and cannot be easily imitated, replicated and transferred by competitors. Empirical evidence on the positive and significant linkage between OL and innovation still exist even until recent years. For example, Zhou, Hu, and Shi (2015)'s study, which indicated the positive association between OL on firm performance (i.e. innovation and financial performance) on 287 listed Chinese companies using sources from secondary data. Investigating on the high-tech industry in Taiwan, Sheng and Chien (2015) has also proven that a high degree of learning orientation has a more pronounced effect on incremental innovation than on radical innovation as knowledge is being applied to refine products in a way that is consistent with the current organizational processes and routines. In line with this, Benjamin, Rita, and Felix (2014) which gathered data from 119 participants working with a Spanish car manufacturer stressed the importance of having a good team climate for learning as it enhances performance and innovation in the long-term. Therefore, from the past literature, it has become clear that the relationship between OL and TI is definitely a fruitful field of future research and should be thoroughly investigated in organizational settings.

2.9.4 Interrelationship between TQM and TI with OL as the Mediator

Innovation performance can also be affected by TQM through the mediating role of OL. Soft quality management, which promotes employee participation, empowerment and teamwork, facilitates knowledge sharing and can be expected to link with innovation (Sitkin, Sutcliffe, & Schroeder, 1994). Flynn (1994) also stressed the significance of soft TQM practices in establishing teamwork, encouraging creative ideas from employees, and promoting communicative atmosphere to achieve fast product innovation. In line with this, soft quality management practices in accordance to Zeng et al. (2015) supports open communication and allows for creative ideas to be generated, which is vital for innovation. Transformational/transactional leadership styles (i.e. another dimension of TQM) have been investigated by Vargas (2015) among the small businesses and was found that such a blended leadership style is able to simultaneously implement diverse courses of action to facilitate OL in order to attain innovation, a higher performance and to gain competitiveness. At the same time, hard TQM practices such as effective process management supports firms to come up with routines that are based on best practices, which can then be applied to develop a learning base to support any innovative activities (Peng, Schroeder, & Shah, 2008; Perfomo-Ortiz, Gonzalez-Benito, & Galende, 2006). Effective use of quality information, such as receiving immediate and useful feedback from the manufacturing process (Flynn, 1994), is instrumental in speeding new products to the market (Kaynak, 2003). Unfortunately, little empirical evidence thus far exist to investigate OL (i.e. knowledge acquisition, dissemination, application and storage) as a mediating factor between each MBNQA-TQM dimension towards TI. Thus far, only Hung et al. (2011) and the author herself (i.e. Lee et al., 2013a, 2013b) have investigated on such a relationship. Thus, it will be worth investigating to determine whether such a mediating correlation exists among the ISO-certified manufacturing firms in Malaysia.

2.10 Chapter Summary

This chapter describes the evolution of total quality management, reviews the TQM concepts defined by well-known quality gurus from the past, and also diving into the descriptions of some of the famous quality awards used by researchers in the area of TQM. In addition, the six dimensions of TQM, four concepts of organizational learning and the two concepts of technological innovation adopted in this study have also been justified using past literature and presented in this chapter.

CHAPTER 3

RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

3.1 Introduction

Chapter 3 focuses mainly on the relation between TQM, OL, and TI based upon literature review. Section 3.2 describes the research framework of this study; while in section 3.3 presents the linkages established between TQM, OL, and TI as well as the hypotheses development based on past empirical studies. Finally, section 3.5 concludes this chapter.

3.2 Model of the Study

To assist in the examination of the tri-dimensional relationships between the three main constructs of TQM, OL, and TI, a research framework as demonstrated in Figure 3.1 is developed. Six MBNQA-TQM practices, namely leadership, strategic planning, customer focus, human resource management, process management, and information analysis, are portrayed to directly affect both OL and TI, at the same time indirectly affecting TI with OL serving as a intervening factor. In simple terms, the model proposes that a higher degree of TQM adoption will result in a higher level of OL and TI within the organization.

The current research attempts to explore and desires to narrow the research gap in the topic of TQM literature studies by laying down a foundation for an in-depth comprehension of the relation between TQM, OL and the TI.

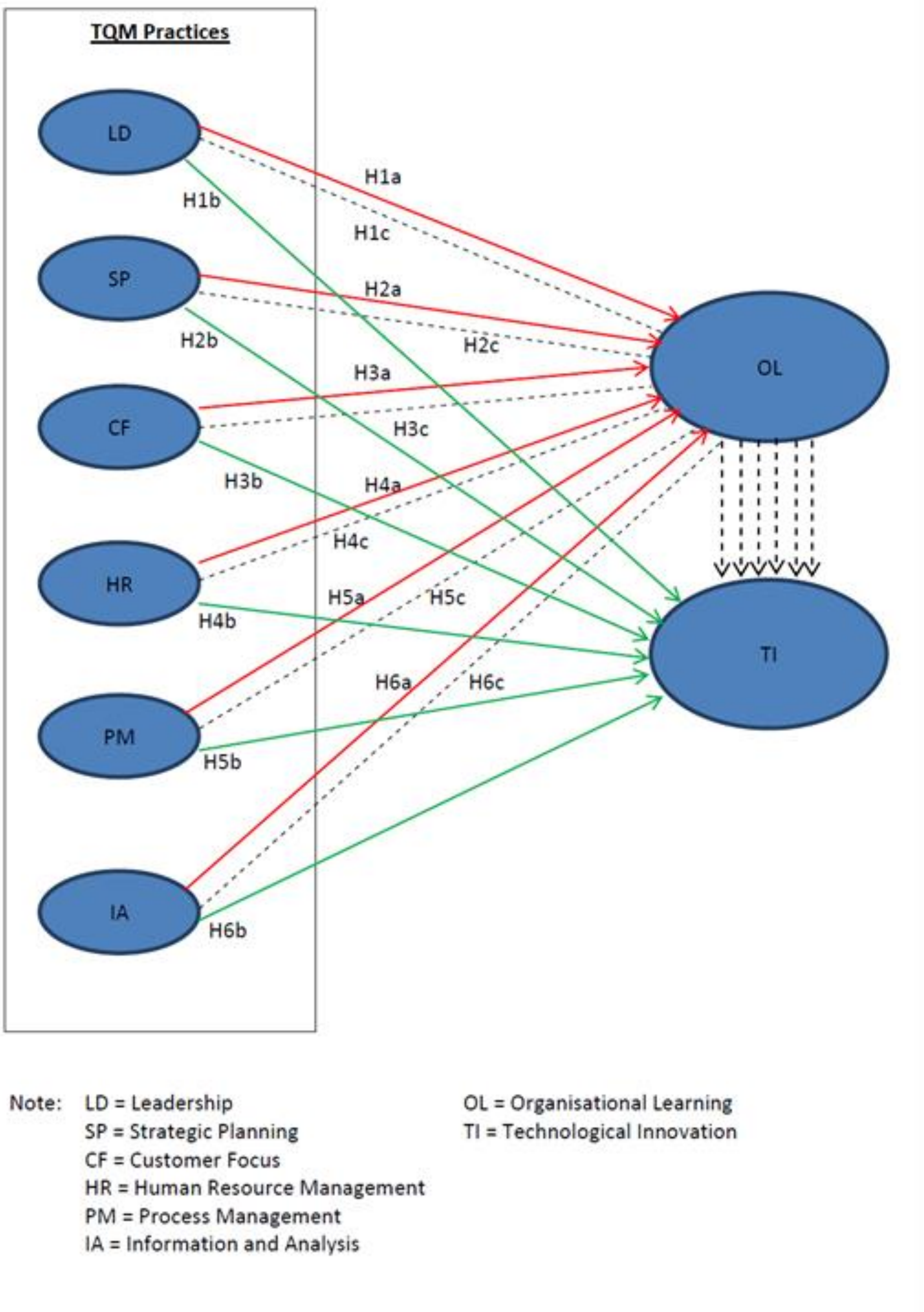


Figure 3.1 Conceptual Framework

3.3 Hypotheses Development

3.3.1 Leadership

Daft (2005) described a leader to be someone who plays a significant role among its followers, where his/her intention is for genuine transformation to happen that reflect the firm's shared objectives. The process of an effective leader is linked with the capability to develop a shared vision, promote systematic thinking, and encourage individuals to increase their skills to fit the environment. Leaders who are charismatic portray confidence, and this is expected to instill positive values into their followers so that they may recognize meaning in their work, increasing their willingness to invest time and effort for the job assigned to them (De Hoogh, Den Hartog, Koopman, Thierry, Van den Berg, Van der Weide, & Wilderom, 2005). Past studies conducted by De Hoogh et al. (2005) and DeGroot, Kiker, and Cross (2000) have shown a positive association between charismatic leadership and employees' effort, as well as work-related attitudes (organizational commitment, career satisfaction and job involvement).

A leader plays an essential part in the context of OL (Atwood, Mora, & Kaplan, 2010; Lam et al., 2011; Senge, Kleiner, Roberts, Ross, Roth, & Smith, 1999; Tung & Chang, 2011; Yee, Lee, Yeung, & Cheng, 2013), where they are said to be the ones to begin the change by incorporating themselves in the growing process that permit changes to occur within the company. Leaders who are successful have the ability to tap into the devotion of their employees to shape a common and promising future for both the firm and the individuals as a whole. Such dedicated leaders can also be termed as transformational leaders, according to Tucker (2004), where they possess values that can encourage their co-workers to become the best of themselves. There appears to be many researchers, both past and present (Berson & Avolio, 2004; Berson, Shamir, Avolio, & Popper, 2001; Birasnav, Rangnekar, & Dalpati, 2011; Elkins & Keller, 2003; Jogulu, 2011; Trautmann, Maher, & Motley, 2007), that supports transformational leaders having the ability to cultivate an environment that learns, adapts, changed for the long-term, which are in line with organizational learning. A study conducted in Indian software companies using Pearson's correlation and multiple regression-stepwise approach confirms that leadership styles in the likes of consulting and delegating are positively supporting OL; while directive and supportive styles are found to be negatively associated with the OL process (Singh, 2010). Furthermore, both transformational and transactional leadership styles are found to positively and significantly related to knowledge management practices using multiple regression analysis, with organizational culture being the moderator of the relationship among the SMEs in Australia (Nguyen & Mohamed, 2011). An empirical study was carried out by Michie and Zumitzavan (2012) recently in The Land of the Free – Thailand, where the relationship between management leadership styles and managers' learning on organizational outcomes was investigated. A case study approach was adopted, where questionnaires were distributed and follow-up interviews were gathered from managers of the small retail tyre firms in north-east Thailand. The findings from the survey proposed that leadership styles as well as learning styles do have an impact on organizational outcomes. Similarly, an earlier research was also carried out by Prugsamatz (2010) in Thailand, in search of the factors that affect OL sustainability in a non-profit organizational setting.

Factors consist of (1) individual motivation to learn (i.e. problem mastery, personal fulfillment, and rewards and recognition), (2) team dynamics (i.e. trust, team expertise, interpersonal communication, and empowerment) and (3) organization cultural practices (i.e. learning supportive leadership, learning supportive mission, learning facilitative structure, and learning facilitative alliance) on organization learning sustainability (i.e. knowledge performance and mission accomplishment). Both qualitative and quantitative research methods which comprised of in-depth interviews and survey questionnaire were adopted. With the use of both qualitative and quantitative analysis (i.e. pearson correlation and multiple regression analysis), the results were generated. It was found that all three main factors (i.e. individual motivation to learn, team dynamics, and organization cultural practices) significantly affect organization learning sustainability in a non-profit setting. However, in the context of 150 software developers in Sri Lanka using regression analysis, the support of a team leader was found to be not a significant predictor of voluntary knowledge sharing in project teams (Wickramasinghe & Widyaratne, 2012). On the other hand, in another research conducted by Xue, Bradley, and Liang (2011), empowering leadership has proven to significantly affect knowledge sharing among college students in major universities in the States with the use of partial least squares technique.

A leader that have a substantial influence on the innovation processes of their firms is believed to hold strong leadership competence (Bossink, 2004; Hauschildt & Kirchmann, 2001; Jung, Chow, & Wu, 2003; Lee, Lam, Ooi, & Safa, 2010a). Sony and Naik (2012) opined that a leader plays an essential role in relating Six Sigma, OL and innovations together, at the same time, they also need to have the ability to build shared vision and be genuinely committed to move the organization forward. It is essential that a leader lend his/her support to his/her own staff that strives to be innovative. Many researchers have looked into the proposition of a leader as being the main determinant to achieving a successful innovative performance in firm (Waldman, Ramirez, House, & Puranam, 2001). An increasing number of studies has further researched into the ways to improve strategic leadership in order to cultivate an environment that is favorable to innovation (Williams, 2004; Waldman et al., 2001). An explorative research was conducted by Bossink (2004) on the effectiveness of different innovation leadership styles (namely instrumental, charismatic, interactive, and strategic) on ecological innovations (i.e. product and process innovations) in construction projects. From the case study, it was shown that when a manager displays constant performance of a leadership style, coupled with an injection of ecological information, it can stimulate ecological innovativeness of the project. Borgelt and Falk (2007) have also conducted a qualitative case study by interviewing leaders and managers in three large companies in Australia on how leadership can foster innovation. The key finding of the paper reported that leadership releases social capital, along with required knowledge resources to help ease the tension between risk management and innovation. Guimaraes (2011) has recently conducted a field test, investigating on the important determinants that can affect the success of business innovation. Four main determinants have been identified, which are strategic leadership, management of technology, competitive intelligence, and specific characteristics of the company's innovation process. With industry clockspeed being the moderator between these determinants and innovation success, the research was carried out to test the proposed framework. Empirical evidence has proven the significance of industry clockspeed as being the moderator variable in the linkage between the four main factors and innovation success. Similarly, using multiple regression analysis, Donate and Guadamillas (2011) also empirically concluded that leadership significantly influenced innovation among 111 Spanish companies in the innovative industries.

Furthermore, it has also been empirically proven that organizational learning may be a mediating factor between leadership and technological innovation. As proven by Hung et al. (2011), in which their empirical investigation was carried out to determine the associations between TQM (i.e. top management support, continuous improvement, employee involvement, and customer focus), OL (i.e. learning culture and learning strategy) and innovation performance (i.e. product, process, and overall organizational innovation) among the high-tech firms in Taiwan. 223 samples were gathered from the high tech industry firms located in Taiwan. From the SEM analysis, OL as a mediator was proven significant between TQM and innovation performance and at the same time fosters innovation performance. In another related study, also using the analysis of SEM, transformational leadership is positively linked to improved organizational performance through both mediators of OL and organizational innovation among 168 Spanish firms (García-Morales, Jiménez-Barrionuevo, & Gutiérrez-Gutiérrez, 2012). Similarly, using SEM analysis, OL has also been proven to mediate between top management support and organizational innovation among 201 Spanish technological companies

(Bolívar-Ramos, García-Morales, & García-Sánchez, 2012). From the local context, OL was found to partially mediate the relationship between leadership and TI among Malaysian manufacturers using Baron and Kenny (1986) three-step method (Lee et al., 2013a, b). Given the above discussion, it is essential to understand whether leadership contributes to both organizational leaning and technological innovation. Given the important role held by the top management, one can conclude that any TQM effort would be ineffective if the top managements are not fully committed to this matter. As shown in the previous paragraphs, many prior empirical studies recognized the direct relationship between leadership with both OL and TI, as well as indirect relationship with TI with OL being the mediator. Given these past findings, it is vital to understand whether leadership, a dimension of TQM, contributes to both OL and TI from the context of ISO-certified manufacturing firms. Thus, it is hypothesized that:

H1a: Leadership is positively related to organizational learning in Malaysian manufacturing firms.

H1b: Leadership is positively related to technological innovation in Malaysian manufacturing firms.

H1c: Organizational learning will be the mediator between leadership and technological innovation among the Malaysian manufacturing firms.

3.3.2 Strategic Planning

Freeman (1984) describes strategic planning as a long run (not less than three years), hierarchical top-down procedure and it is aiming towards achieving a prospective future for the organization. Considered as holistic in nature, strategic planning is predominantly related to the top levels of management.

Nevertheless, this conservative strategy has transformed into a more participative approach, where people are involved when vision, objective and form of a company is being decided (Collier, Fishwick, & Floyd, 2004; Jarzabkowski, 2008; Liedtka, 2000a, b). Prior research (e.g. Gibson & Cassar, 2005; Klatt, Schlaefke, & Moeller, 2011) has confirmed strategic planning having an impact on firm's performance. Some have even proven that strategic planning contributes significantly to SME success (Schwenk & Shrader, 1993; Robinson & Pearce, 1984). Others have demonstrated that small firms having strategic planning in place have a higher chance of survival as compared to those non-planning ones (Birley & Niktari, 1995; Capon & Farley, 1994), especially for the newly start-up companies (Castrogiovanni, 1996; Delmar & Shane, 2003).

Explicitly, past research has proposed that OL can be promoted through participative strategic planning. With the involvement of people in strategic planning, Kim and Mauborgne (1998) argued that trust and social capital among the people may increase, which may then impact on knowledge sharing and OL positively (Hutzschenreuter & Kleindienst, 2007). With participative strategic planning in place, it fosters the interaction among members, in that a shared understanding about a strategy can be developed, and perhaps new business opportunities can be recognized, in which allocation of resources can be arranged to exploit new opportunities (Beer, Voelpel, Leibold, & Tekie, 2005). In accordance to Mintzberg and Lampel (1999), the process of determining a strategic fit can be defined as an OL process. Additionally, when a strategy is developed, it is essential that the strategy (e.g. visions and targets of firm) be communicated (Slater & Narver, 1995). The communication of a firm's strategic plan is a vital component of OL as it includes organizational members in a strategic dialogue, enhances their understanding of the firm’s strategy and steers OL to a common direction (Gibson & Birkinshaw, 2004). Past empirical research proposed that through the development of learning targets in firms, it can assist management to be more effective in the OL process. However, a study conducted by Kohtamaki, Kraus, Makela, and Ronkko (2012) on the SME IT companies in Finland shows insignificant relationship between participative strategic planning and OL using Mplus-analysis. The authors suggested that the managers need to search for other means to facilitate learning at the firm level. Likewise, strategic planning was also found to be not significantly related to learning organization among the Malaysian manufacturers, as proved by Lee et al. (2012)’s research using SEM; while the MBNQA-TQM dimensions, one of which is strategic planning, were found to significantly relate with both learning orientation and market performance among 146 local service firms in Malaysia using SEM analysis (Lam et al., 2011). Nevertheless, based on the numerous empirical studies conducted by the past researchers, the positive correlation between strategic planning and organizational learning is strongly supported.

The earlier research conducted by Rothwell (1992) and Swan and Newell (1995) opined that a business strategy that incorporates the adoption of a new technology is positively correlated with innovation rate. Recent study of Lau, Yam, and Tang (2010) described strategic planning capability as an organization’s capability to recognize its internal strengths and weaknesses and external opportunities and threats, and to devise a plan according to the company’s vision and mission statements, so that the firm can be positioned according to its environment. An empirical study conducted by Lau et al. (2010) in Hong Kong seeks to examine the effect of technological innovation capabilities (TIC) on a firm's innovation performance. The capabilities of learning, research and development (R&D), resource allocation, manufacturing, organizing, marketing, and strategic planning were elements that represented TIC. Using a survey method, 81 data were attained from the electronics firms in that country. To examine the correlation between TIC and innovation performance, both Pearson correlation and regression analysis were performed. The findings confirmed that R&D, allocation of resources, learning, and strategic planning capabilities improve the innovation sales significantly. In the study of Lee et al. (2010b) where SEM analysis was performed on the relations between TQM and product innovation among 125 managers working in the Malaysian electrical and electronics (E&E) firms, concluded that strategic planning, a TQM practice, is positively and significantly associated with product innovation performance. Additionally, Lee et al. (2010a) also proved the positive and significant relationship between TQM practices that are based on the MBNQA model, with both customer satisfaction and innovation among 241 Malaysian firms using SEM analysis.

Additionally, a theoretical possibility exist where OL mediates the effects of strategic planning on technological innovation with the use of Baron and Kenny (1986) three-step approach (Lee et al., 2013b). As confirmed by Hung et al. (2011) among Taiwanese high tech firms; and Lee et al. (2013a) from the context of Malaysian manufacturing firms, OL is a significant intervening variable between TQM and innovation performance. By institutionalizing a comprehensive strategic planning, it is envisioned that the TQM implementation can be ensured to be successful, thus enhancing the performance of both OL and TI. As reported in the prior empirical studies presented above, many researchers did indicate that there is a significant relationship between both the OL and TI with strategic planning. Thus, the suggestion of the following hypothesis:

H2a: Strategic planning is positively related to organizational learning in Malaysian manufacturing firms.

H2b: Strategic planning is positively related to technological innovation in Malaysian manufacturing firms.

H2c: Organizational learning will be the mediator between strategic planning and technological innovation among the Malaysian manufacturing firms.

3.3.3 Customer Focus

It has become a significant component for a company to establish a close relationship with the customers as it serves to have a positive influence on both firm performance (Narver & Slater, 1990; Singh & Ranchhod, 2004) and salesperson performance (Cross, Brashear, Rigdon, & Bellenger, 2007; Donavan, Brown, & Mowen, 2004). As such, both marketing scholars and practitioners alike have switched their focus to the core capabilities of the firm, which is to learn about the wants and requirements of their customers and attend to them (Flint, Woodruff, & Gardial, 2002). In other words, when information regarding customer needs is collected and shared, an organization can be more sensitive towards their needs, respond accordingly and be prepared to respond rapidly (Kulp, Lee, & Ofek, 2004).

One of the ways for organizations to learn is through the feedback provided by the customers, where most of these feedbacks are directed to the frontline employees instead of the use of formal channels. A qualitative study was conducted by Wirtz, Tambyah, and Mattila (2010), where semi-structured in-depth interviews and a quasi-experimental study were used to explore the factors that affect employees' willingness to report customer feedback that can assist a firm in its OL process. From the study, it was found that social capital does impact positively on employees' willingness to report the negative feedback used for evaluation purposes. By doing so, it can assist firms to identify their strengths and weaknesses, at the same time generating ideas to enhance their service further. In line with this study, a qualitative study was conducted by Gorry and Westbrook (2011), where the importance of paying attention to customer stories has been proven to be a great way to learn from the customers (e.g. how they feel about the goods, services, and companies) and from there share their stories with others in the managerial level. By truly caring about the customers and what they have to say, it provides an avenue for business leaders to serve their customer better than their counterparts, enhancing their market opportunities to achieve competitive advantage. From the local context, an empirical study was carried out by Ang et al. (2011) to assess the relations between the MBNQA-TQM practices with both learning organizations and customer orientation among the small service organizations in Malaysia. Using multiple regression analysis, the survey data gathered from managers of these firms were tested. Customer focus was reported to be positive and significant in affecting the learning organizations. Also, in the empirical study of Lam et al. (2011), which investigates the structural relations among MBNQA-TQM, learning orientation, and market performance among firms in the service sector also concluded the positive and significant influence of customer focus (a TQM component) on LO. However, a structural relationship using SEM analysis was conducted between the MBNQA-TQM practices and LO, in which one of the TQM practice is customer focus (Lee et al., 2012) was found not significant among the ISO 9000 certified Malaysian manufacturing firms.

Additionally, in the ever changing and increasingly uncertain marketplace, where there are many customer needs to fulfill and international companies to compete with, organizations are left with no choice but to venture into the latest business process and to purchase the latest technology to stay in business for the long run (Vanhaverbeke & Peeters, 2005). Innovation that has the ability to introduce new products and processes, at the same time fulfilling customer requirements, have become a competitive weapon for many firms. Cooperation with customers provides various benefits, such as identifying business opportunities and reducing the possibilities of poor design at the start of a product development. Therefore, when customers are involved, the company has an upper hand in terms of product innovation (Tsai, 2009). This has been proven later by Najib and Kiminani (2011), where three forms of cooperation, namely (1) inter-firm cooperation; (2) cooperation with the government; and (3) cooperation with research institutions can facilitate SMEs to become more innovative have been empirically examined. According to Najib and Kiminani (2011), inter-firm cooperation comprised of cooperation with different collaborators, such as supplier, customers and competitors. Through the use of path analysis technique, findings certified the significant relation between cooperation and innovation of SMEs in the food processing sector. A similar empirical study was conducted on the SMEs located in the Turkish science and technology parks by Ar and Baki (2011), examining the impact of seven factors (namely top management support, R&D strategy, creative capability, organizational collaboration, organizational learning capability, supplier relationship and customer focus) on innovation (i.e. product and process) and firm performance. With 270 data gathered from managers of these firms, the proposed hypotheses were tested using SEM analysis. The result certified that R&D strategy, creative capability, top management support, customer focus, and supplier relationship have a positive and significant relationship with process innovation. Findings also further confirm that both types of innovations have a positive impact on firm performance. In another related study, TQM practices such as leadership, information analysis, process management, customer focus, strategic planning, and human resource management were investigated on its impact on product innovation among the Malaysian E&E firms (Lee et al., 2010b). Using survey methodology, a total of 125 usable data were gathered and SEM analysis was performed. Findings from the study confirmed that all six practices were reported to positively and significantly link with product innovation performance. Likewise, the MBNQA-TQM practices were also confirmed to be positive and significantly related with both customer satisfaction and innovation among firms in Malaysia, as investigated by Lee et al. (2010a). Zhang and Duan (2010) on the other, hand investigated the impact of market orientation (i.e. competitor orientation, customer orientation, and interfunctional coordination) and innovation orientation on new product performance among the Chinese manufacturing firms. 227 questionnaire surveys were gathered from the manufacturing firms in China. Both analysis of SEM and hierarchical regression were used to test the hypotheses constructed. It was concluded that market orientation and innovation orientation have a positive and significant influence on new product success.

As focusing on customers' requirements can improve a firm's OL and innovative ability, while learning from customers can also enhance a firm's creativity, OL can thus be assumed to intervene between TQM and TI (Lee et al., 2013b). This was further proven by Hung et al. (2011) and Lee et al. (2013a) whereby OL connects the dimension of customer focus with innovation performance. As frequently discussed in the literature of TQM, the ultimate goal of TQM is to satisfy the reasonable needs of the customers, in which one of the ways to satisfy their needs is through interaction (i.e. learning from customers). The interaction between organization and customer is vitally essential. An organization is better able to ascertain the specifications required by customers through the interaction with customers. By institutionalizing a customer focus approach through the implementation of TQM, it encourages the manufacturing firms to continuously look for new ways to produce products and deliver services that meet customers' needs, interests and expectations (i.e. technological innovation). The implementation of TQM can henceforth be considered as a success if it's able to constantly add value for customers. Thus, the hypotheses are as follows:

H3a: Customer focus is positively related to organizational learning in Malaysian manufacturing firms.

H3b: Customer focus is positively related to technological innovation in Malaysian manufacturing firms.

H3c: Organizational learning will be the mediator between customer focus and technological innovation among the Malaysian manufacturing firms.

3.3.4 Human Resource Management

In an increasingly competitive environment today, human resource management has become a main strategic resource that contributes to a firm's value. As such, firms are trying their level's best to develop their human resources with the purpose of transforming them into sustainable competitive advantage (Ordo´n˜ez de Pablos, 2004). There are a myriad of benefits which are linked to an effective HRM, such as a reduced cost in production, an improvement in product quality and profitability, at the same time attracting and retaining capable employees (Ordóñez de Pablos & Lytras, 2008), in which one of it is the ability to learn.

Lopez et al. (2006) explore the relationship between HRM on OL among 195 companies in Spain. Using SEM, findings supported HRM as a determining factor of OL, in which it positively influence a firm's learning ability. In Malaysia, Fong, Ooi, Tan, Lee, and Chong (2011) also examines the correlation between HRM and knowledge sharing on both the manufacturing and service sectors in the country. A total of 237 data was collected from the managers of these firms. With SEM technique being applied to examine the theoretical model, it was proven that HRM can positively affect the knowledge sharing of the Malaysian companies. Additionally, Ang et al. (2011) and Lam et al. (2011) also confirmed the positive significant association between HRM (a TQM practice) and learning organizations/learning orientations among the service firms in Malaysia. In another related study, factors that affect the OL sustainability in a non-profit organizational setting have also been investigated by Prugsamatz (2010). Utilizing both qualitative (i.e. in-depth interviews) and quantitative (i.e. questionnaire survey) methods, the findings indicated that factors such as motivation to learn, team dynamics and organization culture practices play a major role in influencing the OL sustainability of the non-profit organizations. This was later proven by Song, Jeung, and Cho (2011) using SEM in that a supportive environmental, comprising of people level support (e.g. supporting continuous learning, promoting team learning, encouraging dialogue, and fostering empowerment) and structural level support (e.g. providing strategic leadership, structuring embedded system and encouraging system connection) can also significantly affect the OL processes. Also, in the recent empirical study carried out by Lee et al. (2012) using SEM analysis, positive and significant linkage between human resource focus and learning organization was reported among the Malaysian manufacturing firms that have been certified with ISO 9000.

On the other hand, human factors in particularly HRM is said to be the key determinant of a successful innovation, as human element is integrated into the development of innovation (Vrakking, 1990). The interest to analyse the linkage between HRM and innovation was carried out by Jimenez-Jimenez and Sanz-Valle (2005) to establish whether HRM affects the innovation of a firm or otherwise. From the empirical investigation using logistic regression on a sample of Spanish organizations, the results proved the support of HRM influence on innovation. Abu Bakar and Ahmad (2010) empirically assessed the relationship between firm resources (focusing on both tangible and intangible assets) and product innovation performance. Questionnaire survey was mailed to the small and medium enterprises in Malaysia. Through the descriptive analysis, intangible resource (i.e. physical, financial, organizational, reputational, human/intellectual and technological resources) remain the prime factors of product innovation performance. In a study conducted by Donate and Guadamillas (2011), relations between the organizational factors (such as leadership, cultural values, and human resource practices), innovation and knowledge exploration and exploitation practices was investigated using hierarchical multiple regression analysis. Survey data were collected from 111 Spanish firms that belong to the innovative sector. From the findings, it is proposed that when organizational factors are well established, the human barriers to knowledge management can be overcome, resulting in a more successful exploitation of innovation capacity. In the empirical study of Lee et al. (2010b) using SEM approach, the practices of TQM (i.e. HRM, leadership, customer focus, strategic planning, process management, and information analysis) were also reported to be positive and significantly affecting product innovation performance among the 125 E&E firms in Malaysia. Using the analysis of SEM, Lee et al. (2010a) further confirmed the same positive and significant result among TQM, customer satisfaction and innovation among the local firms in Malaysia.

In addition, OL as a mediator between HRM and TI does exist (Lee et al., 2013b), as proven by the empirical research conducted by Chen and Huang (2009). Knowledge management capacity was investigated on whether it mediates the association between strategic human resource practices and innovation performance. Questionnaire were distributed and collected back from 146 from top executives working in the top 5000 Taiwanese firms. Results from regression analysis explained that strategic human resource practices are related positively to knowledge management capacity, which positively impacted on innovation performance. From this study, it is evident that knowledge management capacity plays an essential mediating factor. OL was also found to partially mediate the association between human resource focus and TI within the local manufacturers in Malaysia, as proven by the study of Lee et al. (2013a). Through the implementation of various HRM practices, such as training, employees will know what is essential and required to be performed, thus motivating them to learn during training. With better training, defect rate can also be lowered thus achieving better overall company performance. Additionally, when employees feel empowered and involved, this will also provide them an avenue to be more innovative. Thus, the hypotheses for this study are as such:

H4a: Human resource management is positively related to organizational learning in Malaysian manufacturing firms.

H4b: Human resource management is positively related to technological innovation in certified manufacturing firms.

H4c: Organizational learning will be the mediator between human resource management and technological innovation among the Malaysian manufacturing firms.

3.3.5 Process Management

Process management has become a significant part of modern organizations in all industries (Palmberg, 2010). Known as one of the dimensions of TQM, it is not merely about creating, developing, and implementing a set of business processes, but it takes into account the linkage between the processes and how to manage, analyze, and optimize them (Kohlbacher, 2010). It was recorded in the past that implementing PM consists of (1) removing the barriers between functional groups and connecting the organization together (Llewellyn & Armistead, 2000); (2) controlling and enhancing the organizational processes (Biazzo & Bernardi, 2003; Sandhu & Gunasekaran, 2004); (3) improving both product and service quality (McAdam & McCormack, 2001; Sandhu & Gunasekaran, 2004); (4) identifying outsourcing opportunities and utilizing technology to support business (Lee, 2005; Lindsay, Downs, & Lunn, 2003); (5) aligning strategic goals and customer needs with business processes (Lee & Dale, 1998); and (6) improving company effectiveness and the performance of business (Armistead, Pritchard, & Machin, 1999).

Interestingly, PM has the ability to improve collective learning within and between firms and its business environment, as mentioned by Bawden and Zuber-Skerritt (2002). A research was carried out to empirically investigate the relations between PM and knowledge management (KM) by Ju, Lin, Lin, and Kuo (2006). Data was gathered from the Taiwan manufacturing firms. Adopting the case study approach of both qualitative research and quantitative research, the results reported that PM can be considered as practical directions when executing KM value chain activities as the underlying task of PM incorporates reduction of cost, reducing cycle-time and increasing efficiency. Additionally, an empirical study was also conducted by Schymik, Kulkarni, and Freeze (2007) to observe the relations of business PM with KM. A sum of 57 survey data were gathered from organizations in Arizona. Utilizing the SEM approach, the result proved that business PM positively impacted KM. Furthermore, another past study proposed that the presence of PM supports the knowledge-based requirements management. A survey was conducted, where questionnaires were distributed to the functional heads and IT managers using an online portal. The hypothesis developed has shown to be acceptable from the result generated. From PM viewpoint, analysis of the present situation is required for knowledge-based requirements management to occur (Lehmann, 2012). In the local context, positive relationship were found between process management and learning organization/orientations among Malaysian manufacturers (Lee et al., 2012) and service firms (Lam et al., 2011), in which both these studies performed the SEM analysis. In another related study of Ang et al. (2011), with the use of multiple linear regression test, process management was reported to be the most significant determinant amidst the other TQM practices to influence learning organization among the small local firms in Malaysia.

In accordance to Paim, Caulliraux, and Cardoso (2008), PM is related to how an organization functions and how it manages organizational issues such as the values and culture of a firm (Schein, 1997), knowledge and information (Hlupic, 2003), people management (Cardoso, 2004), and continuous innovation (Davenport, 1993; Goldratt, 1990; Hammer & Champy, 1993). An empirical investigation conducted by Lee et al. (2010b) on the E&E organizations in Malaysia examined the association between TQM and product innovation performance. The elements of TQM for this study comprised of leadership, customer focus, strategic planning, information and analysis, human resource focus, and PM. Findings from the SEM analysis revealed that all six dimensions were positively linked with product innovation performance, with information and analysis being the most dominant TQM factor. Another related study conducted by Lee et al. (2010a), investigated on the effect of TQM practices (i.e. leadership, customer focus, strategic planning, human resource focus, information and analysis and PM) on both customer satisfaction and innovation. Malaysian manufacturing and service firms were the focus in this research and a total of 241 data were gathered via a questionnaire survey. The implementation of TQM practices has again proved the positive influence on customer satisfaction and innovation performance using SEM approach.

OL has been theoretically assumed to mediate the association between PM and TI performance (Lee et al., 2013b). OL has been proven to enhance innovation performance and plays a significant intervening role between TQM and innovation in the study of Hung et al. (2011). Also, in Lee et al. (2013a)'s empirical research among the Malaysian manufacturers, OL was found to fully mediate the relation between PM and TI. Thus, the following hypotheses are put forward:

H5a: Process management is positively related to organizational learning in Malaysian manufacturing firms.

H5b: Process management is positively related to technological innovation in Malaysian manufacturing firms.

H5c: Organizational learning will be the mediator between process management and technological innovation among the Malaysian manufacturing firms.

3.3.6 Information and Analysis

Information and analysis, is one important component under the TQM dimension. In the modern era, every level of an organization depends strongly on information to survive and thrive. There is a strong belief that without information nothing moves and whoever owns it possess the power. In other words, it is a vital resource that is required to develop other resources. Changing circumstances and surroundings have made the need to disseminate information to different levels of management a necessity. Given the increasing level of competition globally, organizations are adopting information technology to conduct their business electronically (Kahraman, Kaya, & Cevikcan, 2011). With the development and use of appropriate information system, adequate information can be disseminated throughout the entire organization, which will then lead to better planning, decision making, and better results (Adeoti-Adekeye, 1997).

As mentioned in O'Dell and Grayson's (1998) study, IT has been found to be significantly linked to knowledge transfer. Al-Gharibeh (2011)'s study later confirms that IT facilitates the knowledge transfer process. In other words, IT plays a vital role in the KM processes (King, 2005). A research was carried out by Pérez-López and Alegre (2012) to analyze on such relationship, where data from survey was collected from 162 managers working in IT intensive firms in Spain. Adopting the SEM analysis approach, the research concluded that competency in IT plays a vital part in the KM processes. Earlier, López, Peón, and Ordás (2009) carried out a study to establish the relations of IT competency with KM works. Methodology of this research inculcates mailing of postal survey to the CEOs of large IT firms and the usage of SEM analysis technique. Findings from the study have shown the positive relationship between IT and KM. Recently, Wu, Wu, Li, and Huang (2011) had also conducted a research incorporating theories from various studies to come out with the determinants of KM. The study hypothesized that IT is a significant driver to the KM performance of a firm. Top 500 companies from the profit rankings of service sector supplied the data for this study via an online survey questionnaire. To further comprehend the firm's present situation of their KM status, phone calls were subsequently made. 142 valid data were gathered in the end. Findings from the SEM path analysis approach supported the proposed hypothesis. Indeed, IT plays a significant role on firms' capability to churn out and utlize knowledge effectively. Based on a research conducted by Aman and Aitken (2011) on the IT on KM managers working in the manufacturing and technology services in Malaysia, the findings certified that IT used for KM had a significant positive relationship with KM capabilities. In other related studies, information analysis was reported to be positive and significantly associated with learning organizations/orientations among the Malaysian manufacturing firms (Lee et al., 2012) and Malaysian service firms (Lam et al., 2011).

IT has changed the manner in which a business operates tremendously, whereby investing in IT is believed to enhance a company's productivity level, innovativeness, performance and revenue, allowing for more efficient information processing, sharing and a speedier responsiveness, thereby resulting in a better coordination of organizational activities (Shin, 1999). The relation between information systems competencies and process innovation has been explored by Gordon and Tarafdar (2007), where a case study was performed on a healthcare company in the United States. They found that there is a correlation between six information system competencies (namely knowledge management, ambidexterity, project management, collaboration, business-IS linkages, and IT/innovation governance) and firm innovation. The investigation of the relation between TQM and product innovation continues with Lee et al. (2010b)'s study using the SEM method, in which information analysis was found to be the most dominant factor among other TQM practices such as customer focus, human resource management, leadership, process management, and strategic planning, in influencing product innovation performance among the E&E firms in Malaysia. Similarly, using SEM approach, the same positive and significant result of TQM, customer satisfaction, and innovation performance was again confirmed in Lee et al. (2010a)'s empirical research of 241 local Malaysian firms. In another study, the linkage between supply chain management practices, operational performance, and innovation performance (i.e. process, product, and service innovation) have been empirically analyzed by Chong, Chan, Ooi, and Sim (2011). The supply chain dimensions include strategic supplier partnership, information sharing, customer relationship, training, information technology, and internal operation. 163 data from Malaysian manufacturing and service firms have been collected and SEM analysis was conducted to reveal the results that these practices have a direct and significant effect on both organizational and innovation performance. It has also been further proven that a better innovation performance also leads to improved organizational performance. Besides that, the factors that influence the adoption of innovation management applications and its linkage with innovation process performance have been thoroughly investigated by Plewa, Troshani, Francis, and Rampersad (2012). Using both quantitative and qualitative research methods, the significance of perceived usefulness and compatibility of IMAs on user's work styles have been confirmed. Furthermore, the intention to use IMA has also been confirmed to be positively and significantly associated with innovation process performance.

In terms of whether OL plays an intervening role between information and analysis and TI (Lee et al., 2013b), Liao and Wu (2010) carried out an empirical research on the relation between KM, OL, and organizational innovation using SEM of LISREL 8.7. Results from the study concluded that OL as the mediator between KM and organizational innovation is significant. Questionnaires were sent to the "Common Wealth Magazine's Top 1000 manufacturers" and "Top 100 financial firms in 2007" and the relationships were analyzed using SEM analysis. This study implied that learning should be encouraged in an organization and members should learn from one another to increase the positive effect of TI. The same results were obtained in Lee et al. (2013a)'s study, in which OL mediated fully the relationship between information analysis and TI among the 258 Malaysian manufacturers. As documented, to assure the success of TQM, having an effective quality information system is strongly encouraged. Given the importance of its functionality, many national quality awards, one of which is the MBNQA award, distinctly defines quality information systems as an essential criterion that must be handled effectively by TQM organizations. It is strongly believed that a good quality information system will enable the organization to deliver a more efficient procedure for data collection, presentation, distribution and use of quality data as a result of promising information communication technology development. Thus, the subsequent hypotheses are formed:

H6a: Information and analysis is positively related to organizational learning in Malaysian manufacturing firms.

H6b: Information and analysis is positively related to technological innovation in Malaysian manufacturing firms.

H6c: Organizational learning will be the mediator between information and analysis and technological innovation among the Malaysian manufacturing firms.

3.4 Hypotheses Summary

A summary of the hypotheses developed based on the MBNQA-TQM practices is presented in Table 3.1 as follows:

Table 3.1 Hypotheses Summary

MBNQA-TQM practices	**Hypotheses Developed**
Leadership	H1a: Leadership is positively related to organizational learning in Malaysian manufacturing firms. H1b: Leadership is positively related to technological innovation in Malaysian manufacturing firms. H1c: Organizational learning will be the mediator between leadership and technological innovation among the Malaysian manufacturing firms.
Strategic planning	H2a: Strategic planning is positively related to organizational learning in Malaysian manufacturing firms. H2b: Strategic planning is positively related to technological innovation in Malaysian manufacturing firms. H2c: Organizational learning will be the mediator between strategic planning and technological innovation among the Malaysian manufacturing firms.
Customer focus	H3a: Customer focus is positively related to organizational learning in Malaysian manufacturing firms. H3b: Customer focus is positively related to technological innovation in Malaysian manufacturing firms. H3c: Organizational learning will be the mediator between customer focus and technological innovation among the Malaysian manufacturing firms.

MBNQA-TQM practices	Hypotheses Developed
Human resource management	H4a: Human resource management is positively related to organizational learning in Malaysian manufacturing firms. H4b: Human resource management is positively related to technological innovation in certified manufacturing firms. H4c: Organizational learning will be the mediator between human resource management and technological innovation among the Malaysian manufacturing firms.
Process management	H5a: Process management is positively related to organizational learning in Malaysian manufacturing firms. H5b: Process management is positively related to technological innovation in Malaysian manufacturing firms. H5c: Organizational learning will be the mediator between process management and technological innovation among the Malaysian manufacturing firms.
Information and analysis	H6a: Information and analysis is positively related to organizational learning in Malaysian manufacturing firms. H6b: Information and analysis is positively related to technological innovation in Malaysian manufacturing firms. H6c: Organizational learning will be the mediator between information and analysis and technological innovation among the Malaysian manufacturing firms.

3.5 Chapter Summary

The theoretical model illustrating the tridimensional relations among TQM, OL, and TI was shown and presented in this chapter. A review on the past empirical research describing the relations among TQM and OL, TQM and TI, as well as the structural relations among TQM, OL and TI, where OL plays an intervening role between TQM and TI were discussed thoroughly in this chapter. Following the discussion of the past literature, the hypotheses developed in this section will be tested in the coming chapter. Research methodology illustrating the research design, population, sample and sampling procedures, variables and measurements, data collection method as well as data analysis techniques would be provided in Chapter 4.

CHAPTER 4

Research Methodology

4.1 Introduction

The research design will be discussed in detail in this section following the set of research questions that were laid out in CHAPTER 1 and also the conceptual framework that was structured in CHAPTER 3. Systematically separated into three parts, this chapter will cover (1) issues relating to research design; (2) survey instrument and operationalization of research constructs; and (3) statistical analysis. Each of this section will be discussed comprehensively in the following subsections.

4.2 Research Design

Research design main purpose is aimed to link the research questions to the data. In other words, the design of this research is to link the questions to the data, as well as the instruments and procedures undertaken to answer the questions (Zhang et al., 2000). A good research design must be designed in a way that the research questions are well fitted to the data. According to Punch (2000), research design is described as a basic blueprint of the empirical research, incorporating some main ideas which include strategy, sample, the techniques and the procedures of collection and examination of the empirical data.

4.3 Research Strategies

To carry out an empirical research, two main methods are available for data collection. They are the qualitative and the quantitative method. However, both of these methods have advantages and disadvantages of their own. The qualitative methodology allows researchers to examine a specific issue in detail and with depth. The researcher is not constrained by the present list of analysis while approaching fieldwork, contributing to the openness, depth and detail of qualitative inquiry. Hence, useful detailed information regarding a smaller sample of people as well as cases can be acquired. According to Patton (1990), although such a method increases the understanding on a specific case and situation under study, generalization is reduced. By contrast, the quantitative techniques entail the use of standardized tools in order that the various perceptions and experiences by each individual can be fitted into a limited list of predetermined answer categories, where a number is assigned to each of it. One of the quantitative method advantages is the possibility of measuring the reactions of many to a limited set of questions, hence facilitating the statistical aggregation of data and comparison among different sets of data. Such a method is believed to provide a wider and a more general set of findings that can be presented succinctly and parsimoniously (Patton, 1990).

Based on the existing theories, a theoretical framework concerning TQM practices was derived. Essentially, it is essential to verify the theory first in order to answer the research questions presented in this research. Punch (2000) claimed that the study of theory verification purports to more accurately test the theory, examining the hypotheses derived from existing theories. When conducting social science studies, it is common for the researcher to choose the quantitative method. A theory will form the base of the research, in which the hypotheses will be deduce from the theory itself and tested using a set of data (Zhang et al., 2000). Hence, using a questionnaire survey is believed to be the most proper strategy to respond to the research question in this research. By using a questionnaire survey, it incurs a lower cost as compared to other forms of data collection. The questionnaire surveys can be easily sent via email to companies with the availability of Internet. The advantages of using such method are that it incorporates a wider geographic coverage within the sample population and larger sample size.

As this research purports to assess the relations between MBNQA-TQM practices, OL and TI among Malaysian manufacturers, the most suitable research strategy to be employed in this research is quantitative approach via self-administered questionnaire survey (Chew, 2007). In other words, a non-experimental quantitative correlational design is involved in this research to measure the influence of MBNQA-TQM dimensions on both OL and TI among the ISO-certified manufacturing firms. The quantitative method employed in this research requires participants to complete a survey to measure, test and ascertain the relationships between the variables. According to many researchers in the likes of Calvo-Mora, Leal, and Roldan (2006), Calvo-Mora, Picon, Ruiz, and Cauzo (2013), Gil-Marques and Moreno-Luzon (2013), Gomez, Costa, and Lorente (2011), Jayamaha, Grigg, and Mann (2011), Moreno-Luzon, Gil-Marques, and Valls-Pasola (2013), and Silva, Gomes, Lages, and Pereira (2014), quantitative correlational design using PLS-SEM method is one of the strongest research approaches in operations management, specifically in the research of TQM. Hence, the most suitable research design to be adopted in this study is a quantitative correlational design.

There are two phases that made up the entire methodology. There are (1) Pre-assessment, also known as pre-testing and (2) Assessment (Measurement, Data analysis and Recommendations). For the first phase, an initial questionnaire derived from past literatures was developed. During the pretest evaluation process, which involved professionals and academicians, several problems with the drafted questionnaire were corrected and rectified. As this process was insufficient, a pilot test procedure involving respondents which are similar to those who will be sampled in the main study is carried out (Bradburn, Sudman, & Wansink, 2004). The purpose of the pilot test was conducted in order to (1) remedy the problem in comprehending and answering to the questionnaire items, (2) identify and determine the questionnaire items that need rephrasing, (3) record the time needed to complete the questionnaire, and (4) test the goodness of the instrument. 36 managerial personnel from small-medium-enterprise ISO-certified manufacturing firms were involved in the pilot study. The respondents were required to comment on the questionnaire items to reduce any confusion that might arise from unfamiliarity with the terminology. In another words, the respondents were required to indicate if they were unable to comprehend any part of the survey questionnaire. During the period of pilot study, there are no evidence indicating any misinterpretation, misunderstanding or even confusion between items in the survey questionnaire. Following the completion of the pilot test, goodness of fit of the instrument was conducted.

This is then followed by the second phase, which involves the planning of the assessment, carrying out the assessment to gather the required information and data, and provide suggestions based on the findings. In other words, the main study is also based on survey, whereby the samples of the Malaysian manufacturing companies were identified to carry out the study. The questionnaires items that have been refined were used to gather the data on the identified issues and appropriate statistical tools were used to analyze the data gathered. By the end of the research, a model is developed to identify the essential MBNQA-TQM elements that will affect both the organizational learning and technological innovation performance.

4.4 Data Analysis Technique

The three research questions entails testing the theoretical model hypothesized in this research. It is essential to ensure that the measurement instruments are both reliable and valid before proceeding to test the model. To determine the reliability and validity of the measurement instruments, reliability analysis and factor analysis need to be carried out. Smart PLS software was used in the assessment.

To assess the relations between the variables as described in the model, PLS-SEM was selected to be the most appropriate statistical method. According to Parker (2013, p.61), PLS is an advanced regression and principal component analysis that investigates the relationship between a matrix of independent variables and a dependent variable. As PLS-SEM can be used to examine small sample sizes as in the current study research samples, examine data that may not follow a normal distribution, and examine data that are complex and have multiple indicators and relationships (Hair, Hult, Ringle, & Sarstedt, 2014), this approach was chosen.

PLS-SEM consists of several components. Independent variables are also known as exogenous latent variables; while the dependent variables are also known as endogenous latent variables. Indicators, also known as manifest variables, are related with every latent variable. To examine the measurement model, the individual item reliability, internal consistency, and discriminant validity are examined. During this process, the scores of the latent constructs are estimated, the estimates of the outer weights and loadings are calculated, and the path coefficients of the structural model are determined. As the algorithm estimates the coefficients for the partial ordinary least squares regression models in both measurement and structural models, the path modeling procedure is also known as partial (Parker, 2013, p.62).

Meanwhile, to test the mediating role of OL on TQM-OL-TI linkage as indicated in RQ3, SmartPLS is employed. The mediating analysis investigates the relationship between the independent constructs and the dependent constructs and the mediating variable. There are some essential criteria to be considered, which include (Olalere, 2013, p.76):

- "The independent variable must reveal significant variation in the assumed mediation"
- "The mediation must be revealed measurable influence on the dependent variable"
- "A controlled effect on the path of the mediator should have an effect on the dependent and independent variables"

From the mediating analysis, it is predicted that the mediation would yield either a full, partial, or no mediating effect at all (Olalere, 2013). The mediating effect in question for the three main constructs is whether OL would serve as mediation between TQM and TI.

As PLS-SEM analysis itself have the ability to answer the research questions set out in CHAPTER 1, hence such an analysis would be deemed to be the most suitable statistical analysis method for this research. CHAPTER 5 will present the details of PLS-SEM analysis that were tested.

4.4.1 PLS-SEM Advantages

The main reason PLS-SEM was chosen in this research is because of its suitability in terms of its flexibility and capability in assessing the multifaceted constructs with numerous indicators (Olalere, 2013). Secondly, according to Chin, Marcolin, and Newsted (2003), large sample sizes, intervals scales and multivariate normal distribution are not required in a PLS analysis, hence confirming the superiority of PLS method as compared to other analysis techniques. Famously known for its capability to test small samples sizes, PLS-SEM can be concluded to be a better analysis option as compared to covariance-based Structural Equation Modeling (Chin et al., 2003; Lee, Ooi, Chong, & Lin, 2014). In accordance to Hair, Black, Babin, and Anderson (2010), a sample size ratio of 1:10 is considered to be sufficient and adequate for PLS path modeling. Considering the sample size for this research is only 190 and it is a relatively small sample to carry out covariance-based SEM, therefore PLS-SEM analysis method would be a better option. Thirdly, PLS-SEM can be applied for both formative and reflective modeling techniques, depending on the suitability and requirements necessary to assess the specific constructs (Gefen, Straub, & Boudreau, 2000). Additionally, providing more accurate estimates of moderating and mediating effects by taking into account any measurement error that limits or constraints the estimated relationships and enhances the theory validation, is also another advantage of PLS-SEM (Chin, Marcolin, & Newsted, 2003; Henseler & Fassott, 2009). According to Parker (2013, p.72), a PLS path model can be categorized into two models, which are the measurement model (i.e. measurement relating to the measurement model) and the structural model (i.e. measurement relating to some endogenous latent constructs to other latent constructs). The measurement model will be first examined in this research with the testing of its reliability, convergent validity, and discriminant validity, which is then followed by the assessment of the structural model (Chan, Thong, Venkatesh, Brown, Hu, & Tam, 2010; Ringle, Wende, & Will, 2005; Venkatesh, Thong, & Xu, 2012). In summary, as the present research does not attempt to use PLS-SEM to create a model, but to test the validation of the theory developed within the research, it can be concluded that the purpose is to confirm the relevancy of the specified model, the elements, and the relationships within the model. In other words, to analyse the relationships between the various constructs identified in the six main hypotheses, PLS-SEM estimation method is found to be the most suitable analysis technique to be employed in this research.

4.4.2 PLS-SEM Limitations

Even though Smart PLS is considered a robust analysis and reporting tool, it does have its limitations as well (Hair, Ringle, & Sarstedt, 2011). According to Hair et al. (2011), most of the researchers and scholars adopted the PLS-SEM method as their data was not normally distributed. Wong (2013) further make mention that researchers also need to take into consideration some shortcomings of PLS-SEM such as (a) the issue of collinearity if it is not well managed; (b) the small sample size whereby high-valued structural path coefficients are needed; (c) biased loadings that may result in both component estimation and path coefficients; (d) inability to model undirected correlation as arrows are always single headed; and (e) it may also result in "large mean square errors in the estimation of path coefficient loading" (Wong, 2013, p. 3). Even with such limitations, PLS-SEM is still an appropriate SEM method in applied research projects such as operations management (e.g. Lee et al., 2014; Ooi, 2014), business strategy (e.g. Hulland, 1999) and information system (e.g. Leong et al., 2013; Tan, Ooi, Chong, & Hew, 2014).

4.5 Variables and Measurements

4.5.1 TQM Practices

The measure is based on factors derived from the literature review presented in CHAPTER 2. Six dimensions of MBNQA-TQM, namely leadership, customer focus, strategic planning, information and analysis, process management, and human resource focus were assessed in this research. The descriptions in the instrument that are used to measure TQM practices are adapted from several sources. The questionnaire items were selected as they are theoretically well-developed and have been proven to possess strong content validity and are reliable (Prajogo & Cooper, 2010). A total of 30 items were developed to itemize the characteristics of the six components. Each item is measured using a five-point Likert scale, ranging from strongly disagree = 1 to strongly agree = 5. Even though there are debates going on in terms of whether Likert scale belongs to the interval or ordinal scale (Newman, 1994), Likert scale is termed as an interval scale in this study. This is such as Likert scales are frequently used with interval procedures provided that the scale items have at least five to if possible seven categories, as stated by Jaccard and Wan (1996). In addition, these scales also communicated interval properties to the target respondents, hence the data produced is assumed to be intervally scaled (Jaccard & Wan, 1996; Madsen, 1989; Schertzer & Jerome, 1985).

4.5.1.1 Leadership

Deriving from a thorough review of past literature, five items were selected to measure the construct of leadership. For all the five items, the mean score of each response is tabulated. The value of mean score is proportionally tied with the level of leadership practice. The five indicators used to measure the leadership dimension are tabulated on Table 4.1.

Table 4.1 Operationalization of Leadership

No	Items	Source
LD1	"Actively participates in quality management and improvement process".	Adopted from Zhang et al. (2000, p.752)
LD2	"Strongly encourages employee involvement in quality management and improvement activities".	
LD3	"Empowers employees to solve quality problems".	
LD4	"Arranges adequate resources for employee education and training".	
LD5	"Discusses many quality-related issues in top management meetings".	

4.5.1.2 Strategic Planning

Similarly, five items were used to gauge the level of strategic planning a firm is engaged in. For all the five items, the mean score of each response is tabulated. The value of mean score is proportionally tied with the level of strategic planning a firm is engaged in. The five indicators used to measure the strategic planning dimension are tabulated on Table 4.2.

Table 4.2 Operationalization of Strategic Planning

No	Items	Source
SP1	Has "a mission statement which has been communicated throughout the company and is supported by our employees".	Adopted from Prajogo and Sohal (2006, p.308)
SP2	Has "a comprehensive and structured planning process which regularly sets and reviews short and long-term goals".	Adopted from Prajogo and Sohal (2006, p.308)
SP3	Always incorporates supplier capabilities, and "needs of other stakeholders including the community when we develop our plans, policies and objectives".	Adopted from Teh (2010, p.86); Adapted from Samson and Terziovski (1999)
SP4	Has "a written statement of strategy covering all business operations which is clearly articulated and agreed by our senior manager".	Adopted from Prajogo and Sohal (2006, p.308)
SP5	Includes "continuous quality improvements in the planning process".	Adopted from Sohail and Teo (2003, p.49)

4.5.1.3 Customer Focus

Five items were used to measure the level of customer focus in this research. The mean score for customer focus dimension was tabulated, in which a higher mean score indicates a higher level of customer orientation. The five indicators used to measure the customer focus dimension is tabulated on Table 4.3.

Table 4.3 Operationalization of Customer Focus

No	Items	Source
CF1	"Collects extensive complaint information from customers".	Adopted from Zhang et al. (2000, p.754)
CF2	Treats quality-related customer complaints with top priority.	Adapted from Zhang et al. (2000)
CF3	"Conducts a customer satisfaction survey every year".	Adopted from Zhang et al. (2000, p.754)
CF4	"Always conducts market research to collect suggestions on how to improve on products".	Adopted from Zhang et al. (2000, p.754)
CF5	Has "precise knowledge of customer expectations".	Adopted from Sohail and Teo (2003, p.49)

4.5.1.4 Human Resource Focus

Based on characteristic such as the implementation of training, reward and recognition and the well-being of employees, there are a total of five items chosen to measure the constructs. The mean score of the responses for the human resource focus dimension was calculated; where a higher mean score implies that the firm focuses more on human resource practices. Table 4.4 shows the five indicators used to measure the human resource dimension.

Table 4.4 Operationalization of Human Resource Focus

No	Items	Source
HR1	Has a company-wide "training and development process for all our employees".	Adopted from Prajogo and Sohal (2006, p.309)
HR2	Formally and regularly measures employee satisfaction.	Adapted from Prajogo et al. (2007)
HR3	Actively uses "employee flexibility, multi-skilling and training to support performance improvement".	Adopted from Prajogo and Sohal (2006, p.309)
HR4	Maintains "a work environment that contributes to the health, safety and well-being of all employees".	Adopted from Prajogo and Sohal (2006, p.309)
HR5	Has a reward and recognition system within the company that rewards relationship and task accomplishments based on work quality.	Adapted from Zhang et al. (2000)

4.5.1.5 Process Management

To measure the level of process management in a firm, five indicators were used. The mean value for the process management construct is calculated. Table 4.5 lists out the five items used to measure the process management dimension.

Table 4.5 Operationalization of Process Management

No	Items	Source
PM1	Has a set of clear goals that guide employees in their work as they work in teams.	Adapted from Sohail and Teo (2003)

No	Items	Source
PM2	Encourages employees “to develop new and innovative ways for better performance”.	Adopted from Sohail and Teo (2003, p.47)
PM3	Has employees that understand their respective role.	Adapted from Sohail and Teo (2003)
PM4	“Has the ability to monitor all production/services processes to improve quality”.	Adopted from Sohail and Teo (2003, p.48)
PM5	Uses “statistical process control to monitor production/service processes”.	

4.5.1.6 Information Analysis

Five items were chosen to represent the dimension of information and analysis. The level of information and analysis practiced in the sampled firms was assessed by calculating a mean score. Table 4.6 lists out the five items used to measure the information analysis dimension.

Table 4.6 Operationalization of Information and Analysis

No	Items	Source
IA1	Conducts regular reviews on its’ quality performance.	Adapted from Sohail and Teo (2003)
IA2	Has the “knowledge, availability, access and collection of data”.	Adopted from Sohail and Teo (2003, p.48)
IA3	Has the “availability of key performance figures for analysis and decision making”.	Adopted from Sohail and Teo (2003, p.48)

No	Items	Source
IA4	"Has undertaken benchmarking relative to cost position".	Adopted from Teh (2010, p.88)
IA5	"Has undertaken benchmarking of other firms' product quality and procedures".	Adapted from Samson and Terziovski (1999)

4.5.2 Organizational Learning

As measured by Huber (1991), organizational learning is categorized into four stages. 19 statements of organizational learning, consisting of knowledge acquisition, distribution, interpretation, and organizational memory, are adapted from several sources as shown in the subsections below. To measure respondents' perceptions towards the level of organizational learning in their organizations, each of the item is measured with the use of a five-point Likert scale, with 1 being strongly disagree to 5 being strongly agree.

4.5.2.1 Knowledge Acquisition

According to Lopez et al. (2006), knowledge can be acquired from the experiences of others or through self. The items for knowledge acquisition were derived from Lopez et al. (2006) and Ooi (2013, p.110). There are five items in total that were chosen to measure this variable. The mean score of the responses for the knowledge acquisition dimension was tabulated. A higher mean value indicates that a higher level of knowledge was required. Table 4.7 lists out the five indicators used to measure the knowledge acquisition dimension.

Table 4.7 Operationalization of Knowledge Acquisition

No	Items	Source
KA1	Co-operation "agreements with other companies, universities, technical colleges, etc., are fomented".	Adopted from Lopez et al. (2006, p.238)
KA2	Our organization "is in touch with professionals and expert technicians".	Adopted from Lopez et al. (2006, p.238)
KA3	Our organization encourages "employees to join formal or informal networking made up by people from outside the organization".	Adopted from Ooi (2013, p.110); Adapted from Lopez et al. (2006)
KA4	"New ideas and approaches on work performance are experimented continuously".	Adopted from Lopez et al. (2006, p.238)
KA5	"Organizational systems and procedures support innovation".	Adopted from Lopez et al. (2006, p.238)

4.5.2.2 Knowledge Distribution

Also known as knowledge sharing and knowledge transfer, knowledge dissemination refers to the exchanging of knowledge, information or expertise between individuals in the organization (Bartol & Srivastava, 2002; Lin, 2007). The mean score was calculated for the responses of knowledge distribution dimension, where a higher mean value indicates a higher level of knowledge being shared and transferred. The five items used to measure the knowledge distribution dimension are listed out in Table 4.8.

Table 4.8 Operationalization of Knowledge Distribution

No	Items	Source
KD1	"All members are informed about the aims of the company".	Adopted from Lopez et al. (2006, p.238)
KD2	"Meetings are periodically held to inform all the employees about the latest innovations in the company".	
KD3	Our organization "has formal mechanisms to guarantee the sharing of the best practices among the different fields of the activity".	
KD4	"There are within the organization individuals who take part in several teams or divisions and who also act as links between them".	
KD5	"There are individuals responsible for collecting, assembling and distributing internally employees' suggestions".	

4.5.2.3 Knowledge Interpretation

The interpretation or the application of knowledge refers to developing the knowledge acquired, which enables knowledge to be more effective, increasing its worth. Cegarra-Navarro and Martínez-Conesa (2007) opined that the knowledge interpretation stage incorporates information gathered from both the acquisition and dissemination stages, in which such information acquired is then integrated into the day-to-day processes of the business. The degree of knowledge application being practiced within the firm was tabulated by calculating the mean score of responses in accordance on the four items tabulated in Table 4.9.

Table 4.9 Operationalization of Knowledge Interpretation

No	Items	Source
KI1	"Employees share knowledge and experience by talking to each other".	Adopted from Martinez-Costa and Jimenez-Jimenez (2009, p.109)
KI2	"Current organizational practice encourages employees to solve problems together before discussing them with a manager".	Adopted from Lopez et al. (2006, p.238)
KI3	Our organization "is able to rid itself of obsolete knowledge and seek new alternatives".	Adopted from Lopez et al. (2006, p.238)
KI4	Our organization "offers other opportunities to learn (visits to other parts of the organization, internal training programmes, etc) so as to make individuals aware of other people or departments' duties".	Adopted from Lopez et al. (2006, p.238)

4.5.2.4 Organizational Memory

According to researchers such as Lopez et al. (2006, p.218) and Tippins and Sohi (2003), organizational memory is defined as information stored in the system of the company for future use. Five items were used to measure the construct. The level of organizational memory was taken into account by tabulating the respondents' mean score based on the five items shown in Table 4.10.

Table 4.10 Operationalization of Organizational Memory

No	Items	Source
OM1	Our organization "has databases to stock its experiences and knowledge so as to be able to use them later on".	Adopted from Lopez et al. (2006, p.238)
OM2	Our organization "has directories or e-mails filed according to the field they belong to, so as to find an expert on a concrete issue at any time".	Adopted from Lopez et al. (2006, p.238)
OM3	"There is access to the organizations data basis and documents through some kind of network" (Intranet etc.).	Adopted from Lopez et al. (2006, p.239)
OM4	All the employees in our "organization have access to the organization's databases".	Adopted from Lopez et al. (2006, p.239)
OM5	The codification and "knowledge administration system makes work easier for employees".	Adopted from Lopez et al. (2006, p.239)

4.5.3 Technological Innovation

According to Prajogo and Sohal (2003b), technological innovation comprises of product and process innovation, which is measured using several criteria taken from previous empirical studies of innovation, such as Avlonitis, Kouremenos, and Tzokas (1994), Cohn (1980), Deshpande, Farley, and Webster (1993), Hollenstein (1996), and Kleinschmidt and Cooper (1991). The criteria set incorporate the number, speed, and level (in terms of newness of the technological aspect or novelty) of innovations, and to become "first" in the market. Combining these four characteristics of innovation, they can be applied to two main areas of innovation, being product and process innovations. 6 items representing technological innovations were adopted from Prajogo and Sohal (2006). Respondents were asked to give their feedback based on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

4.5.3.1 Product Innovation

Product innovation, in accordance to Damanpour and Gopalakrishnan (2001), refers to creating new products and services with the intention of meeting the needs and expectations of the market. The operationalizations of product innovation were adopted from Prajogo and Sohal (2006). Three items (as listed in Table 4.11) were employed to gauge this variable, where the scale raises questions on the level of product newness and the speed of the new product development. Based on the responses given, a mean score is calculated to determine the level of product innovation among sampled firms.

Table 4.11 Operationalization of Product Innovation

No	Items	Source
TI1	"The level of newness (novelty) of new products" is adequate.	Adopted from Prajogo and Sohal (2006, p.309)
TI2	We use the latest technological innovations in new product development.	Adapted from Prajogo and Sohal (2006)

No	Items	Source
TI3	"The speed of new product development is fast".	Adopted from Prajogo and Sohal (2006, p.309)

4.5.3.2 Process Innovation

Process innovation, according to Bi et al. (2006), refers to the adoption of new and improved production and delivery methods, incorporating a change in the tools, software and/or methods used. Operationalization for process innovation is adopted from Prajogo and Sohal (2006), where three items were selected to gauge the level of updated-ness or novelty of technology used in the process. Mean score of the responses based on the three items listed in Table 4.12 is used to determine the degree of process innovation of the firms.

Table 4.12 Operationalization of Process Innovation

No	Items	Source
TI4	Our organization is technologically competitive.	Adapted from Prajogo and Sohal (2006)
TI5	"The updated-ness or novelty of technology used in" process is adequate.	Adopted from Prajogo and Sohal (2006, p.309)
TI6	The speed of adoption of the latest technological innovations in process is fast.	Adapted from Prajogo and Sohal (2006)

4.6 Questionnaire Development

In the quality management field, researchers such as Blauw and During (1990), Flynn et al. (1994), Mann (1992), and Saraph, Benson, and Schroeder (1989), have used questionnaire surveys method to gather their data. As each researcher have their own research agenda, their questionnaires differed from one another. However, it was found that many of these questionnaires partly met the requirements or purpose of this research after the questionnaires were examined; hence, it became a necessity to develop a new set of research questionnaire by adapting and modifying the existing survey questionnaires. The design of the survey questionnaire in this research study strongly depends on the concepts of the theory and the operationalization of the variables. When comes to designing the questionnaire, the main issue would be to determine the measurement questions, in which the respondents would be asked to answer. In the process of designing the survey questionnaire, the following six issues were adhered to (Zhang, 2000b, p.73):

- "Why is the question asked?"
- "What is the purpose of asking this question?"
- "Is the question of a proper scope?"
- "Can the respondents answer adequately?"
- "Will the respondents answer willingly?"
- "Are the scales clear?"

The questionnaire survey used in this study investigates the relations between MBNQA-TQM practices, organizational learning, and technological innovation. Hence, the scope of these three areas should be included in the questionnaire. The items which are developed to measure the TQM practices needs to be based upon the six MBNQA TQM practices presented in CHAPTER 2: Leadership, strategic planning, customer focus, human resource focus, process management, and information analysis. The developed items to measure the organizational learning needs to be based upon the concepts of the four constructs: knowledge acquisition, knowledge distribution, knowledge interpretation, and organizational memory. As for the items development for technological innovation, the statements should include the concepts of the two constructs, which are process and product innovation. The operationalization of the six TQM constructs, the four organizational learning constructs, and the two dimensions of technological innovation have already been discussed in CHAPTER 2 and CHAPTER 3. Table 4.1 to Table 4.12 showed the items for each construct and the source where the questions are adapted. All the items used in the survey is based on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Furthermore, the wording of the questions need to be given adequate attention when developing the measurement items (Zhang, 2000b, p. 74):

- "Is the wording of the question stated in terms of a shared vocabulary?"
- "Is the wording of the question precise and unambiguous?"
- "Are there unstated or misleading assumptions?"
- "Is there biased wording?"

As for the composition of the questionnaire, it is separated into three parts:

- Section A: The measure of the demographic variables

- Section C: The measure of the TQM practices
- Section C: The measure of the Organizational Learning
- Section D: The measure of Technological Innovation

Based on an extensive review of the literature, the research items were developed.

4.7 Construct Operationalization

To determine the measured variables that will represent a construct and the way in which they will be measured is one of the main processes in the measurement model. In other words, this process is also known as construct operationalization (Hair, Anderson, Tatham, & Black, 2006). Thus, a set of items that were used to measure the constructs of TQM, organizational learning, and technological innovation need to be adequately developed. In order to tap into the conceptual domain of the theoretical constructs, the items were chosen and developed in a careful manner (Zhang et al., 2000). A detailed explanation on how the items were chosen and developed is presented in CHAPTER 2 and CHAPTER 3. A summary on the operationalization of the construct for this research has been presented in Table 4.1 to Table 4.12 in the previous section.

4.8 Selection of Study Area & Sampling Method for Survey

The population for this research comprised of manufacturing firms that have been certified with ISO 9000 quality system series in Malaysia. Such firms, which have TQM installed in place, were extracted from the Federation of Malaysian Manufacturers (FMM) Directory (2012 edition), whereby this directory will be used as the sampling frame for this study. The FMM Directory (2012) was mainly selected for two reasons. The first reason is that the Directory itself contains more than 2,000 firms, from different sectors, of different sizes, and is the largest economic organization in this developing nation. The second reason is that FMM has been well-established for 38 years, hence this directory can be considered a prominent representation of both the manufacturing and service industries in Malaysia. For this reason, the chosen sample can be considered as a valid and reliable representation of the population. Due to the stringent rules that oversee the full membership of FMM, out of the total 2,135 FMM members (i.e. organizations), only 47 percent of these firms have been officially granted an ISO certification (FMM, 2008).

The immediate respondents for this study were full-time managerial employees (i.e. executives, section heads, section managers, accountants, supervisors, departmental managers and etc) who possessed adequate knowledge in the quality management area, with an understanding of their firms' level of organizational learning and technological innovation (Prajogo, 2006). Part-time employees were not included in the sample for data analysis as they usually work for only short periods of time in the company and may not possess sufficient knowledge or be qualified to assess the company thoroughly

(Arumugam et al., 2009). Researchers like Prajogo (2007), Samat, Ramayah, and Mat Saad (2006), Sit et al. (2009), Tavana, Mohebbi, and Kennedy (2003), and Terziovski (2006), have also chosen this group of target respondents to represent their sample group for the empirical research of TQM. Furthermore, it was postulated by Tavana et al. (2003) that a commitment towards quality management was mainly instigated by top managers, and that the departmental managers were normally more familiar with the basic principles and practices of quality management when compared to other levels of employees (i.e. low-level management). Hence, this target group was selected as the respondents for this study.

Sampling is needed as it is possible to generate findings which can represent the whole population at a lower cost as compared to data collection for the whole population, which is impractical. Besides, budget and time constraints are the major hindrance to conduct surveys on the entire population. Hence, sampling is a process whereby the researcher chooses a sample from the entire population for a study (Leary, 2004). Probability and non-probability are the two sampling techniques discussed in the research methods literature. Simple random, systematic, stratified, cluster, and multi-stage are the strategies used for probability sampling. Such sampling method uses a form of random sampling in some of their stages. Through the use of probability sampling, all the cases or elements in the population has an equal chance to be selected as a sample for the study. On the other hand, non-probability sampling does not use random sampling, as mentioned by Kerlinger and Lee (2000). To ensure representativeness, probability sampling method is employed in this study (Krosnick, 1999).

Probability sampling technique using simple random sampling technique is adopted in this study, as 600 ISO certified manufacturing firms will be randomly retrieved and chosen from the FMM Directory (2012) to participate in a survey. From the FMM Directory (2012) itself, a total of 1268 ISO-certified manufacturing firms were identified. Each firm in the population is assigned a number, after which the computer (i.e. Research Randomnizer) is used to perform a random selection of 600 cases from the target population. Simple random sampling was chosen not only because of its simplicity to assemble the sample, it is also considered a fair method to select a sample from a chosen population since each case has an equal chance to be selected (Sekaran & Bougie, 2010). Additionally, such a sampling design offers the least bias and provides the most generalizability, as the sample obtained is reasonable enough to draw conclusions from the results of the study (Sekaran & Bougie, 2010). Acknowledged as the most popular method used in empirical studies to assess the relationship between variables (Guest, 1999; Edgar & Geare, 2005; Ooi et al., 2007a), survey questionnaire was adopted as the primary form of data collection, where only one site per organization was incorporated in the sample.

Following the pilot study conducted on 36 small-medium, ISO-certified, local manufacturing firms, the final version of the questionnaire survey was delivered out to 600 ISO-certified manufacturing firms identified from FMM Directory (2012).

4.9 Data Collection Method

As an effort to validate the research model being developed, a self-administered survey questionnaire was adopted in this study. A survey is used due to its advantages as described by Zakaria (1999, p.127):

- It covers a wider scope, whereby more information can be captured.
- Although survey is more expensive and time consuming as compared to field and laboratory experiments, the amount and quality of information yielded are more economical. As a cross sectional research is conducted, more information can be collected from the selected target respondents through survey method.
- The information provided by survey research is also accurate (within sampling error).
- As the survey method enables a large number of cases to be studied, it provides an opportunity for the results to be replicated among the few subsets of the survey sample. As the findings are replicated among the various subgroups, this strengthens the assurance that such a finding can explain a general phenomenon in a society. In addition, by carefully reporting the methodology of a given survey, it promotes the replication carried out by other researchers among other samples or subgroups.

It was suggested by Sekaran (2003, p. 236) that 'whenever possible, questionnaires are best administered personally to a group of people'. There are several advantages to personally administered questionnaires. Having high response rate, reducing interviewer bias, and ensuring the benefits of mutual personal contact are some of the benefits of self-administered questionnaire approach (Oppenheim, 2000). Apart from that, it allows the researcher to explain, clear up doubts or to provide any additional essential information to the respondents. It also allows the researcher to gather all completed questionnaires in a short time period (Sekaran, 2003; Hayes, 2000).

The sampled firms selected in this study are chosen from the FMM Directory (2012). From the Directory itself, a total of 1268 manufacturing firms that are certified with ISO were identified. Although self administered approach was used, it is still impractical to approach every respondent personally due to the hectic working schedule of the target respondents. Practicality was one of the factors considered when carrying out the data collection for this research. More importantly, the 600 respondents were chosen from organizations located in various parts of Malaysia, which includes Kuala Lumpur, Selangor, Perak, Penang and Melaka. The mentioned states were chosen as they are states with the most industrialization in Malaysia (Kuala Lumpur Structure Pan 2020, 2008; Federation of Malaysia Manufacturers (FMM) Directory, 2008, Teh et al., 2009). Furthermore, one can find many world leading firms in the field of electronics with manufacturing operation and services in the above mentioned five states (Malaysia Industrial Development Authority, 2008; Teh et al., 2009). All the organizations in these five states that are listed in the FMM Directory 2012 with ISO certification as indicated in the directory were selected for the survey. Hence, a random sample of 600 Malaysian ISO-certified manufacturing firms was selected.

With the help of a group of student assistants, the final version of the questionnaire was sent out to these firms during the first quarter of 2012. One key informant from every company who can provide the desired information (Arumugam et al., 2008; Sekaran, 2003) is eligible to participate in the questionnaire survey. This is done so that an objective, unbiased information can be gathered from a representative group, in which the persons surveyed represents the true population under study. These informants included executives, managers and above. The reasons the managerial employees are chosen are explained in section 4.8. Hence, the sample represented mainly focus on the managerial staff. A covering letter to explain the objective of this study was attached together, assuring the participants of the confidentiality of their responses, and instructing them to complete each question. The set of questionnaire were not pre-numbered for identification to assure respondents of anonymity. Besides, only an aggregate or summary of data from the collected responses is published, hence the information is not able to be traced onto any specific respondent. The participants are given a month to respond, in which a gentle reminder will be sent to those who are yet to respond.

4.10 Determination of Sample Size and Sampling Results

From the 600 survey questionnaire distributed, 265 responses were collected back, indicating a response rate of 44.17 percent. 7 of the surveys were deemed not usable as either no attempt was made to answer any of the questions, or only part of questionnaire was attempted. Hence, only 258 questionnaires were deemed usable for analysis. Since this study focuses on the ISO 9000 certified firms from the manufacturing sector, the non-ISO 9000 manufacturing companies were discounted, reducing the sample size to 190.

The adequacy of the sample size should be ascertained and determined before PLS-SEM is performed (Hair, Black, Babin, Anderson, & Tatham, 2005; Fotopoulos & Psomas, 2009; Lu, Yao, & Yu, 2005; Lee et al., 2010). Different researchers made different propositions with regards to the sample size required before conducting the PLS-SEM. Past researchers in the likes of Forza and Filippini (1998), Hair, Anderson, Tatham, and Black (1992, p.10), and Hoyle (1995) proposed a sample size of 100 to 200 as a generally good starting point to conduct path modeling (Wong, 2013, p.5). It is also a general guideline to obtain suffice sample size by having 15 cases for each variable or indicator in the measurement (Stevens, 2002). Since there are 6 independent variables and 2 dependent variables for the present study, the minimum cases should be 120 samples. As the number of samples collected for this study is 190, it can be concluded that the current sample size of 190 is greater than the acceptable range and thus can be assumed to be sufficient. On the other hand, Marcoulides and Saunders (2006) proposed a general guideline that the minimum sample needed depends on the maximum number of arrows pointing at the latent construct as indicated in the structural model (see Table 4.13). To illustrate this, as shown in Table 4.13, if the maximum number of arrows pointing at the latent constructs in the model is 10, the minimum sample size required is 91. Since there are 12 arrows pointing at the latent construct (see Figure 3.1), the sample size of 190 is considered adequate to conduct PLS-SEM analysis. Additionally, according to Hair, Sarstedt, Ringle, and Mena (2012) and Chin (1998), the size of 190 also fulfilled the heuristic that the sample size should be equal or larger than ten times the largest number of structural paths directed at a particular construct. Hence, PLS-SEM approach was employed to examine the structural model of this study.

Table 4.13 Suggested Sample Size of PLS-SEM

Minimum Sample sized required	Maximum number of arrows pointing at latent constructs in the model
52	2
59	3
65	4
70	5
75	6
80	7
84	8
88	9
91	10

As mentioned by Sekaran (2003), for this kind of correlational study in Malaysia, a low survey response rate is generally expected. Likewise, for the study of Ahmad and Yusof (2010) on the TQM practices between Japanese and non-Japanese electrical and electronics firms in Malaysia, a 21.9% response rate was recorded. Another study by Lam, Lee, Ooi, and Phusavat (2012) on TQM in Malaysia, a 20% response rate was recorded. Hence, the reported response rate in this research is deemed to be acceptable.

4.11 Measurement Evaluation

4.11.1 Reliability Overview

According to Zhang et al. (2000), reliability refers to whether an instrument will obtain the same result when it is used to measure an item more than once. It is also concerned with the degree to which a test, experiment or any other measuring procedure to produce the same results in any repeated trails, as stated by Zhang et al. (2000). In other words, the reliability test is used to measure whether the survey instruments' data can be reproduced (Litwin, 1995).

The internal consistency reliability of the reflective measures in PLS-SEM includes the Cronbach's Alpha, which measures whether the indicators have equal outer loadings. As compared to Cronbach which assumes that all indicators are equally reliable, composite reliability accounts for the different outer loadings (Hair et al., 2014; Olalere, 2013, p.78), hence composite reliability method was preferred when conducting PLS-SEM.

4.11.2 Validity Overview

Validity is described as the degree to which the instrument measures what it is intended to measure. To assess the validity of a measurement model, the two most popular methods are convergent validity and discriminant validity. Therefore, in order to evaluate the measurement instruments in this study, these two validities were conducted.

4.11.2.1 Convergent Validity

In accordance to Leong, Hew, Tan, and Ooi (2013, p.5611), convergent validity is referred to as "the ability of a construct to produce the same outcomes even though various approaches are utilized". In other words, the level to which dimensional measures of the same concept are correlated is examined using convergent validity. According to Xie (2011, p.194), the scale instrument is measuring its intended construct if the correlations are high. Hence, Byrnes (1994) concluded that the items of the scale instrument should load strongly on their common constructs. The convergent validity for the measurement model was assessed using three main criteria, as mentioned by Fornell and Larcker (1981) (as cited in Leong et al. (2013, p.5611):

a) The factor loading for each item should be more than 0.50
b) The Composite Reliability (CR) values for each construct should be more than 0.70.
c) The values for Average Variance Extracted (AVE) should exceed 0.50

If a value of less than 0.50 is reported of AVE, then the variance due to measurement error exceed that of the constructs, which in this case, according to Xie (2011, p.195) means that the convergent validity of the construct is questionable.

4.11.2.2 Discriminant Validity

In accordance to Thong (2001, p.152), discriminant validity is referred to "the degree to which items differentiate between variables". In order to assess discriminant validity, the correlation analysis and the square root of AVEs to its inter-constructs correlations is used. If the corresponding correlation coefficients of the construct were lower than the square root of AVEs, discriminant validity is attained, as mentioned by Leong et al. (2013). Good discriminant validity is indicated by higher variance-extracted estimates, which according to Xie (2011, p.196), means that the relation between a construct and its indicators is stronger than the relation between the construct and other constructs. Hence, AVE, as proposed by Fornell and Larker (1981), is the main indicator to examine both convergent validity and discriminant validity in this study. In this manner, the construct validity is checked using both convergent and discriminant validity before the measurement model is examined and finalized (Xie, 2011, p.196).

4.12 Handling Missing Data in Survey Sample

To analyze data in the presence of missing values, there are generally four generic methods as mentioned by Little and Rubin (1987). They are the (1) Complete Case Method; (2) Imputation-Based Method; (3) Re-weighting Method; and (4) Model-Based Method.

The Complete Case Method was applied in this research as it is one of the most popular methods that deal with incomplete data (Levy & Lemeshow, 1999). Such a method involves excluding cases of missing values on any variables used in the particular analysis.

In addition, the sample size of this research is considered to be adequate based on the suggestion given by Hair et al. (2006), where the 15:1 ratio is met.

As the missing values are relatively small compared to the sample size of the study, the missing values did not decrease the sample size in a significant way that causes biasness.

4.13 Chapter Summary

Upon completion of the reliability analysis, item analysis and validity analysis, one can conclude that the instruments used to measure the TQM practices, organizational learning, and technological innovation is valid and reliable. Therefore, the data gathered from this instrument will then be used to further conduct the data analysis.

CHAPTER 5

DISCUSSION ON DATA ANALYSIS

5.1 Introduction

This chapter presents the findings of the analysis with respect to the research questions and hypotheses formulated. Results obtained from both descriptive statistics and Partial Least Square-Structural Equation Modeling was presented. Data analysis in this chapter is separated into a few subsections: (a) descriptive analysis describing the personal characteristics of the respondents and the company's demographic profile; (b) the common method bias analysis; (c) the multicollinearity analysis; (d) the measurement model analysis; and lastly (e) the structural model analysis. The measurement model incorporates the measurement of indicators, the tests for both reliability and validity; while the structural model incorporates the analysis of the linkage among the latent constructs and the coefficient of determination (R^2). The findings in CHAPTER 5 within the context of the literature will be further discussed in detail in CHAPTER 6. As such, this chapter will only present and analyze the 190 data that has been collected; while CHAPTER 6 will draw general conclusions or compare results to those of other researchers.

5.2 Characteristics of Demographic Profile

In this section, respondents' demographic profile is analyzed and discussed in detail. The main aim of this analysis is to supply information on the background of those that took part in the survey. The following tables depict the findings of the survey, in which frequency and distribution are used to illustrate the respondents' characteristic in the survey.

Table 5.1 supplies the demographic information of the participants with regards to their gender, age, marital status, highest education completed, the length of time in the current organization, their current job position, and their primary job function. As shown in Table 5.1, the male respondents comprised of a larger sample as compared to their female counterparts, where 62.1% are male and 37.9% are female. In terms of age, 6.8% are aged below 25 years old, 22.6% are between the age of 26-30, 18.4% are between the age of 31-35, 16.8% are between the age of 36-40, 24.2% are between the age of 41-45 and 11.1% are above 45 years of age. As for marital status, it was shown that majority of the respondents are married (i.e. 60.0%), whereas 40.0% are single. In this group of respondents, only a minor percentage (i.e. 4.7%) of the respondents has no college degrees. Suffice to say, 13.7% are diploma/ advanced diploma holders, 58.4% are degree or professional qualification's holders, 20.5% have obtained their master degrees, and only 2.6% are PHD holders. Furthermore, 4.7% of the respondents have worked less than 1 year in their current companies, 24.7% worked between 1-2 years, and the rest (i.e. 70.6%) have been working in their respective firms for more than 3 years. As for the positions held by the respondents, 42.1% are executives, 46.8% are managers or heads of departments, 5.8% are either in the position of a general manager, director or CEO and the remaining 5.3% are either section managers, supervisors, section heads, accountants, departmental managers etc. In terms of their job functions, 16.8% are with R&D, 11.6% with production, 22.1% with marketing, 8.4% with administration, 11.6% with finance, 5.3% with HR, 5.8% with information technology, and 4.2% are with procurement. This information represents that the respondents are from various job functions in the organizations. Based on the data gathered, it can be generally concluded that this sample consists of highly qualified young target respondents coming from different departments of a firm, who has a reasonably good knowledge on the practices of TQM, OL, and TI of their companies.

Table 5.1 Profile of Target Respondents

Demographic Variables	Frequency	Percentage
Gender		
Female	72	37.9
Male	118	62.1
Age		
Below 25	13	6.8
26-30	43	22.6
31 -35	35	18.4
36-40	32	16.8
41-45	46	24.2
Above 45	21	11.1
Marital Status		
Single	76	40.0
Married	114	60.0
Highest Education Completed		

Demographic Variables	Frequency	Percentage
No college degree	9	4.7
Diploma/Advanced diploma	26	13.7
Bachelor degree/Professional qualification	111	58.4
Master degree	39	20.5
PhD Degree	5	2.6
Length of Time		
Less than 1 year	9	4.7
1-2	47	24.7
3-5	33	17.4
5-10	51	26.8
10-20	37	19.5
Above 20	13	6.8
Job position		
Executive	80	42.1
Manager/Head of Department	89	46.8
General Manager/Director/CEO	11	5.8
Other	10	5.3
Primary job scope		
R&D	32	16.8
Production	22	11.6
Marketing	42	22.1
Administration	16	8.4
Finance	22	11.6
HR	10	5.3
Information technology	11	5.8
Procurement	8	4.2
Others	27	14.2

5.3 Characteristics of Company's Profile

Table 5.2 depicts the profile of the organizations being sampled. 100% of the respondents are from the manufacturing sector. As for the types of organizations, 48.4% are from electrical and electronics products, 9.5% are from chemical and chemical products, 8.9% are from textiles and textile products, 12.6% are from food products, 8.4% are from rubber and plastic products, 7.4% are from machinery and hardware, and the remaining 4.7% are from other products manufactured. In terms of the number of employees, a total of 14.7% of the respondents have less than 50 employees in their firms; 30.0% have 51-200 employees, and 55.3% hire more than 200 employees. As for the status of the organization, 100% are ISO certified firms. From the perspective of ownership, 47.4% are foreign owned company, 18.4% are state owned company; while the remaining are local private family owned company, with Chinese ownership being the majority (i.e. 28.9%) and non-Chinese being the minority (i.e. 5.3%).

Table 5.2 Profile of Organizations

Demographic Variables	Frequency	Percentage
Category of Organizations		
Manufacturing	190	100.0
Types of Organizations		
Electrical & electronics products	92	48.4
Chemical & chemical products	18	9.5
Textiles & textile products	17	8.9
Food products	24	12.6
Rubber & plastic products	16	8.4
Machinery & hardware	14	7.4
Other products manufactured	9	4.7
Number of employees		
Less than 50	28	14.7
51-200	57	30.0

Demographic Variables	Frequency	Percentage
Above 200	105	55.3
Status of organization		
ISO certified (i.e. ISO 9000)	190	100
Ownership		
Foreign owned company	90	47.4
State owned company	35	18.4
Local private family owned company		
(i) Chinese	55	28.9
(ii) Non-Chinese	10	5.3

5.4 Descriptive Analysis

Table 5.3 Descriptive Statistics of Constructs (n = 190)

Constructs	Mean	SD	Minimum	Maximum
TQM				
Leadership	4.0382	0.5493	2.75	5.00
Strategic Planning	4.0253	0.5480	2.80	5.00
Customer Focus	3.9968	0.5542	2.40	5.00
Human Resource Focus	3.8355	0.6416	1.25	5.00
Process Management	3.9434	0.5754	2.25	5.00
Information Analysis	3.9716	0.5134	2.20	5.00
Organizational Learning	3.8556	0.4975	2.22	4.94
Technological Innovation	3.8640	0.5335	2.17	5.00

Based on the descriptive analysis of the constructs, the overall situation with regards to the MBNQA-TQM practices among the managerial personnel can be understood. From the findings generated in Table 5.3, the mean score reported for the TQM dimensions ranged from 3.8355 (HR) to 4.0382 (LD), revealing that the TQM practices implemented in these firms is rather high. The highest mean score reported among the TQM practices is leadership, with minimum value reported at 2.75 and maximum value reported at 5.00. This implies that the leaders of the firms actively involved themselves in quality management and improvement processes. Meanwhile, the mean score reported of human resource management is the lowest among TQM dimensions, with minimum value reported at 1.25 and maximum value reported at 5.00. This implies that human resource focus, in which the welfare of employees is well taken care of, is the weakest among the six TQM constructs. Nevertheless, the mean score of 3.8355 reported of HR is still well above average, which indicates that the HR focus is still implemented at a healthy level among the manufacturing firms in Malaysia.

5.5 Testing of Common Method Bias

As the information is collected from the same target respondents for both the predictor and response variables, common bias may exist. Common Method Bias (CMB) is described as "the overlapping between two variables due to high correlations between the underlying constructs" (Podsakoff & Organ, 1986; Tan et al., 2014, p.298). To test for common method bias, Harman's single factor test was carried out and findings reported that common variance is less than 50%.

Hence, from the result, it can be concluded that the issue with CMB is not significant in this study.

5.6 Non-response Bias

Cross tabulation and Chi-square test of dependence on the number of employees and ownership were conducted and the results revealed that there is no significant difference between the early and late respondents (Hoang et al., 2006, p.1101). Therefore, the non-response bias problem does not exist in this study.

5.7 Analysis of the Measurement Model

In accordance to Olalere (2013, p. 68), the measurement model computes the linkage "between the latent variables and their corresponding indicators". Hence, to investigate the measurement model, the composite reliability, both convergent validity and discriminant validity were performed.

5.7.1 Convergent Validity

In accordance to Olalere (2013, p.100), convergent validity "measures the extent of positive correlation between a measure and alternate measures of the same construct". Convergent validity, as mentioned by Tan et al. (2014, p.299) refers "to the capability of a construct to yield the same results even though different approaches are engaged". Convergent validity was assessed for the measurement model based on three main criteria (Fornell & Larcker, 1981):

(a) All items in factor loadings should be greater than 0.50

(b) The CR values for all constructs should be greater than 0.70

(c) The values for AVE should exceed 0.50

According to Hair et al. (2014, p.103), the measurement for convergent validity is computed from AVE; while AVE "calculates the grand mean value of the squared loadings of the indicators". The AVE values are reported in Table 5.4, in which Customer Focus (CF) = 0.6042; Human Resource Management (HR) = 0.6271; Information & Analysis (IA) = 0.5610, Leadership (LD) = 0.6160; Process Management (PM) = 0.6240; Strategic Planning (SP) = 0.6315; Knowledge Acquisition (0.6797); Knowledge Dissemination (0.5483); Knowledge Interpretation (0.6228); Organizational Memory (0.6083) and Technological Innovation (TI) = 0.5496. As a general guideline, the minimum recommended value stated by Molina et al. (2007) should be 0.50, hence the results reported met the minimum requirement set for convergent validity.

As affirmed by Fornell and Larcker (1981), a more suitable indicator will be composite reliability, as such an analysis considers the "actual factor loadings instead of assuming that every item is fairly weighted in the composite load determining" (Lin & Lee, 2004; Molina et al., 2007). It was seconded by Leong et al. (2013, p.2115), in which the reliability of the construct can be measured using the "formula of $\frac{(\sum\lambda)^2}{(\sum\lambda)^2+\sum\delta}$ where λ=factor loading and δ=error variance". It is suggested by Molina et al. (2007) that the minimum proposed value for

Composite Reliability is to be 0.70. The Composite Reliability values as reported in Table 5.4 for Customer Focus is 0.8590; Human Resource Management = 0.8704; Information & Analysis = 0.8645, Leadership = 0.8649; Process Management = 0.8691; Strategic Planning = 0.8726; Knowledge Acquisition (0.8640); Knowledge Dissemination (0.8584); Knowledge Interpretation (0.8318); Organizational Memory (0.8613) and Technological Innovation = 0.8797. As the Composite Reliability values for all factors exceed 0.70, it can be concluded that the internal consistency in this research is high.

The Cronbach's alpha values (Table 5.4) reported for all constructs are strong with Customer Focus being 0.7808; Human Resource Management (0.8017); Information & Analysis (0.8052), Leadership = (0.7938); Process Management (0.7992); Strategic Planning (0.8056); Knowledge Acquisition (0.7627); Knowledge Dissemination (0.7936); Knowledge Interpretation (0.6959); Organizational Memory (0.7852) and Technological Innovation = 0.8358. As the results reported for all latent constructs except for Knowledge Interpretation surpassed the 0.70 benchmark proposed by Nunally (1978). Nevertheless, Forozia and Farhoodnea (2012) argued that a value exceeding 0.65 is also considered as valid and reliable. Thus it can be confirmed that the measurement is good.

Table 5.4 Convergent Validity and Reliability

Constructs	Scale Type	Loadings	Cronbach's alpha	Composite Reliability	AVE
First Order Factor					
Customer Focus (CF)	Reflective		0.7808	0.8590	0.6042
CF1		0.7412			
CF3		0.7756			
CF4		0.8347			
CF5		0.7544			
Human Resource Management (HR)	Reflective		0.8017	0.8704	0.6271
HR2		0.7982			
HR3		0.8273			
HR4		0.7405			
HR5		0.7991			
Information Analysis (IA)	Reflective		0.8052	0.8645	0.5610
IA1		0.7587			
IA2		0.7142			
IA3		0.7283			
IA4		0.7580			
IA5		0.7838			
Leadership (LD)	Reflective		0.7938	0.8649	0.6160
LD1		0.8044			
LD2		0.7821			
LD3		0.8229			
LD4		0.7269			
Process Management (PM)	Reflective		0.7992	0.8691	0.6240
PM1		0.7930			
PM2		0.7938			
PM3		0.7986			
PM4		0.7742			
Strategic Planning (SP)	Reflective		0.8056	0.8726	0.6315
SP2		0.7489			

Constructs	**Scale Type**	**Loadings**	**Cronbach's alpha**	**Composite Reliability**	**AVE**
SP3		0.8102			
SP4		0.8236			
SP5		0.7939			
Technological Innovation (TI)	Reflective		0.8358	0.8797	0.5496
TI1		0.7336			
TI2		0.7921			
TI3		0.7410			
TI4		0.7080			
TI5		0.7467			
TI6		0.7238			
Second Order Factors					
Knowledge Acquisition (KA)	Reflective		0.7627	0.8640	0.6797
KA1		0.8784			
KA2		0.8066			
KA3		0.7855			
Knowledge Dissemination (KD)	Reflective		0.7936	0.8584	0.5483
KD1		0.7169			
KD2		0.7501			
KD3		0.7658			
KD4		0.7589			
KD5		0.7087			
Knowledge Interpretation (KI)	Reflective		0.6959	0.8318	0.6228
KI1		0.8343			
KI2		0.7678			
KI4		0.7636			
Organizational Memory (OM)	Reflective		0.7852	0.8613	0.6083
OM1		0.7886			
OM2		0.7960			
OM3		0.7507			

Constructs	Scale Type	Loadings	Cronbach's alpha	Composite Reliability	AVE
OM5		0.7837			

All items for factor loadings as shown in Table 5.4 also reported values that are greater than the acceptable threshold of 0.50, indicating that "50% of the variance of the indicators has been accounted for" (George & Hrivnak, 2009, p.65). Since OL is operationalized as a second order factor, following the recommendations of Chin (1998), and in line with Wang and Scheepers (2012), the convergent validity of the first order factors (knowledge acquisition, knowledge interpretation, knowledge dissemination, and organizational memory) is determined by the strength of loadings of the first order factors on the second order factor of OL. Table 5.5 shows that all OL dimensions loads highly on their second order constructs. Hence, it can be concluded that the convergent validity has been established.

Table 5.5 PLS loadings on second-order construct – OL

Second Order Construct	First Order Constructs	PLS outer loadings	T-Statistics
OL	OLKA	0.8275	35.7194**
	OLKD	0.8878	46.2633**
	OLKI	0.8148	28.5472**
	OLOM	0.8122	29.457**

Note: all loadings are significant at $p < 0.01$; OLKA = knowledge acquisition; OLKD = knowledge dissemination; OLKI = knowledge interpretation; OLOM = organizational memory

Following the theoretical considerations that was laid out in section 2.7.4, here are some of the empirical considerations that OL is proven and validated to be a reflective model.

The first consideration is that the OL items should display high positive intercorrelations. It has been proven in Table 5.4 that that the internal consistency and reliability for OL is high (>0.70); and all OL items in factor loadings is more than 0.50. The AVE values for the OL constructs are also more than 0.50 (Diamantopoulos & Siguaw, 2006). With that, the first consideration is satisfied.

The second consideration, according to Diamantopoulos and Siguaw (2006), is that the items must have the same sign and significant of relationships with the construct. Refereeing to Table 5.5, all the OL dimensions (i.e. OLKA, OLKD, OLKI, and OLOM) have positive sign, loads highly and are significant on the second order construct of OL, therefore establishing convergent validity exists. Furthermore, referring to Table 5.7, the indicator's loading on a construct exceeds all of its cross loadings with other constructs, and this concludes that discriminant validity is met. Thus, the second empirical consideration that OL is a reflective model is fulfilled.

5.7.2 Discriminant Validity

Discriminant validity as described by Thong (2001, p.152) is "the degree to which items differentiate between variables". As proposed by Deng, Mo, and Liu. (2014, p. 218), the test for discriminant validity can be investigated by comparing the "square root of AVEs and the correlation between any two constructs". Findings in Table 5.5 reported that the values of square root of AVEs exceeded the correlation values. The test for discriminant validity is also carried out to ascertain that "each pair of independent variables in the correlation" is less than the criterion set by Hair et al. (2010), which is 0.90. As indicated in the result, LD and SP reported the largest coefficient value of 0.6134; however it is still smaller than the 0.90 criterion set. Table 5.5 summarized the findings that all coefficients satisfy the criterion of discriminant validity for each determinant in the model, as proposed by Hoang et al. (2006).

Table 5.6 Discriminant Validity Test Results

	CF	HR	IA	LD	KA	KD	KI	OM	PM	SP	TI
CF	**0.7773**										
HR	0.4581	**0.7919**									
IA	0.5802	0.5931	**0.7490**								
LD	0.4575	0.4510	0.5400	**0.7849**							
KA	0.5000	0.5621	0.5141	0.4170	**0.8244**						
KD	0.5062	0.5399	0.5864	0.5078	0.6646	**0.7405**					
KI	0.4654	0.4853	0.5307	0.3917	0.6197	0.6202	**0.7892**				
OM	0.4013	0.4943	0.5610	0.3695	0.5251	0.6065	0.5700	**0.7799**			
PM	0.4770	0.5702	0.5973	0.5755	0.6254	0.6007	0.5651	0.5109	**0.7899**		
SP	0.5421	0.5072	0.5835	0.6134	0.5092	0.5616	0.5075	0.5008	0.6101	**0.7947**	
TI	0.5612	0.5207	0.5701	0.4226	0.5732	0.6139	0.5875	0.6046	0.5351	0.5850	**0.7414**

Diagonal elements (bold) are the square root of the AVE for each construct. Off-diagonal factors demonstrate the inter-correlations.

The cross-loadings were also examined during the discriminant validity test. Given if an indicator's loading on a construct exceeds all of its cross-loadings with other constructs, discriminant validity is achieved. As illustrated in Table 5.6, the pattern of loadings and cross-loadings support the discriminant validity criteria (Venkatesh et al., 2012). Based on such findings, the measurement model portrayed strong discriminant validity.

Table 5.7 PLS-SEM Loadings and Cross-Loadings

	CF	HR	IA	LD	OLKA	OLKD	OLKI	OLOM	PM	SP	TI
CF1	**0.7412**	0.3863	0.4601	0.3720	0.3924	0.3973	0.3932	0.2769	0.3888	0.4080	0.4088
CF3	**0.7756**	0.3222	0.4715	0.3897	0.3397	0.4141	0.2959	0.2896	0.3459	0.3953	0.4066
CF4	**0.8347**	0.3816	0.4667	0.3541	0.4251	0.3563	0.3277	0.3137	0.4013	0.4217	0.4810
CF5	**0.7544**	0.3326	0.4084	0.3114	0.3924	0.4079	0.4246	0.3618	0.3457	0.4560	0.4430
HR2	0.3644	**0.7982**	0.4421	0.3379	0.4687	0.4265	0.3775	0.3995	0.3301	0.3437	0.4220
HR3	0.3426	**0.8273**	0.4999	0.3660	0.4893	0.4854	0.4267	0.4571	0.5095	0.4341	0.4169
HR4	0.4213	**0.7405**	0.5055	0.3517	0.3310	0.3313	0.3374	0.3053	0.4187	0.4140	0.3942
HR5	0.3371	**0.7991**	0.4398	0.3748	0.4748	0.4523	0.3893	0.3901	0.5426	0.4184	0.4171
IA1	0.4152	0.5027	**0.7587**	0.4746	0.3596	0.4023	0.3339	0.4349	0.4616	0.5066	0.4150
IA2	0.3995	0.3895	**0.7142**	0.3579	0.3080	0.4475	0.3364	0.4302	0.4959	0.4418	0.4155
IA3	0.4095	0.3664	**0.7283**	0.3376	0.2999	0.3684	0.3108	0.3716	0.3717	0.3742	0.3714
IA4	0.4473	0.4339	**0.7580**	0.4381	0.4136	0.4446	0.4883	0.3728	0.4602	0.4223	0.4327
IA5	0.4900	0.5107	**0.7838**	0.4081	0.5085	0.5131	0.4856	0.4804	0.4439	0.4392	0.4854
LD1	0.3635	0.3814	0.4811	**0.8044**	0.3007	0.3444	0.2687	0.2918	0.4217	0.4429	0.3094
LD2	0.3497	0.3044	0.4147	**0.7821**	0.2956	0.3898	0.2430	0.2215	0.4470	0.4877	0.2339
LD3	0.3370	0.2472	0.3571	**0.8229**	0.3248	0.4063	0.2976	0.3177	0.4620	0.5193	0.3369
LD4	0.3762	0.4548	0.4372	**0.7269**	0.3678	0.4347	0.3868	0.3077	0.4631	0.4673	0.4078
OLKA1	0.4391	0.4609	0.4139	0.3321	**0.8784**	0.5386	0.5479	0.4344	0.5163	0.4766	0.5268
OLKA2	0.4261	0.4477	0.4284	0.3596	**0.8066**	0.5417	0.5009	0.4406	0.5412	0.4518	0.4616
OLKA3	0.3698	0.4818	0.4296	0.3400	**0.7855**	0.5638	0.4820	0.4235	0.4889	0.3275	0.4265
OLKD1	0.4147	0.3586	0.4385	0.3575	0.4582	**0.7169**	0.4143	0.4424	0.5077	0.4118	0.3909
OLKD2	0.4009	0.4106	0.4328	0.3521	0.4676	**0.7501**	0.5225	0.5217	0.5258	0.4242	0.4393
OLKD3	0.3289	0.4443	0.4475	0.4332	0.5242	**0.7658**	0.4393	0.3828	0.4442	0.3761	0.4596
OLKD4	0.3720	0.3829	0.4627	0.3702	0.4878	**0.7589**	0.4389	0.4394	0.3980	0.4194	0.4843
OLKD5	0.3573	0.4001	0.3900	0.3675	0.5223	**0.7087**	0.4749	0.4538	0.3466	0.4464	0.4961
OLKI1	0.3712	0.3357	0.3411	0.2618	0.4901	0.489	**0.8343**	0.4138	0.4303	0.4026	0.4277
OLKI2	0.3640	0.3110	0.4198	0.3243	0.4855	0.5185	**0.7678**	0.4060	0.4220	0.4288	0.4769
OLKI4	0.3657	0.4988	0.4936	0.3402	0.4903	0.4602	**0.7636**	0.5270	0.4836	0.3699	0.4851
OLOM1	0.3176	0.3412	0.3577	0.2227	0.4065	0.4495	0.4601	**0.7886**	0.2976	0.3131	0.4671
OLOM2	0.3069	0.4451	0.4784	0.3067	0.3878	0.4536	0.4331	**0.7960**	0.3114	0.3823	0.4524
OLOM3	0.3489	0.3261	0.4136	0.2510	0.3954	0.4590	0.4383	**0.7507**	0.4472	0.4301	0.4620
OLOM5	0.2810	0.4266	0.4968	0.3672	0.4458	0.5262	0.4464	**0.7837**	0.5302	0.4351	0.5025
PM1	0.3343	0.5443	0.4640	0.4224	0.4554	0.5150	0.4381	0.4474	**0.7930**	0.4990	0.4479
PM2	0.3352	0.4633	0.4857	0.4756	0.5403	0.4759	0.4827	0.3734	**0.7938**	0.5156	0.4165
PM3	0.4177	0.4003	0.4650	0.4887	0.4845	0.4508	0.4631	0.3297	**0.7986**	0.4992	0.4504
PM4	0.4249	0.3869	0.4729	0.4327	0.4977	0.4539	0.4000	0.4645	**0.7742**	0.4102	0.3733
SP2	0.3912	0.3112	0.3945	0.3916	0.2780	0.3851	0.3681	0.4257	0.4342	**0.7489**	0.3898
SP3	0.4046	0.4666	0.4785	0.5125	0.4289	0.4518	0.3871	0.4361	0.4686	**0.8102**	0.4714
SP4	0.4590	0.4338	0.4611	0.4789	0.4808	0.4996	0.4329	0.3699	0.4827	**0.8236**	0.5139
SP5	0.4647	0.3874	0.5151	0.5580	0.4099	0.4395	0.4217	0.3694	0.5516	**0.7939**	0.4737
TI1	0.4296	0.4130	0.4827	0.3502	0.5034	0.4742	0.5130	0.4850	0.4495	0.4724	**0.7336**
TI2	0.4214	0.4060	0.3459	0.3114	0.4382	0.4810	0.4624	0.4295	0.4034	0.4610	**0.7921**
TI3	0.3549	0.4181	0.4713	0.3368	0.4412	0.4555	0.3844	0.4385	0.3890	0.4723	**0.7410**
TI4	0.4072	0.4099	0.4749	0.3444	0.3892	0.3779	0.4297	0.4373	0.4461	0.4540	**0.7080**
TI5	0.5079	0.3083	0.3492	0.2873	0.3927	0.4635	0.4190	0.4691	0.3205	0.3575	**0.7467**
TI6	0.3711	0.3562	0.4083	0.2428	0.3725	0.4746	0.3929	0.4253	0.3651	0.3770	**0.7238**

5.8 Analysis of the Structural Model

The structural model shown in Figure 5.1 was analyzed using PLS-SEM, together with the support of Smart PLS 2.0 software analysis. Findings of the structural model in this study are separated into six sections:

(1) The structural model is assessed for collinearity issue;

(2) The significance and relevance of the structural model relationships are evaluated;

(3) The R^2 value of the endogenous variable is evaluated;

(4) The path coefficients;

(5) The predictive relevance of Q^2 is evaluated;

(6) The effects sizes

5.8.1 Testing for Construct Collinearity

In order to assess the collinearity issue, both Variance Inflation Factor (VIF) and tolerance were conducted. If the correlations between independent variables are too high, collinearity problem exists. Table 5.7 reports the values for VIF to be lesser than 10 and tolerance values to be greater than 0.10, as suggested by Kline (2005). Moreover, all correlation coefficients shown in Table 5.6 are also lesser than the 0.90 value set by Field (2005). Hence, no collinearity issue was found in the dataset presented.

Table 5.8 Testing for Constructs Collinearity

Construct	Standardized Coefficients (Model 1: OL)	Standardized Coefficients (Model 2: TI)	Collinearity Statistics	
Constant	β	β	Tolerance	VIF
CF	0.126*	0.208**	0.554	1.804
HR	0.205**	0.153*	0.563	1.777
IA	0.240**	0.172*	0.455	2.198
LD	0.006	-0.074	0.532	1.881
PM	0.305**	0.120	0.473	2.116
SP	0.101	0.267**	0.446	2.243

a. Dependent Variable: Model 1 = OL; Model 2 = TI
Note: CF = Customer Focus; HR = Human Resource Management; IA = Information & Analysis; LD = Leadership; PM = Process Management; SP = Strategic Planning

5.8.2 Evaluate Significance and Relevance of the Structural Model Relationship

The structural model used in this study was shown in Figure 5.1 while results obtained from hypotheses testing are shown in Table 5.9. This research employed a bootstrapping approach with 5000 sub-samples in order to obtain t-statistics (Lallmahomed, Rahim, Ibrahim, & Rahman, 2013, p.2782). The PLS analysis was employed to assess the relations between MBNQA-TQM dimensions and organizational learning as indicated in the RQ1: “Do MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) relate significantly with organizational learning in the Malaysian manufacturing firms?”; and the relations between MBNQA-TQM dimensions and technological innovation as stated in the RQ2: “Do MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) relate significantly with technological innovation in the Malaysian manufacturing firms?"

The results reported in Table 5.12 showed that the dimensions of Customer Focus (CF), Leadership (LD), Human Resource Management (HRM), Strategic Planning (SP), Information & Analysis (IA), and Process Management (PM) explained 62.66% of the Organizational Learning (OL); while these six MBNQA-TQM dimensions explained 56.66% of Technological Innovation (TI), thus proving the applicability of the MBNQA model in both OL and TI context. Furthermore, the MBNQA framework was also proven to predict organizational learning in Lee et al. (2012) study.

As shown in Table 5.9, the PLS-SEM results reported that the dimensions of HR ($\beta = 0.1965$, $p < 0.01$); IA ($\beta = 0.2008$, $p < 0.01$); PM ($\beta = 0.3059$, $p < 0.01$), CF ($\beta = 0.1276$, $p < 0.05$) and SP ($\beta = 0.1643$, $p < 0.05$) significantly influence organizational learning, with PM showing the strongest influence. Based on this result, H2a, H3a, H4a, H5a and H6a were supported. On the contrary, the dimensions of LD ($\beta = -0.0222$, $p > 0.05$) was found to be not a significant predictor in influencing organizational learning. With this, H1a was not supported. In response to the RQ1, the findings of this research indicate that five out of six TQM practices, namely SP, CF, HR, IA and PM are significantly impact on organizational learning.

In accordance to Table 5.9, as for technological innovation, SP ($\beta = 0.1773$, $p < 0.01$) and CF ($\beta = 0.1743$, $p < 0.01$) were reported to be significant and positive predictors of TI, hence, supporting H2b and H3b. However, LD (β = -0.0549, p > 0.05), IA (β = 0.0653, p > 0.05), HR (β = 0.0576, p > 0.05) and PM (β = -0.0129, p > 0.05) were found to be insignificantly related to TI, hence not supporting H1b, H4b, H5b, and H6b. In response to the RQ2, the findings revealed that SP and CF were positively and significantly influence on technological innovation.

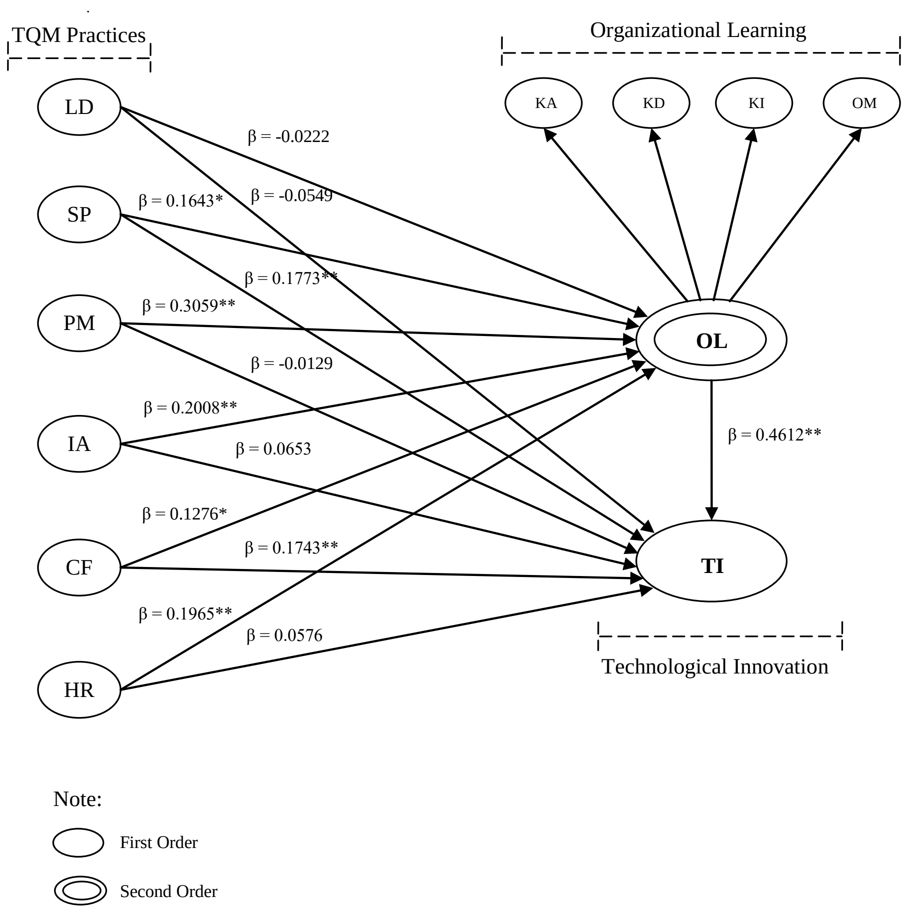


Figure 5.1 The Relationship of TQM, Organization Learning and Technological Innovation

Table 5.9 PLS-SEM Results for Hypotheses Testing

Hypo.	Path	Original Sample	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T-Statistics (|O/STERR)	Supported
H1a	LD →OL	-0.0222	-0.0529	0.0398	0.0398	0.5584	No
H1b	LD →TI	-0.0549	-0.0755	0.0559	0.0559	0.9814	No
H2a	**SP→ OL**	**0.1643**	**0.1653**	**0.0814**	**0.0814**	**2.0179***	**Yes**
H2b	**SP→ TI**	**0.1773**	**0.1817**	**0.0672**	**0.0672**	**2.6402****	**Yes**
H3a	**CF→ OL**	**0.1276**	**0.1253**	**0.0637**	**0.0637**	**2.0048***	**Yes**
H3b	**CF→ TI**	**0.1743**	**0.1797**	**0.0665**	**0.0665**	**2.6231****	**Yes**
H4a	**HR→OL**	**0.1965**	**0.2010**	**0.0579**	**0.0579**	**3.3964****	**Yes**
H4b	HR→TI	0.0576	0.0739	0.0558	0.0558	1.0326	No
H5a	**PM→OL**	**0.3059**	**0.3036**	**0.0702**	**0.0702**	**4.3566****	**Yes**
H5b	PM→TI	-0.0129	-0.0701	0.0528	0.0528	0.2448	No
H6a	**IA→ OL**	**0.2008**	**0.2046**	**0.0744**	**0.0744**	**2.6990****	**Yes**
H6b	IA →TI	0.0653	0.0946	0.0683	0.0683	0.9556	No

Note: $p< 0.01$**; $p< 0.05$*

5.8.3 Coefficient of Determination (R^2)

Results obtained from structural model are used as predictive functions for the relationship between constructs (Olalere, 2013). The variance accounted for R^2 in these predictions is reported in the PLS-SEM algorithm reports. Table 5.12 reported that the variables with the highest explained variance is OL (R^2 = 62.67%), followed by TI (R^2 = 56.67%). A general guideline for R^2 as suggested by Olalere (2013) is 0.20; while values between 0.10 are considered to have low levels of predictive accuracy.

5.8.4 Path Coefficients

Path of coefficient constructs are shown in Table 5.10.

Table 5.10 Path Coefficients of Constructs

	CF	HR	IA	LD	OL	PM	SP	TI
CF					**0.1276***			**0.1743****
HR					**0.1965****			0.0576
IA					**0.2008****			0.0653
LD					-0.0222			-0.0549
OL					N/A			**0.4612****
PM					**0.3059****			-0.0129
SP					**0.1643***			**0.1773****
TI					N/A			N/A

Note: $p< 0.01$**; $p< 0.05$*

As shown in Table 5.10, CF (β = 0.1276, p < 0.05), HR (β = 0.1965, p < 0.01), IA (β = 0.2008, p < 0.01), PM (β = 0.3059, p < 0.01) and SP (β = 0.1643, p < 0.05) have a strong direct path effect on organizational learning. Meanwhile, LD (β = -0.0222, p > 0.05) has the weakest direct path effects on organizational learning.

Table 5.10 also reported that CF (β = 0.1743, p < 0.01), and SP (β = 0.1773, p < 0.01) are positively and significantly related with Technological Innovation. Meanwhile, LD (β = -0.0549, p > 0.05), HR (β = 0.0576, p > 0.05), PM (β = -0.0129, p > 0.05), and IA (β = 0.0653, p > 0.05) have no direct effects on Technological Innovation.

5.8.5 Predictive Relevance Q^2

According to Olalere (2013, p.88), the Q^2 statistic assists in determining the predictive relevance of the relative construct in a SEM model. As proposed by Olalere (2013, p. 88), values reported to be greater than zero connotes that the construct predicts its data points for the given construct; however, a zero value or lesser means that the items for a given construct is not accurately predicted. As a relative measure of predictive relevance, Wong (2013, p.27) proposed that a value of "0.02, 0.15 and 0.35 signify that an exogenous construct has a small, medium, or large predictive relevance for a selected endogenous constructs". Known as the blindfolding procedure, it can be used to calculate the Q^2 value in PLS-SEM. As recommended by Hair et al. (2014), this study uses the cross-validated redundancy as a base measure of Q^2 as it incorporated the main element of the path model (the structural model information) to predict the omitted data points. Table 5.11 illustrates the construct cross-validated redundancy.

Table 5.11 Construct Cross-validated Redundancy

Total	**SSO**	**SSE**	**1-SSE/SSO**
OL	2850	2095.5376	0.2647
TI	1140	790.8239	0.3063

Note: SSE = Sum of squares of prediction errors; SSO = Sum of squares of observations

The results shown in the last column of Table 5.11 (i.e. 1 – SSE/SSO) are the values of Q^2 statistics. The highest predictive value is calculated for TI, which is 0.3063; while the lowest is calculated for OL, which is 0.2647. As the Q^2 values are greater than zero, this suggests that both constructs have predictive relevance.

Table 5.12 Results of R^2 and Q^2 values

Endogenous Latent Variable	R^2 Value	Q^2 Value
OL	0.6266	0.2647
TI	0.5666	0.3063

Findings for R^2 value and Q^2 for all endogenous latent variables are shown in Table 5.12. The value of R^2 helps in determining the predictive relationship among constructs; while Q^2 serves in determining the accuracy of that predictive relationship between endogenous constructs in the model, as stated by Olalere (2013, p.91). All Q^2 values shown in the table above are considerably above 0, hence supporting the predictive relevance for the two endogenous latent variables.

5.9 The Effect Sizes

It is essential to report the effect sizes f-square (f^2) when interpreting the analysis results as it provides a detailed of non-significant findings and a comprehensive understanding when demonstrating the practical side of statistically significant effects (Fairchild & McQuillin, 2010). According to Cohen (1988), 0.02 is categorized as small, 0.15 as medium and 0.35 as large when assessing the effect size f-square. The effect sizes f^2 for the endogenous constructs with the use of a blindfolding approach are shown in Table 5.13 and Table 5.14.

Table 5.13 Effect Size - OL

DV: Organizational Learning (OL)		
IV	**Path coefficient**	**f-square**
LD	-0.0222	0.0008
SP	0.1643	0.0332
PM	0.3059	0.1192
IA	0.2008	0.0487
CF	0.1276	0.0257
HR	0.1965	0.0578

Note: DV = Dependent variable; IV = Independent variable; LD = Leadership; SP = Strategic Planning; PM = Process Management; IA = Information & Analysis; CF = Customer Focus; HR = Human Resource Management

Table 5.14 Effect Size - TI

DV: Technological Innovation (TI)		
IV	**Path coefficient**	**f-square**
OL	0.4612	0.1774
LD	-0.0549	0.0037
SP	0.1773	0.0323
PM	-0.0129	0.0000
IA	0.0653	0.0048
CF	0.1743	0.0374
HR	0.0576	0.0042

Note: DV = Dependent variable; IV = Independent variable; LD = Leadership; SP = Strategic Planning; PM = Process Management; IA = Information & Analysis; CF = Customer Focus; HR = Human Resource Management

5.10 The Mediating Effects Analysis

In this present study, the mediating effects analysis was performed. The mediating analysis includes demonstrating the theoretical indirect relationship between constructs, which is to establish the extent to which indirect effects through the mediating variables changes the hypothesized direct paths, as mentioned by Olalere (2013, p.92). The entity variable in this study (i.e. LD, SP, CF, HR, IA, PM) for OL was hypothesized to intervene the relationship between the TQM dimensions and TI. The objective is to ascertain the path coefficients, at the same time exposing the significant and important indirect effects of relationships.

The Variance Accounted For Statistic, also known as VAF, which calculates the impact of indirect effects on a dependent variable, or the degree that the dependent variable is explained by the indirect effects through mediators, determines the significance of this indirect effect. According to Hair et al. (2014) and Olalere (2013), a VAF exceeding 80% or more is regarded as a full mediation; while a VAF that is recorded between 20% to 80% is regarded as being partially mediated. Meanwhile, a VAF that is less than 20% is regarded as no mediation.

Table 5.15 Total, Direct and Indirect Effect of the Predictors of Technological Innovation

Construct	Direct effect	Indirect effect	Total effect	T Statistics
CF	0.1744	0.0588	0.2332	3.2153**
SP	0.1773	0.0758	0.2531	3.0741**

Note: *significant at $p < 0.01$ based on 5000 bootstraps; CF = Customer Focus; SP = Strategic Planning

According to the significant indirect effects shown in Table 5.15, the role of the mediator variable is examined by calculating the Variance Accounted For

(VAF) factor identical to Shaw (2014). As shown in Table 5.16, it has been confirmed that there are moderately mediating effects (Hair et al., 2013).

Table 5.16 Variance Accounted For (VAF) of the Mediator Variables for TI

IV	**MV**	**DV**	***a***	***b***	***c'***	**VAF (%)**
SP	OL	TI	0.1643	0.4612	0.1773	29.94%
CF	OL	TI	0.1276	0.4612	0.1743	25.24%

Note: IV = Independent variable; MV = Mediator variable; DV = Dependent variable; SP = Strategic Planning; CF = Customer Focus; TI = Technological Innovation; $VAF = \frac{ab}{ab + c'} \times 100\%$

As shown in Table 5.16, in response to the RQ3, the results of the analysis reported that organizational learning intervenes between the following: strategic planning and technological innovation; customer focus and technological innovation. Therefore, H2c (SP → OL → TI), and H3c (CF → OL → TI) are partially supported.

5.11 Chapter Summary

In this chapter, the data analysis for this research was presented. In order to answer the research questions constructed in this study, both descriptive statistics and Partial Least Square-Structural Equation Modeling approach were used. The findings revealed that H2a (SP → OL), H3a (CF → OL), H4a (HR → OL), H5a (PM → OL), H6a (IA → OL), H2b (SP →TI), and H3b (CF → TI) were supported. As for the mediation model, where the PLS-SEM approach was applied, it was found that H2c (SP → OL → TI) and H3c (CF → OL → TI) are partially supported. The next chapter will further discuss the result reported in this chapter.

CHAPTER 6

CONCLUSION

6.1 Introduction

This chapter presents the discussion on the findings and explains every finding within the context of past literatures. Following that, the contributions in terms of both theoretical and practical are presented in this chapter. Lastly, limitations of this research study as well as recommendations for future research will also be discussed in this chapter.

6.2 Discussions on Hypotheses

The following subsections will discuss in detail the findings of each hypothesis and sub hypothesis based on the data analysis generated and tabulated in CHAPTER 5. The result of each hypothesis will be explained within the context of literature reviews presented in CHAPTER 2.

6.2.1 Hypotheses 1a, b and c

Based on the findings generated, no significant relation was found between leadership and organizational learning, indicating that hypothesis 1a is not supported. Such a result contradicts with the past studies of Atwood et al. (2010), Lam et al. (2011), Senge et al. (1999), Tung and Chang (2011), and Yee et al. (2013), where leaders play an important role in the OL context. Such a result is also inconsistent with Baerson et al. (2001), Berson and Avolio (2004), Birasnav et al. (2011), Burns (1978), Elkins and Keller (2003), Jogulu (2011), Nguyen and Mohamed (2011), and Trautmann et al. (2007), as all the past studies agreed that transformational leaders have the ability to cultivate a healthy learning environment as they possess values that can motivate and encourage their employees to be dedicated in learning. However, the result in this study has proven otherwise. It portrays that the top management has not been effective in encouraging members to participate in the OL process of the firm, consistent with that of Wickramasinghe and Widyaratne (2012). Furthermore, this finding does not correspond with the ones conducted by Michie and Zumitzavan (2012) and Prugsamatz (2010) where a supportive leader plays a significant influence on organization learning sustainability. As can be summarised from the past literature, apart from motivating their workers to be involved in the quality management activities, the senior managers themselves need to also be proactive in the participation of such quality improvement processes, providing adequate resources (e.g. education and training) for employees, and empowering them to solve quality problems. By doing so, it is believed that a healthy learning culture can be cultivated, thus ensuring that the organizational learning process of acquiring, disseminating, applying and storing can be properly implemented.

With hypothesis 1b, result has confirmed the insignificant relation between leadership and technological innovation. Such a finding proves inconsistent with that of Borgelt and Falk (2007), Bossink (2004), Donate and Guadamillas (2011), Hauschildt and Kirchmann (2001), Jung et al. (2003), and Lee et al. (2010a), where an effective leader is proven to hold a significant influence on a firm's process innovation. The result in the present study, however, has proven that the top executives have not been dynamic enough to foster an innovative environment within their firms. Apart from that, the past research of Bossink (2004), where innovation leadership style can stimulate the ecological innovativeness of the project, and Guimareas (2011)'s study of strategic leadership being a main determinant to ensure business innovation success have been proven to contradict with the result of the current study. In order to ensure that the level of newness in products is sufficient and the speed of adopting the latest technological innovations in new product development is fast, the top management need to actively involve themselves in the TQM process, strongly encouraging their workers to be actively involved in the quality management and improvement activities, at the same time providing sufficient resources and training programme to the employees, so that the workers may be well equipped with the knowledge to operate high-tech machinery.

Inconsistent with the study of Bolivar-Ramos et al. (2012), Garcia-Morales et al. (2012), Hung et al. (2011), and Lee et al. (2013a, b) where OL serves as a mediating role between top management support and innovation performance, the finding in this study has proven otherwise. In other words, hypothesis 1c is not supported in that organizational learning does not mediate the relationship between leadership and technological innovation. This result implies that a leader needs to be more committed towards organizational learning by involving themselves and encourages others in the firm to be part of the learning process, providing adequate employee education, at the same time to discuss the quality-related matters during the top management meetings, as this will promote a higher organizational learning among organizational members. Members in the firm would be better informed about the objectives and the latest innovations in the firm, in which this will then lead employees to be more active in sharing their knowledge and experience by conversing with one another. When organizational members learn, they will be better equipped with the new knowledge, getting rid of the obsolete knowledge, to operate the more up-to-date technological processes and produce newer products at a faster speed.

6.2.2 Hypotheses 2a, b and c

Strategic planning which was hypothesized to be positively and significantly related to organizational learning among the Malaysian manufacturing firms has been supported by the results generated. In other words, hypothesis 2a is supported. In line with the present finding, both Hutzschenreuter and Kleindienst (2007), and Kim and Mauborgne (1998) shared the same perspective in that when members of the firm are included in the planning stages, this allows for communication and interaction among members, hence positively impacting on knowledge sharing and organizational learning. The result is also in line with that of Slater and Narver (1995), in that when a strategy is developed, the strategy should be communicated, and that this enhances the understanding of the firm’s strategy and steers organizational learning to a common direction.

From the local context, Lam et al. (2011) and Lee et al. (2012) both concluded the positive significant relation between strategic planning and organizational learning in their empirical studies, which are consistent with the present research finding. However, the research outcome of this study is inconsistent with the results of Kohtamaki et al. (2012), in that participative strategic planning was found insignificantly related to organizational learning among the SME IT companies in Finland. From the research findings of this study, it is thus essential that when a mission or written statement that includes continuous quality improvements is formed or when a business plan incorporating short and long-term goals has been structured comprehensively, it should be communicated and disseminated to employees of all levels throughout the company via company's Intranet system to ensure that all members of the firm are well informed. By doing so, this will help steer and direct the firm's organizational learning to a common direction.

On the other hand, the current finding also reported that strategic planning is significant towards improving the degree of technological innovation among the Malaysian manufacturing firms, thus supporting H2b. In line with the studies of Rothwell (1992) and Swan and Newell (1995), a well laid-out business plan that takes into consideration the adoption of new technology can have a positive effect on the rate of innovation. At the same time, the result is also consistent with Lau et al. (2010), in which strategic planning capability posed a significant positive effect on innovation sales. Both the local empirical studies of Lee et al. (2010) and Lee et al. (2011) also confirms likewise. From here, it can be concluded that when a company has an all-inclusive and a structured planning process that often sets and reviews short and long-term goals, at the same time taking into consideration supplier capabilities, and needs of other stakeholders (such as including the community when developing plans, policies and objectives), the firm will be better positioned to innovate novelty products at a more efficient pace according to its environment.

The result of this study also implies that the relationship between strategic planning and technological innovation is moderately mediated by the construct of organizational learning, therefore supporting hypothesis H2c. Such a finding was also consistent with that of Hung et al. (2011) and Lee et al. (2013a, b) where organizational learning serves as a strong intervening factor between TQM and innovation among the Taiwanese firms and the Malaysian firms respectively. This has proven to be so for the Malaysian manufacturing firms. When the company mission statement and its long-term goals that incorporate continuous quality improvements are clearly written out, articulated and supported throughout the whole organization, this sets a clear OL direction for the firm, in which this will encourage organizational members to collaborate with universities and technical colleges, to acquire knowledge from professionals and expert technicians. Once knowledge and experience is gained, the best practices among diverse fields of the activity can be shared to the other members in the firm either through formal and/or informal mechanisms. The new knowledge gained can then be stored in the firm's databases, granting access to the organizational members to the organizations databases, to be used later on. This inevitably promotes a healthy OL culture in the firm, enabling the members of the firm to solve problems at a faster rate, ridding itself of outdated knowledge and seeking new alternatives in doing things. As a result, the creativeness within the employees can be stimulated to churn out new products/services at a faster rate, ensuring first mover advantage is at hand, benefiting the organization as a whole.

6.2.3 Hypotheses 3a, b and c

Customer focus is reported to have a significant positive relationship with OL, which confirms the support of H3a. The result of this study is constant with the findings of Wirtz et al. (2010), in which customers' feedback can assist organization in their organizational learning process. Parallel with the present research finding is the study of Gorry and Westbrook (2011), in which to pay an attentive ear to customers' stories has been proven to be an effective way to learn from them, providing an avenue for firms to serve their customers better. Ang et al. (2011) and Lam et al. (2011) also reported the positive and significant relation between customer focus and learning organizations/orientations among the local Malaysian firms, which can be used to support the current finding of this research. From the findings reported in this study, it is obvious that the element of customer focus is ranked as a priority for the sampled Malaysian manufacturing firms, where customers' opinions are appreciated and shared among the employees, ensuring that customers' expectations are met through the products produced. The result confirms that (1) when customers' suggestions and complaints are treated with top priority, and (2) customer satisfaction survey and market research are conducted on a continuous basis to gather customers' suggestions, such information acquired is essential for a firm to meet customers' expectations. When such information is shared among organizational individuals and applied in the final products produced, this in turn ensures customers' loyalty. Thus, it can be deduced that customer focus is an essential component to ensure organizational learning success.

In the meantime, customer orientation was also shown to have a positive and significant relation with technological innovation amongst the Malaysian manufacturers. In other words, hypothesis H3b is supported. This research outcome is on par with the findings of Vanhaverbeke and Peeters (2005), where the fulfillment of customers' requirements is the exploration of new business processes and the acquisition of new technological capabilities. In the current research, customer focus was implied to be one of the main focuses to stimulate technological innovation. This finding is in line with the ones conducted by Ar and Baki (2011), Lee et al. (2010a, b), Najib and Kiminani (2011), and Tsai (2009), where cooperation with customers significantly affects innovation. These studies all shared the same opinion in that working closely with customers assist firms to identify business opportunities and developed new products which are desired by customers. Furthermore, Zhang and Duan (2010) belief that customer orientation and innovation orientation on new product performance is significantly related has also been supported by the present research findings. As proven by the current research, it is essential that the manufacturing companies of Malaysia make decisions after considering the needs and requirements of customers, giving due worth to customers' suggestions, ensuring that new products can be developed and existing products modified to achieve maximum satisfaction.

From the result generated, the relation between customer focus and technological innovation is partially mediated by organizational learning, hence supporting hypothesis H3c. This result is in line with Hung et al. (2011) and Lee et al. (2013a, b), where organizational learning link TQM practices with innovation performance. When customers' needs remain a company's main objective, market research will be carried out from time to time to collect suggestions from customers on how to improve on products. When such precise knowledge of customers' expectations are acquired, shared out among organizational members, applied in the products manufactured, and stored in company databases for future use, such knowledge in turn can be utilized to stimulate a company's creativity to innovate and create the right products or services that can better satisfy customers' needs.

6.2.4 Hypotheses 4a, b and c

Human resource focus has been proven to be a vital determinant that affects organizational learning, hence supporting H4a. This demonstrates the significance of human resource management, in that through training itself, sharing of information among employees is made possible, thus improving the organizational learning processes. Finding from this study is consistent with Fong et al. (2011) and Lopez et al. (2006), where HRM serves to have a positive influence on firms' learning ability. Likewise, the recent local empirical research of Ang et al. (2011) and Lam et al. (2011) also reported that the association between HRM and learning organizations/orientations is a significant one. Supported by the studies of Prugsamatz (2010) and Song et al. (2011), teamwork and employee empowerment (i.e. dimensions of human resource management) also play an important role in affecting the organizational learning sustainability. When an organization maintains a healthy working environment for its employees, continuously developing their employees by providing them with adequate training and education programmes, reminding them the methods and the concept of quality which often includes TQM principles, encouraging teamwork and problem solving skills, and the flexibility to complete the task at hand, employees will be motivated to acquire the needed information, share them with other organizational members, apply them in their problem solving process and store its knowledge in its databases, thus ensuring the success of the organizational learning process.

On the other hand, proven to be inconsistent with the past literature of Jimenez-Jimenez and Sanz-Valle (2005), and Vrakking (1990), human resource focus in this study has been confirmed to have no significant influence on technological innovation. Therefore, H4b is not supported. The past literatures have argued and concluded that HRM is a significant component that determines a successful innovation. However, being inconsistent with the past literatures, finding in this study indicates that HRM practices, such as the provision of training, flexibility, empowerment, and rewards given to the employees were not sufficient enough to inspire technological innovation. In a past research conducted by Abu Bakar and Ahmad (2010), it was empirically confirmed that human/intellectual and technological resources remain the main factors of product innovation performance. In a research performed by Donate and Guadamillas (2011), they also shared the same perspective in which an established set of human resources practices can help overcome the human barriers to knowledge management, resulting in a higher innovation capacity. Lee et al. (2010a, b) also confirms the positive and significant relation between HRM and innovation. As evidently provided by the past empirical research, in order to reap the benefits of achieving a higher level of technological innovation, it is vital that the top executives of these Malaysian manufacturing firms continuously re-evaluate their HR practices/policies and look into providing more training programs to the employees on a continuous basis to ensure that the workers are up-to-date with the latest technology/ machinery; at the same time, segregating them into teams and empowering them with the flexibility to finish the task at hand. By doing so, it is believed that new skills can be shared and cultivated among team members, ensuring a successful exploitation of innovation capability.

Additionally, human resource focus poses no indirect effect on the technological innovation of these Malaysian manufacturers through the organizational learning construct. Thus hypothesis H4c is not supported. Nevertheless, firms should look into their HR practices such as training methods, which should be re-assessed regularly to ensure that programmes are delivered on time and according to business relevance. Apart from that, by actively involving employees in TQM activities, high levels of employee motivation can be primarily maintained, which have the ability to encourage organizational learning among its employees; an organization-wide learning experience that incorporates experimenting new ideas and approaches on work performance, acquiring organizational systems and procedures that support innovation, disseminating information regarding the latest innovations in the company to organizational members via meetings, and stocking on such experiences and knowledge in company databases to be used later on. As and when employees involve themselves in the learning cycle, they possess the knowledge and the skills to operate sophisticated technology and with this, employees' interest to innovate will increase, resulting in the development of new products at a faster rate. Supporting this idea are the studies of Chen and Huang (2009) and Lee et al. (2013a, b), where organizational learning plays the role of a mediating factor between TQM and innovation performance.

6.2.5 Hypotheses 5a, b and c

Hypothesis 5a was supported as the finding in this study has revealed that process management is positively and significantly related with organizational learning. Such a finding has revealed that when employees are clear with the company objectives and certain of their respective roles, this will encourage organizational learning. Consistent with this finding, Bawden and Zuber-Skerritt (2002) has also claimed that quality of collective learning can be enhanced through process management. Other researchers such as Ju et al. (2006), Lehmann (2012), and Schymik et al. (2007) reported similar findings as well, where process management has been empirically validated to be significantly linked with knowledge management. They have proven that process management supports the transmission of information, which indirectly enhances the learning in an organization. Local empirical studies of Ang et al. (2011), Lam et al. (2011), and Lee et al. (2012) are also consistent with the present finding of this research. Therefore, it is encouraging to see that the senior executives of the Malaysian manufacturing firms emphasize on their process management system to ensure that the goals that are set within the firm provides clear guidance to the employees, so that employees can understand their respective roles in the organizational learning process. At the same time, the SPC in these firms was also monitored consistently and continuously to ensure that the transmission of knowledge can be done appropriately. It is clear that with an adequate and well-established process management, it can assist firms to develop a more appropriate process for organizational learning activities to happen. Therefore, process management should not be taken lightly as it is believed to influence the learning in a firm.

However, the result of this study indicated that process management is insignificantly related to technological innovation, thus hypothesis 5b is not supported. This result proves inconsistent with that of Davenport (1993), Goldratt (1990), and Hammer and Champy (1993), where all of them opined that process management is associated with the organizational functions and addresses organizational concerns such as the continual improvement in innovation. However, the result in this study proves that the inclusion of process management was not significant enough to influence on the technological innovations of these Malaysian manufacturing companies. Contradictory to the current finding is the study of Lee et al. (2010a, b), where the authors confirmed that the TQM practices, which includes process management, is positively and significantly related to product innovation. From the past literatures, a general conclusion can be drawn. It is essential for the sampled firms to set clear standards and goals, continuously monitor all production/services processes, and encourage their workers to develop new and innovative ways to achieve a more outstanding performance for their firms. Instead of spending their resources to solve issues relating to product quality, firms should divert their attention to innovation instead.

Adversely, organizational learning is not mediating the linkage between the process management and technological innovation, hence not supporting hypothesis H5c. However, it is essential that formalised process management (e.g. set clear goal as guide for employees working in teams, encourage the development of newer and innovative ways for better performance, monitor the process of production/service for quality improvement, use of statistical process control for monitoring all processes) be implemented in the work environment to increase the level and speed of technological innovations through the acquisition, distribution, application, and the storage of knowledge. Such was proven in the studies of Hung et al. (2011) and Lee et al. (2013a, b), who empirically confirmed that organizational learning is an important mediating factor between TQM and innovation performance.

6.2.6 Hypotheses 6a, b and c

Information analysis is reported to be positively and significantly related with organizational learning, hence supporting H6a. The result of this study is consistent with that of Al-Gharibeh (2011) and O'Dell and Grayson (1998), whereby IT ease the process of knowledge transfer with its ability to connect people with information. This proves that the firms in this current survey have sufficient data and information analysis to assist in the acquisition, distribution, application, and the storage of knowledge. This finding is also in line with López et al. (2009) and Pérez-López and Alegre (2012), where the competency of IT plays a vital role in the processes of knowledge management. Furthermore, IT has also been shown to be a significant driver for knowledge management performance by the empirical study conducted by Aman and Aitken (2011) and Wu et al. (2011). Lam et al. (2011) and Lee et al. (2012) from the local Malaysian context have also been found to be on par with the present research finding. With the use of advanced technology and processes that is up to date, it has been proven that an adequate information system infrastructure remains a competitive asset for the Malaysian manufacturing firms, where it can be used to handle the knowledge flow within a firm in a more efficient and effective manner. From the result, it can be generalized that information analysis (e.g. having the availability, access and collection of knowledge and data, having the ability to analyse and make decision with available key performance figures, having cost position based benchmarking, and having undertaken benchmarking of other firms' product quality and procedures) is an important TQM element to support a company's organizational learning process.

However, there is no significant relation between information analysis and technological innovation among the Malaysian manufacturing companies, hence not supporting H6b. This contradicts with Gordon and Tarafdar (2007), whereby information systems competencies posed an effect on firm's innovation. The result in the present study was also not supported by Plewa et al. (2012), who argued that the compatibility of innovation management applications has been proven to be significantly linked with innovation performance. Similarly, Chong et al. (2011) in their empirical study have also proven that information technology (i.e. a dimension of supply chain management practices) can significantly and directly impact on both organizational and innovation performance. Lee et al. (2010a, b)'s studies, where information analysis was proven to be a significant factor, seemed not to be the case of this present study. Therefore, it is advisable for the Malaysian manufacturing firms to identify the right IT system as a stimulator towards the enhancement of technological innovation. By (1) regularly conducting reviews on its quality performance, (2) having the knowledge, availability, access and collection of data, (3) making available the key performance figures for analysis and decision making, (4) undertaking benchmarking relative to cost position and of other firms' product quality and procedures, in this respect, information and analysis will not only be used as a tool to maintain company performance, but it can also be used as an instrument to encourage technological innovation.

In addition, organizational learning has been found to have no mediating effect in the link between information analysis and technological innovation, hence not supporting H6c. This is inconsistent with Liao and Wu (2010) findings, whereby organizational learning significantly intervenes the relationship between knowledge management and organizational innovation; and is not congruent with Lee et al. (2013a, b), where OL mediates the relation between information analysis and technological innovation. In this regard, the practice of information analysis in the Malaysian manufacturing firms represents the adequacy of information system that assist in the knowledge flow (e.g. knowledge acquisition, distribution, application, and storing) of the company, resulting in higher levels of technological innovation, and it is essential that manufacturing firms look into improving their IT system.

6.3 Discussions on Research Questions

Based on the data analyzed in CHAPTER 5, the following sections will discuss on the findings for each research question, and explained within the context of literature reviews examined in CHAPTER 3.

6.3.1 Discussions on Research Question One

In relation to the first research question RQ (1) –“Do MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) relate significantly with organizational learning in the Malaysian manufacturing firms?”, the research findings in this study have revealed that TQM practices, in particularly customer focus, human resource management, process management, information analysis, and strategic planning have been proven to be significantly and positively related to organizational learning in the Malaysian manufacturing firms. This finding is clearly to be in line with the past literatures of Ang et al. (2011), Gorry and Westbrook (2011), Lam et al. (2011), and Wirtz et al. (2010) (for customer focus); Ang et al. (2011), Fong et al. (2011), Lam et al. (2011), Lee et al. (2012), Lopez et al. (2006), Prugsamatz (2010), and Song et al. (2011) (for human resource management); Ang et al. (2011), Bawden and Zuber-Skerritt (2002), Ju et al. (2006), Lam et al. (2011), Lehmann (2012), Lee et al. (2012), and Schymik et al. (2007) (for process management); Al-Gharibeh (2011), Aman and Aitken (2011), Lam et al. (2011), Lee et al. (2012), López et al. (2009), O'Dell and Grayson (1998), Pérez-López and Alegre (2012), and Wu et al. (2011) (for information analysis); Beer et al. (2005), Mintzberg and Lamperl (1999), and Gibson and Birkinshaw (2004) (for strategic planning), where positive relationships were found between these TQM practices and organizational learning. However, leadership was found to be insignificantly related to organizational learning, contradictory to the past literatures of Atwood et al. (2010), Lam et al. (2011), Senge et al. (1999), Tung and Chang (2011), and Yee et al. (2013), to name a few. Hence, the first research question was answered.

6.3.2 Discussions on Research Question Two

In response to RQ (2) – "Do MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) relate significantly with technological innovation in the Malaysian manufacturing firms?", it was found that strategic planning is significantly and positively related with technological innovation among the Malaysian manufacturing firms, which is in line with the past studies of Lau et al. (2010), Lee et al. (2010, 2011), Rothwell (1992), and Swan and Newell (1995). Furthermore, customer focus has also been found to be positively and significantly related with technological innovation among the Malaysian manufacturing firms. The past empirical research of Ar and Baki (2011), Lee et al. (2010a, b), Najib and Kiminani (2011), Tsai (2009), Vanhaverbeke and Peeters (2005), and Zhang and Duan (2010) also supported the result of the present study. However, the remaining TQM practices, such as leadership, process management, information analysis and human resource management were found to be insignificantly related with technological innovation. Hence, the second research question was answered.

6.3.3 Discussions on Research Question Three

In response to RQ(3) – "Is the relationship between MBNQA-TQM practices (i.e. leadership, strategic planning, customer focus, human resource focus, process management, and information analysis) and technological innovation performance mediated by organizational learning in the Malaysian manufacturing firms?", it was found that TQM practices such as strategic planning, and customer focus are mediated by organizational learning; while the remaining constructs like leadership, human resource management, information analysis, and process management are insignificantly mediated by organizational learning. Hence, the final research question for this research has been addressed.

6.4 Implications

This study provided further insights regarding the significance of TQM to the local manufacturing firms. Furthermore, the border of the present literature is widen by this study as it examines the mediating role of organizational learning while it explains the relation between MBNQA-TQM and technological innovation using Smart PLS approach. This study has contributed theoretically and practically, providing beneficial and practical findings and methods to both quality researchers and practicing managers. Such implications are further explained in the subsections below.

6.4.1 Theoretical Implications

Predominantly, this research serves to be the first few that rationales the multidimensionality of MBNQA-TQM constructs and its relations with a developing nation organizational learning. Although there are past research done in the field of TQM, these papers rarely highlight on the relations between each MBNQA-TQM and organizational learning. This study provides a clearer perception of MBNQA-TQM and its involvement towards organizational learning within the Malaysian ISO manufacturing firms. The linkage between TQM and organizational learning in the Malaysian context fills the current discrepancy and subsequent gap in knowledge. The present theoretical framework used in this study emphasizes on the MBNQA-TQM dimensions that are predominantly important to ascertain a high level of organizational learning among the local manufacturing firms in Malaysia. Furthermore, as compared to the research conducted by Terziovski et al. (2000), Martinez-Costa and Jimenez-Jimenez (2008, 2009) and Hung et al. (2011) in the developed and emerging nations, such as Australia, Spain and Taiwan respectively, this present research further confirms that the implementation of MBNQA-TQM practices are imperative to assist the Malaysian manufacturing firms to become successful in their organizational learning process. Hence, this study is believed to widen the TQM and organizational learning literature and to provide quality management practitioners and academicians deeper comprehension on the association between TQM practices and organizational learning. Apart from that, this study is believed to gather the attention of other researchers with its relatively new theoretical model. It is with great hope that future research could also be carried out on different nations or a comparison between different industries be done on the conceptual model to study the relation between TQM practices and organizational learning.

Furthermore the present study also provides a better perception pertaining to MBNQA-TQM and its involvement in technological innovation among the Malaysian ISO-certified manufacturing firms. The linkage between the TQM constructs and technological innovation in the Malaysian manufacturing firms fills the gap in the extant literature. The proposed conceptual model used in this study emphasizes on the MBNQA-TQM practices that are predominantly vital to ascertain high levels of technological innovation in the Malaysian manufacturing firms. Investigations on the multidimensionality of TQM elements were carried out. The present findings which were tabulated can assist these firms in increasing its levels of technological innovation, which are quite inadequate currently. Ultimately, the present work seeks to ignite the interest of other researchers to dive into the essential concepts of TQM, and attempts to uncover the situations at which TQM can add to the establishment of technological innovation for the Malaysian manufacturing companies.

As little has been written regarding the implementation of TQM on organizational learning and technological innovation experienced by the Malaysian manufacturing firms, this research contributes by formulating and testing a conceptual framework that explains the different types of MBNQA-

TQM practices on both organizational learning and technological innovation, in addition with organizational learning being the mediator. In other words, the current conceptual framework has extended the present research on TQM by incorporating organizational learning as an intervening variable to examine on each MBNQA-TQM practice on technological innovation. This has filled a significant research gap in the literature of TQM, organizational learning, and technological innovation. To the best understanding of the researcher, this study is the first effort in Malaysia to relate MBNQA-TQM, OL and TI, with OL (i.e. knowledge acquisition, distribution, application and storage) as a mediator, a contribution that enrich the TQM literature bank in Malaysia. Additionally, minimal empirical research was found exploring both the direct and indirect effects in the interrelations among MBNQA-TQM, organizational learning, and technological innovation, in which the subsequent findings obtained from this study is expected to improve and deepen the understanding of issues relating to TQM in firms, which are useful to theory building in quality studies. In this respect, the establishment of multidimensional and mediating relationships between the six MBNQA-TQM constructs, organizational learning, and technological innovation in this study contributes to the literature on quality management by providing a Malaysian standpoint on this subject, an important distinction that previous studies have not identified.

6.4.2 Practical Implications

In totality, this research has revealed the importance of MBNQA-TQM framework in which it reemphasizes the main belief that some of the TQM components such as strategic planning, human resource management, customer focus, information analysis, and process management are positively and significantly related to organizational learning. Therefore, the benefits that would derive from quality improvement efforts are regarded as crucial and manufacturing firms can decide on the specific total quality programmes and policies to implement that are beneficial when comes to managing their organizations' organizational learning process. Furthermore, this article also puts forth some valuable insights to help the managers of these firms to recognize problem areas in their own firms and to carry out corrective actions. Findings have proven that only leadership is not significantly related to organizational learning and should be improved and amended accordingly. Managers should be more proactive in the involvement of the quality management and improvement process to ensure that the organizational process runs smoothly. In other words, managers should take the initial step and be an example to the employees in being one who is active in learning all the time, to ensure that the organizational learning process is successful.

Apart from that, the data gathered and the result generated from this research also confirmed the positive relations between two MBNQA-TQM practices (i.e. strategic planning, and customer focus) with technological innovation among the Malaysian manufacturing firms. Hence, in order to attain or build up an organizational culture that steer itself towards innovation (at least for the Malaysian manufacturing firms), it is strongly advised that such TQM practices be utilized as instruments by the company managers. Among the six MBNQA-TQM constructs, strategic planning showed the highest impact on technological innovation, followed by customer focus. Thus, it is proposed that the elements of strategic planning and customer focus, as explained earlier in the discussion section, be employed by the Malaysian manufacturing firms in order for the further enhancement of technological innovation. As innovation is perceived to be a risky business, competing solely on commodity business alone carries a higher risk. Unforeseen changes in the markets, such as the changes in government policy and economic changes, are beyond the control of a firm. However, when a firm remains its position as an innovation leader, the firm would have the capacity to operate at a level where very few or no rivals can match what it is offering.

In general, the proposed conceptual framework can serve as a diagnostic instrument for the organizational practitioners to gain a greater insight into the positive influences of MBNQA-TQM practices on firms' organizational learning and technological innovation performance. The findings in this study do allow the industrial practitioners to manage their employees' behaviour by applying the right TQM components to increase the level of both organizational learning processes and technological innovation performance. Furthermore, this present research study has also confirmed that organizational learning partially mediates between TQM practices (i.e. strategic planning and customer focus) with technological innovation. One effective way to stimulate technological innovation within a firm is to enhance the organizational learning behaviour among the employees through the effective implementation of the various TQM constructs.

As previously mentioned, TQM can be applicable not only to the private sector, but also to the public sectors. Considering that TQM acts as the catalyst for both TI and OL, TQM can indeed have a useful role to play in the government. During the 90s, the Malaysian government undertook a major TQM initiative, in which such TQM program incorporated quality awards for which the national government agencies could compete with. Such agencies differ in their success level at TQM implementation and in competing for awards. To establish TQM in any government agency, training, empowerment and incentives needs to be provided to employees at all levels. Moreover, an environment that fosters learning, open communication and team work needs to be cultivated to attain a more efficient and effective performance through TQM. For such results to be consistently achieved, the government needs to be committed in creating the right business climate, adequate incentives, and the right protection.

6.4.3 Methodology Implications

A rigorous statistical validation was carried out in this research on the MBNQA-TQM model, OL and TI among the Malaysian manufacturers. Generally, the conceptualization and operationalisation of these three main constructs was supported. Furthermore, the conceptual framework was investigated for its validity and reliability across the sample of both academicians and practitioners and was found to perform well.

All three constructs of MBNQA-TQM, OL and TI were constructed based on existing literature and was later pilot-tested on a sample of fellow researchers and manufacturing managers. This study also developed a SEM framework as SEM has been proven to be the renowned statistical analysis in many social sciences research. The application of SEM has indeed provided a huge potential for both theory development as well as instrument validation in operation management research. In other words, this empirical research has taken advantage of the benefits of using SEM. In general, the model provided strong support for the hypothesized relationships.

6.5 Limitations and Direction for Future Research

In line with other empirical studies, this study does have its limitations. Hence it is essential to acknowledge the limitations explicitly to determine possible future research opportunities.

The first limitation is generalizability. Data collected is only limited to Malaysian manufacturers, which may result in survey biasness. Hence, for future research, the scope of this research should be widen to integrate data from service industry, multinationals and their subsidiaries, or other South East Asian countries (e.g. Thailand, Singapore, or Indonesia) or other developing nations (e.g. India, Korea, or China) or other more developed nations (e.g. the United States of America, Japan, Germany, Australia, Canada, or the United Kingdom), so that a comparative study can be done to determine where Malaysia is at. It is also possible to examine these relationships based on every country's data to identify and determine the possible variations. Hence, when future research considers exploring TQM at an international stage in accordance to the combined data from all the countries, this would certainly make rich the comprehension of the subject matter.

The second limitation identified in this study would be its research approach, where the data collected of this current study uses a cross-sectional approach instead of adopting a longitudinal approach. Hence, the time sequence of the relations among the three constructs could not be ascertained. While causal relationship can be inferred, they cannot be strictly determined. It is proposed that future researchers extend the study by collecting data using the longitudinal approach, enabling the researchers to assess the complex relations among the three latent constructs. In addition, such an approach is also able to determine how the constructs and their relationship evolve over a period of time, hence providing a more detailed study. In other words, it would be beneficial to test the effects of TQM elements on organizational learning and technological innovation in a proper manner using longitudinal study. The issue of the relation between TQM, organizational learning and technological innovation can be resolved with longitudinal study as it has the ability to elucidate the process which organizational learning or technological innovation changes in response to TQM practices.

The use of survey questionnaire would be the third limitation of this study. Although it is a widely used research instrument by many researchers due to it being a cost effective approach for collecting data, questions asked in a survey might be unclear to certain participants and this might lead to response biases. Additionally, the survey approach also presents a static view of the variables in this study, hence limiting the capability to reveal the dynamic nature of the associations between the constructs. For future research, a case study approach can be considered, where exploratory interviews or a field observation could be performed to garner a more in-depth understanding from the participants themselves with regards to the process involved in the relations between TQM, organizational learning and technological innovation.

The fourth limitation would be the consideration of a moderating factor. As this study focused solely on the mediating factor of OL, future studies can also consider incorporating moderating factors – e.g. firm size (Glaister, Dincer, Tatoglu, Demirbag, & Zaim, 2008), contextual factors (Zhang, Linderman, & Schroeder, 2012), market turbulence (Santos-Viajnde & Alvarez-Gonzalez, 2007) etc - or a combination of both moderating and mediating effects, as carried out by Choi and Eboch (1998), Douglas and Judge (2001), Shah and Ward (2003), Sousa and Voss (2001), and Wang, Chen, and Chen (2012), to gain further clarity. Future empirical research can investigate if the moderating variable(s) affect each specific relationship between TQM and firm performance in terms of technological innovation.

6.6 Chapter Summary

To conclude, a conceptual model is proposed in this research, linking the three main constructs of MBNQA-TQM, organizational learning and technological innovation among the Malaysian ISO-certified manufacturing firms. In other words, the six TQM practices based on the MBNQA framework were tested on their relationships with both organizational learning and technological innovation constructs. Additionally, the intervening role of organizational learning is also examined between each TQM practice with technological innovation. The proposed hypotheses were assessed among the Malaysian manufacturers.

The results confirmed the TQM constructs such as strategic planning, information analysis, human resource management, customer focus, and process management were proven to be significantly related with organizational learning; while leadership was found to be insignificantly linked with organizational learning. On the other hand, the findings of this present work has also proven that strategic planning, and customer focus were positively and significantly related to technological innovation; while other TQM dimensions such as leadership, human resource management, information analysis, and process management were found to be insignificantly correlated with technological innovation. Therefore, hypotheses H2a, H3a, H4a, H5a, H6a, H2b, and H3b, were supported. However, the findings do not support the hypotheses H1a, H1b, H4b, H5b, and H6b because the respective path coefficients were not significant.

As for organizational learning being the mediator on TQM-OL-TI linkage, findings confirmed that organizational learning partially mediates between the following: strategic planning and technological innovation; and customer focus and technological innovation; while no mediation was found between the following: leadership and technological innovation; human resource management and technological innovation; information analysis and technological innovation; and process management and technological innovation; hence partially supporting H2c, and H3c; while H1c, H4c, and H5c and H6c are not supported. Several contributions in terms of theoretical and practical have been thoroughly presented in this chapter. With several limitations identified in this study, future research could be directed to testing the proposed conceptual model on other national culture and sector to redefine the theoretical model.

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APPENDIX A

LIST OF PUBLICATIONS

This appendix will present the list of publication resulting from this research work. The list of publication is as follows:

(A) Journal Publications

1. **Lee, V.H.,** Choong, C.K., Wong, K.L. and Ooi, K.B. (Forthcoming, 2013), "Organizational Learning as a Mediating Factor of TQM Practices and Technological Innovation: An Empirical Analysis of Malaysia's Manufacturing Firms", *International Journal of Innovation and Learning*.
2. **Lee, V.H**., Ooi, K.B**.** and Choong, C.K. (2013), "Integrating TQM, Organizational Learning and Technological Innovation", *International Journal of Innovation and Learning*, Vol. 13, No. 1, pp. 78-95.

(B) International Conference Proceedings

1. **Lee, V. H**., Choong, C.K., Wong, K.L. and Ooi, K.B. (2013), "Organizational Learning: A Mediating Factor between Technological Innovation and TQM", *Proceedings of the Technology Innovation and Industrial Management Conference*, 29-31 May, Phuket, Thailand.

APPENDIX B

SURVEY QUESTIONNAIRE

The Integration between Total Quality Management (TQM) Practices, Organizational Learning and Technological Innovation

Survey Questionnaire

This survey is carried out concerning your organization's Total Quality Management (TQM) adoption and its relationship with both organizational learning and technological innovation. Please answer all questions to the best of your knowledge. There are no right or wrong responses to any of these statements. All responses provided are kept confidential and for academic purpose only.

Thank you for your participation.

Instructions:

1) There are **FIVE** (5) sections in this questionnaire. Please answer ALL questions in ALL sections.
2) Completion of this form will take you approximately 20 minutes.
3) Please feel free to share your comment in the space provided. The contents of this questionnaire will be kept **strictly confidential**.

Section A: Demographic Profile

In this section, we are interested in your company background in brief. Please tick your answer and your answers will be kept strictly confidential.

QA1: Gender: ❑ Female ❑ Male

QA2: Age: ❑ Below 25 Years Old ❑ 26-30 Years Old ❑ 31-35 Years Old
❑ 36-40 Years Old ❑ 41-45 Years Old ❑ Above 45 Years Old

QA3: Marital status: ❑ Single ❑ Married

QA4: Highest education completed:
❑ No College Degree
❑ Diploma/Advance Diploma
❑ Bachelor Degree/Professional Qualification
❑ Master Degree
❑ PhD Degree

QA5: Length of time with your organization:
❑ Less than 1 Year ❑ 1-2 Years ❑ 3-5 Years
❑ 5-10 Years ❑ 10-20 Years ❑ Above 20 Years

QA6: Your job position:
❑ Executive (e.g. Assistant Manager, System Analyst, Engineer etc)
❑ Manager/Head of Department
❑ General Manager/Director/Chief Executive Officer
❑ Other (please specify): ____

QA7: Your primary job scope:
❑ Research & Development
❑ Production
❑ Marketing
❑ Administration
❑ Finance
❑ Human Resource
❑ Information Technology
❑ Procurement
❑ Other (please specify): ____

Section B: Details of Organization

In this section, we are interested in your company background in brief. Please tick your answer and your answers will be kept strictly confidential.

QB1: Category of your organization's product or services:

- ❑ Manufacturing (please specify):
  - ❑ Electrical & electronics products
  - ❑ Food products
  - ❑ Chemical & chemical products
  - ❑ Rubber & plastic products
  - ❑ Textiles & textile products
  - ❑ Machinery & hardware
  - ❑ Other (please specify):____
- ❑ Services (please specify):
  - ❑ Education
  - ❑ Healthcare
  - ❑ Travel & tourism
  - ❑ Finance
  - ❑ Insurance
  - ❑ Entertainment
  - ❑ Other (please specify):____

QB2: Number of employees in your organization:

❑ Less than 50 ❑ 51-200 ❑ Above 200

QB3: Status of your organization:

- ❑ ISO Certified.
  If yes, how long has your organization been committed to the certification?
  Please specify: _______________
- ❑ Planning to ISO Certification
- ❑ Non-ISO Certified

QB4: Ownership:

- ❑ Foreign owned company
- ❑ State owned company
- ❑ Local private family owned company
  - ❑ Chinese
  - ❑ Non-Chinese

Section C: Total Quality Management Practices

This section is seeking your opinion regarding the Total Quality Management (TQM) practices in your company. Respondents are asked to indicate the extent to which they agreed or disagreed with each statement using 5 Likert scale [(1) = strongly disagree; (2) = disagree; (3) = neutral; (4) = agree and (5) = strongly agree] response framework. *Please circle one number per line to indicate the extent to which you agree or disagree with the following statements.*

Leadership:

No	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Top management…					
LD1	Actively participates in quality management and improvement process.	1	2	3	4	5
LD2	Strongly encourages employee involvement in quality management and improvement activities.	1	2	3	4	5
LD3	Empowers employees to solve quality problems.	1	2	3	4	5
LD4	Arranges adequate resources for employee education and training.	1	2	3	4	5
LD5	Discusses many quality-related issues in top management meetings.	1	2	3	4	5

Strategic Planning:

No	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Our organization…					
SP1	Has a mission statement which has been communicated throughout the company and is supported by our employees.	1	2	3	4	5
SP2	Has a comprehensive and structured planning process which regularly sets and reviews short and long-term goals.	1	2	3	4	5
SP3	Always incorporates supplier capabilities, and needs of other stakeholders including the community when we develop our plans, policies and objectives.	1	2	3	4	5

SP4	Has a written statement of strategy covering all business operations which is clearly articulated and agreed by our senior manager.	1	2	3	4	5
SP5	Includes continuous quality improvements in the planning process.	1	2	3	4	5

Customer Focus:

No	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Our organization…					
CF1	Collects extensive complaint information from customers.	1	2	3	4	5
CF2	Treats quality-related customer complaints with top priority.	1	2	3	4	5
CF3	Conducts a customer satisfaction survey every year.	1	2	3	4	5
CF4	Always conducts market research to collect suggestions on how to improve on products.	1	2	3	4	5
CF5	Our organization has precise knowledge of customer expectations.	1	2	3	4	5

Human Resource Focus:

No	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Our organization…					
HR1	Has a company-wide training and development process for all our employees.	1	2	3	4	5
HR2	Formally and regularly measures employee satisfaction.	1	2	3	4	5
HR3	Actively uses employee flexibility, multi-skilling and training to support performance improvement.	1	2	3	4	5

HR4	Maintains a work environment that contributes to the health, safety and well-being of all employees.	1	2	3	4	5
HR5	Has a reward and recognition system within the company that rewards relationship and task accomplishments based on work quality.	1	2	3	4	5

Process Management:

No	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Our organization…					
PM1	Has a set of clear goals that guide employees in their work as they work in teams.	1	2	3	4	5
PM2	Encourages employees to develop new and innovative ways for better performance.	1	2	3	4	5
PM3	Has employees that understand their respective role.	1	2	3	4	5
PM4	Has the ability to monitor all production/services processes to improve quality.	1	2	3	4	5
PM5	Uses statistical process control to monitor production/service processes.	1	2	3	4	5

Information Analysis:

No	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Our organization…					
IA1	Conducts regular reviews on its' quality performance.	1	2	3	4	5
IA2	Has the knowledge, availability, access and collection of data.	1	2	3	4	5
IA3	Has the availability of key performance figures for analysis and decision making.	1	2	3	4	5
IA4	Has undertaken benchmarking relative to cost position.	1	2	3	4	5

IA5	Has undertaken benchmarking of other firms' product quality and procedures.	1	2	3	4	5

Section D: Organizational Learning

This section is seeking your opinion regarding the organizational learning performance. Respondents are asked to indicate the extent to which they agreed or disagreed with each statement using 5 Likert scale [(1) = strongly disagree; (2) = disagree; (3) = neutral; (4) = agree and (5) = strongly agree] response framework. *Please circle one number per line to indicate the extent to which you agree or disagree with the following statements.*

No	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Knowledge Acquisition					
KA1	Co-operation agreements with other companies, universities, technical colleges, etc., are fomented.	1	2	3	4	5
KA2	Our organization is in touch with professionals and expert technicians.	1	2	3	4	5
KA3	Our organization encourages employees to join formal or informal networking made up by people from outside the organization.	1	2	3	4	5
KA4	New ideas and approaches on work performance are experimented continuously.	1	2	3	4	5
KA5	Organizational systems and procedures support innovation.	1	2	3	4	5
No	**Questions**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	Knowledge Distribution					
KD1	All members are informed about the aims of the company.	1	2	3	4	5
KD2	Meetings are periodically held to inform all the employees about the latest innovations in the company.	1	2	3	4	5

KD3	Our organization has formal mechanisms to guarantee the sharing of the best practices among the different fields of the activity.	1	2	3	4	5
KD4	There are within the organization individuals who take part in several teams or divisions and who also act as links between them.	1	2	3	4	5
KD5	There are individuals responsible for collecting, assembling and distributing internally employees' suggestions.	1	2	3	4	5
No	**Questions**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	Knowledge Interpretation					
KI1	Employees share knowledge and experience by talking to each other.	1	2	3	4	5
KI2	Current organizational practice encourages employees to solve problems together before discussing them with a manager.	1	2	3	4	5
KI3	Our organization is able to rid itself of obsolete knowledge and seek new alternatives.	1	2	3	4	5
KI4	Our organization offers other opportunities to learn (visits to other parts of the organization, internal training programmes, etc) so as to make individuals aware of other people or departments' duties.	1	2	3	4	5
No	**Questions**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	Organizational Memory					
OM1	Our organization has databases to stock its experiences and knowledge so as to be able to use them later on.	1	2	3	4	5
OM2	Our organization has directories or e-mails filed according to the field they belong to, so as to find an expert on a concrete issue at any time.	1	2	3	4	5
OM3	There is access to the organizations data basis and documents through some kind of network (Intranet etc.)	1	2	3	4	5

OM4	All the employees in our organization have access to the organization's databases.	1	2	3	4	5
OM5	The codification and knowledge administration system makes work easier for employees.	1	2	3	4	5

Section E: Technological Innovation

This section is seeking your opinion regarding the innovation. Respondents are asked to indicate the extent to which they agreed or disagreed with each statement using 5 Likert scale [(1) = strongly disagree; (2) = disagree; (3) = neutral; (4) = agree and (5) = strongly agree] response framework. *Please circle one number per line to indicate the extent to which you agree or disagree with the following statements.*

No	Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Product Innovation					
PD1	The level of newness (novelty) of new products is adequate.	1	2	3	4	5
PD2	We use the latest technological innovations in new product development.	1	2	3	4	5
PD3	The speed of new product development is fast.	1	2	3	4	5
	Process Innovation					
PS1	Our organization is technologically competitive.	1	2	3	4	5
PS2	The updated-ness or novelty of technology used in process is adequate.	1	2	3	4	5
PS3	The speed of adoption of the latest technological innovations in process is fast.	1	2	3	4	5

Thank you for your time, opinions and comments.
~ The End ~

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