

Application of Structural Equation Modeling (SEM) in Quantitative Research

Author:

Md Fauzi Ahmad@Mohamad

Email:

mohdfauzi@uthm.edu.my

Abstract: Structural Equation Modeling for SEM is second generation statistical analysis techniques for analyzing the inter-relationships among multiple variables in a model. SEM is an extension of the general linear model (GLM) that enables a researcher to test a set of regression equations simultaneously.

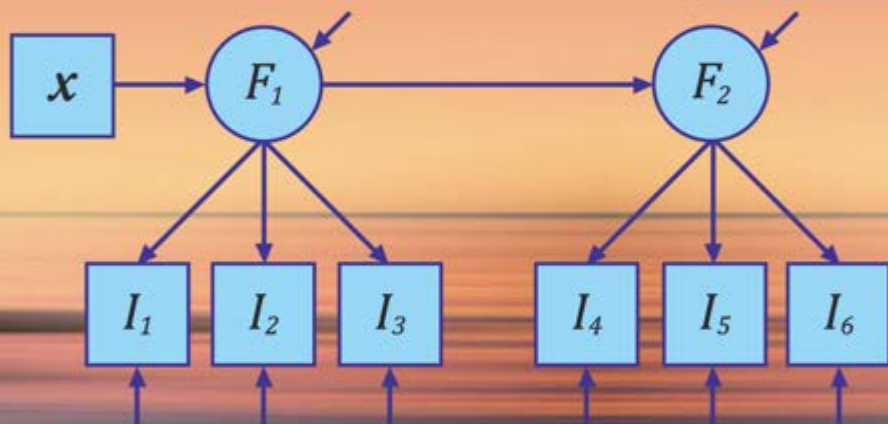
SEM software can examine complex relationships and models, such as confirmatory factor analysis and second order latent variables which improves the weaknesses of ordinary least square (OLS) method. Major applications of SEM are causal model, confirmatory factor analysis, second order factor analysis and multivariate analysis. It starts from explanation on SEM through empirical data focusing on quality management. Empirical data will provide better understanding of SEM application.

Hopefully this book will provide a useful reference towards a better understanding in SEM which can lead to implementing successful research for students and researchers.

Keywords: Structural Equation Modeling (SEM), General Linear Model (GLM), Ordinary Least Square (OLS)

Application of Structural Equation Modeling (SEM) in QUANTITATIVE RESEARCH

Empirical Study



Structural Equation Modeling is a second generation statistical analysis techniques for analyzing the inter-relationships among multiple variables in a model

Research is easy if you can do it in a systematic way

MD. FAUZI AHMAD@MOHAMAD

Application of Structural Equation Modeling (SEM) in QUANTITATIVE RESEARCH

Empirical Study

Structural Equation Modeling is a second generation statistical analysis techniques for analyzing the inter-relationships among multiple variables in a model

Research is easy if you can do it in a systematic way

MD. FAUZI AHMAD@MOHAMAD



© Penerbit UTHM
First Published 2017

Copyright reserved. Reproduction of any articles, illustrations and content of this book in any form be it electronic, mechanical photocopy, recording or any other form without any prior written permission from The Publisher's Office of Universiti Tun Hussein Onn Malaysia, Parit Raja, Batu Pahat, Johor is prohibited. Any negotiations are subjected to calculations of royalty and honorarium.

Perpustakaan Negara Malaysia Cataloguing—in—Publication Data

Md. Fauzi Ahmad @ Mohamad, Dr.

Application of Structural Equation Modeling (SEM) in
QUANTITATIVE RESEARCH / MD. FAUZI AHMAD@
MOHAMAD

Includes index

Bibliography: page 131

ISBN 978-967-0764-77-1

1. Quantitative research--Methodology.

2. Quantitative research. I Title.

001.42

Published by:
Penerbit UTHM
Universiti Tun Hussein Onn Malaysia
86400 Parit Raja,
Batu Pahat, Johor
No. Tel: 07-453 7051
No. Faks: 07-453 6145

Website: <http://penerbit.uthm.edu.my>
E-mail: pt@uthm.edu.my
<http://e-bookstore.uthm.edu.my>

Penerbit UTHM is a member of
Majlis Penerbitan Ilmiah Malaysia
(MAPIM)

Printed by:
PERCETAKAN IMPIAN SDN BHD
No. 10, Jalan Bukit 8,
Kawasan Perindustrian Miel
Bandar Baru Seri Alam
81750 Masai, Johor

Dedicated

To my beloved mother and father,
Haji Mohamad and Hajjah Mariah.
My family, Fatan Adibah, Faiza Irdina and Faiz Saffin,
My Dearest Sisters and Brothers
Fadzil, Fauziana, Fariza, Fuad and Fatimah

TABLE OF CONTENT

<i>Preface</i>	<i>xi</i>
<i>Acknowledgements</i>	<i>xiii</i>
<i>List of Abbreviations</i>	<i>xv</i>
Chapter 1 STRUCTURAL EQUATION MODELING (SEM)	1
Structural Equation Modeling (SEM) Introduction	1
Major applications of SEM	3
The Variable Terms in SEM	4
Chapter 2 QUALITY EVOLUTION	7
Quality	8
Evolution of Quality	10
Chapter 3 TOTAL QUALITY MANAGEMENT (TQM)	13
Economic Transformation Programme	13
TQM Definitions	15
TQM in Malaysia	16
TQM Constructs	19
Chapter 4 BUSINESS PERFORMANCE	31
Performance Measures	31
Business Performance	32
Chapter 5 META-ANALYSIS	39
Relationship between TQM and Business Performance	39

Chapter 6 RESEARCH DESIGN	45
Overall Structure of Methodology	46
Survey Methodology	47
Questionnaire Development	48
Population and Sampling of the Study	49
Population and Sampling	50
Expert Validation	51
Content Validity	51
Chapter 7 EXPLORATORY FACTOR ANALYSIS	55
Treatment for Missing Data	55
Response Rate for Pilot Study	55
Respondent General Descriptive Statistic for Pilot Study	56
Validity and Reliability Analysis: Exploratory Factor Analysis (EFA)	59
EFA and Reliability test on TQM	60
EFA and Reliability test on Business Performance (BP)	66
Chapter 8 NON-RESPONSE BIAS AND COMMON METHOD BIAS	71
Survey Methodology	71
Questionnaire Design	71
Survey Response Rate	72
Nonresponse Bias	72
Common Method Bias	73
Chapter 9 DESCRIPTIVE STATISTICS	75
Descriptive Statistics of Respondents	75
The Extent of TQM Practices in Malaysian Automotive Industry	77
The Ranking of TQM Practices Based on Descriptive Result	79

Chapter 10	CONFIRMATORY FACTOR ANALYSIS	83
	Confirmatory Factor Analysis	83
	Goodness of Measures	83
	Validity	83
	Construct Validity	84
	Convergent Validity	84
	Discriminant Validity	85
	Reliability	86
Chapter 11	MEASUREMENT MODEL: FIRST ORDER CONFIRMATORY FACTOR ANALYSIS (CFA)	87
	Exogenous Variable: TQM	87
	Endogenous Variable: Business Performance (BP)	97
Chapter 12	MEASUREMENT MODEL: SECOND ORDER CONFIRMATORY FACTOR ANALYSIS (CFA)	103
	Unidimensionality of Second Order CFA	104
	Construct Validity of Second Order CFA	104
	Convergent Validity and Composite Reliability (CR) of Second Order CFA	106
	Discriminant Validity of Second Order CFA	107
	Final Measurement Model of Second Order CFA	107
	Conclusions on Measurement Model	107
	Normality Test	108
Chapter 13	STRUCTURAL MODEL	111
	Relationship between TQM and Business Performance	111

Chapter 14	MEDIATOR EFFECT	115
	TPM mediates the relationship between TQM and BP	115
Chapter 15	MODERATOR EFFECT	119
	Ownership moderates the relationship between TQM and BP	119
	<i>Appendix</i>	127
	<i>Bibliography</i>	131
	<i>Biography</i>	147
	<i>Index</i>	149

PREFACE

Finally, I manage to complete writing this book. Thanks to God for giving me, patience and inspiration. Structural Equation Modeling or SEM is a second generation statistical analysis techniques for analyzing the inter-relationships among multiple variables in a model. SEM is an extension of the general linear model (GLM) that enables a researcher to test a set of regression equations simultaneously. SEM software can examine complex relationships and models, such as confirmatory factor analysis and second order latent variables which improves the weaknesses of ordinary least square (OLS) method. Major applications of SEM are causal model, confirmatory factor analysis, second order factor analysis and multivariate analysis. It starts from explanation on SEM and types of testing. This book provides researchers with the application of SEM through empirical data focusing on quality management. Empirical data will provide better understanding of SEM application. I believe that this book will be able to help who are in the theories of applying this techniques in their research.

Hopefully this book will provide a useful reference towards a better understanding in SEM which can lead to implementing successful research for students and researchers. My sincere, thanks to UTHM for giving me the opportunity to write this book, particularly to share my experience and knowledge in this small contribution.

“Research is easy if you can do it in a systematic way”

**Dr. Md. Fauzi Bin Ahmad @ Mohamad
Production and Operation Department,
Faculty of Technology Management and Business,
Universiti Tun Hussein Onn, Malaysia.**

ACKNOWLEDGEMENTS

In preparing this book, I was in contact with many people, researchers, academicians, and practitioners. They have contributed towards my understanding and thoughts. In particular, I wish to express my sincere appreciation to Dr. Norhayati, Dr. Ahmad and Prof Shari for encouragement, guidance, critics and friendship. Without his continued support and interest, this book would not have been the same as presented here.

My sincere appreciation also extends to dean, department head, all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space. I am grateful to all my family members. Without their understanding and support, I can't complete my book with success. I always pray that Allah can give me the direction for success in life.

This book is one of my small contribution to this country and nation based on my experience, observation and research. Hopefully this book will be useful as a guidance to industries for improving company performance and assist Malaysia to achieve vision 2020. At last, thanks to UTHM for giving me the opportunity to publish this book.

All The Best !
Gambatte !

LIST OF ABBREVIATIONS

AFTA	ASEAN Free Trade Agreement
BP	Business Performance
GLM	General Linear Model
OLS	Ordinary Least Square
PDCA	Plan-Do-Check-Action
PQA	Product Quality Assurance
QA	Quality Assurance
QC	Quality Control
SEM	Structural Equation Modeling
SMEI	Small Medium Sized Industry
SPSS	Statistical Package for the Social Science
TPM	Total Preventive Maintenance
TQM	Total Quality Management

Chapter 1

STRUCTURAL EQUATION MODELING (SEM)

Structural Equation Modeling (SEM) Introduction

Researchers in social science have used statistical analysis for analysing their research data in quantitative study. At the beginning stage, researchers often used **univariate and bivariate analysis** to analyse data. **To analyse more complex relationships** in a conceptual model, researchers have started applying more advance multivariate analysis method named as **Structural Equation Modeling (SEM)**. The evolution of statistical analysis started from first-generation through the 1980s then followed by second-generation in 1990s (Hair et al. 2014). First-generation analysis such as exploratory factor analysis (EFA), Anova and multiple regression has their weaknesses which is unable to involve in sophisticated multivariate data analysis. Structural Equation Modeling Structural Equation Modeling or SEM is a **second generation statistical analysis techniques** and it has been introduced for analyzing the inter-relationships among multiple variables in a model as shown in Table 1.1. The Structural Equation Modeling technique employs the combination of quantitative data and the correlational or causal assumptions into the model (Awang, 2014). The inter-relationships among variables could be expressed in a series of single and multiple regression equations. SEM is an **extension of the general linear model (GLM)** that enables a researcher to test a set of regression equations simultaneously. SEM software can examine complex relationships and models, such as confirmatory factor analysis and second order latent variables.

Chapter 2

QUALITY EVOLUTION

*“The only advice it accepted was to produce **high quality goods, goods of world standards, so as to be accepted by the world markets**”*

-Tun Dr.Mahathir

*“**Being number one is about being the best in the world in terms of quality on a sustained basis. We’ve never tried to become number one in terms of volumes or revenues; as long as we keep improving our quality, size will automatically follow**”*

-Katsuaki Watanabe, Toyota

This book focuses on SEM application in quality management. This chapter explains the quality evolution starting from quality evolution until TQM (Total Quality Management). In particular, this book focuses on the impact of TQM practices on business performance in Malaysia automotive industry as empirical study. TQM is crucial in ensuring that a company can survive in the continuously growing competition in the global market. Continuous efforts in improving quality, productivity, cost and timely delivery can enhance their competitiveness. Japanese companies are very successful today because of the TQM principles adoption and the implementation of TQM and quality practices, which are expounded by quality gurus such as Deming, Juran, Taguchi and others. TQM is an essential element that ensures business will meet the demands of customers well into the twenty first century (Talha, 2004). Yusof (2000) views TQM as not only bringing benefit to a nation’s community and employee but also to the wide range of the world’s community through the provision of excellent products from excellent organization at affordable price.

Chapter 3

TOTAL QUALITY MANAGEMENT (TQM)

“In Toyota everybody works as a team. We even call our suppliers our partners, and we make things that everybody thinks we should make”

-Katsuaki Watanabe, Former Toyota President

Economic Transformation Programme

Malaysia has experienced rapid economic progress over the last few decades. Nevertheless, the global economy has changed and Malaysia needs a new economic model to transform into a high-income developed country. Malaysia economic performance shows a loss in momentum over the past decade and the main factor slowing of the growth performance is weak labour productivity growth (Performance Management and Delivery Unit, 2012). Malaysia has to enhance its competitiveness by increasing better productivity and technology in order to sustain the economic growth (Talib & Senin, 2008). Thus, Malaysia’s economic transformation requires a transformation in the country’s productivity growth. After strong growth in the 1990’s, Malaysia’s economic growth over the past decade has been much slower on average about half of the previous decade, as shown in Figure 3.1. Private sector investment growth is lower compared to pre-1997 period on the underlying reasons including high costs, bureaucracy issues, lack of skilled professionals, and inadequate opportunities for investment.

Strategies that have succeeded to successfully change Malaysia from a poor country to a middle-income country are not suitable for the next stage of Malaysian development. In response to that, the Economic Transformation Programme (ETP) is a new economic model approach with the main purpose to transform Malaysia from developing country to a developed and high-income country where the private sector will

Chapter 4

BUSINESS PERFORMANCE

“I think that is why the Japanese produce such high quality products we are familiar with today. Their cars are of the best quality. Really they are as good as the top German cars. In fact in many ways they are better. And I believe this derives from their desire not to be ashamed of their work”

-Tun Dr.Mahathir

Performance Measures

This book focus on the impact of TQM practices on business performance in Malaysia automotive industry. In this section, author reviews performance measure and the dimensions for business performance based on previous works. A serious research effort to measure both quality management practices and their effects on quality outcomes begins with Saraph et al., (1989). Then, it was followed by Flynn et al., (1994), Ahire et al., (1996), and Black & Porter (1996). There are different views in terms of TQM and business performance in previous studies. Some studies view TQM as a multidimensional construct (Sila, 2007; Pinho, 2008; Grando & Belvedere, 2006) while others view it as a single construct (Fynes et al., 2008). Performance measured was also different across studies. Financial performance, measured in terms of growth in market share, profitability, and return on assets, was considered in some studies (Demirbag et al., 2006). Other studies considered operational performance measured in terms of product quality, inventory performance (Agus & Hassan, 2011), and customer satisfaction (Zakuan et al., 2010). In some studies, multidimensional indicators of performance are considered (Kakkar & Narag, 2007; Zakuan et al., 2010) while others used single performance construct (Arumugam et al., 2008, Demirbag et al., 2006).

Chapter 5

META-ANALYSIS

Relationship between TQM and Business Performance

Meta-analysis is a statistical technique for combining the findings from previous studies which based on literature review. **Meta-analysis are important for identifying effect size based on systematic review procedure.** There are significant relationship between TQM and business performance as evidenced in previous studies, as shown in Table 5.1. The benefits of TQM are improved quality, employee participation, teamwork, working relationships, customer satisfaction, employees satisfaction, productivity, communication, and market share (Besterfield, 2004). Most previous studies show a positive relationship between TQM practices and business performance (Jun et al., 2006; Bou & Beltrán, 2007; Gunday et al., 2011; Miyagawa & Yoshida, 2010; Ismail et al., 1998). However, there are also studies that show TQM does not improve the business performance (Corredor & Goñi, 2011; Claver-Cortés et al., 2007). Some of the findings are also partially correlated with the business performance (Demirbag et al., 2006; Feng et.al., 2006; Arumugam et al., 2008).

Chapter 6

RESEARCH DESIGN

Scientific research must begin with a structure or plan. The structure that defines the number of variables to be studied and their relationship with one another is termed as research design. Flynn et al., (1990) examined empirical research methods in operation managements. They compared various research methods such as survey, case study, field experiment, panel study, and focus group. Survey questionnaire is the most commonly used research method in production and operations management research (Konecny & Thun, 2011; Agus & Hassan, 2011). Yin (2009) compared different research strategies based on three conditions: type of research questions, investigator control over behavioural events, and degree of focus on contemporary issues. Both case study and survey have no investigator control over behavioural events, and they focus on contemporary issues. The case study answers questions related to how and why. On the other hand, the survey answers questions related to who, what, where, how many, and how much. This study will attempt to answer such questions and survey method is the preferred method. This study is more suitable using survey method than case study method. The reason is because the nature of the research, which focuses to identify what are the relationships amongst variables rather than exploring phenomena (Gunday et al., 2011; Fotopoulos & Psomas, 2010). Based on all these considerations, a mail survey has been used in this research to empirically investigate the proposed research model. The empirical survey is divided into two parts: a pilot survey and a final survey. The purpose of the pilot survey is to study the responses and to rectify, modify, and redefine the questions for the final survey. The questionnaire has been mailed to the target population. To encourage feedback, respondents have been promised to receive a summary of the research result (Fynes et al., 2008). Two repeat mailings of the instrument have been made to improve the response rate for final survey.

Chapter 7

EXPLORATORY FACTOR ANALYSIS (EFA)

Treatment for Missing Data

Using the SEM, treatment of missing value is important. Complete data are required for the probability density and adjustment must be made to incomplete datasets (Brown, 1994). In this study, different procedure has been used to adjust to the missing data for each situation. The first step is to eliminate input errors on the part of the data entry. The second step is to deal with the issue of non-response from the respondents. There are vary and no clear limit of missing data amongst researchers such as 10% (Byrne, 2010; Kline, 2011) and 25% (Sekaran & Bougie, 2010). In this study, the missing data has been filled in with the expectation maximisation (EM) for data which has less than 10% of missing (Byrne, 2010; Kline, 2011). Otherwise, the information has been dropped from the study for more than 10% of missing data.

Pilot Study

A pilot study has been conducted to determine the clarity of the questionnaire and to test the validity and internal reliability of the measures. Pilot data were collected using a self-administered questionnaires that have been distributed to 300 car manufacturers and suppliers companies in Malaysia. It has been requested that the questionnaire to be completed by a quality manager in charge of quality management. The pilot data has been analysed using SPSS.

Reponse Rate for Pilot Study

Prior to the final survey, pilot study has been conducted. A total of 300 surveys were distributed to quality assurance manager of these

Chapter 8

NON-RESPONSE BIAS AND COMMON METHOD BIAS

Survey Methodology

Survey method is used to collect the data and information from the samples. Chang (2002) describes survey as questioning the respondents and the recording of their responses to be used as data for analysis. Survey has many advantages such as geographical flexibility, ability to reach a widely dispersed sample especially in international study, free from interview bias, economical method and it gives respondent more time to answer (Mangione, 1995). However, the weaknesses of survey method is that the survey is limited to only one respondent of each company (Lam et al., 2011). In general, compared to interview method, survey method is relatively cost effective, time saving, and energy saving (Cooper & Schindler, 2003). In this study, a questionnaire using a seven-point Likert scale has been used for collecting data. The methodology begins with designing the questionnaire and followed by validity and reliability testing of the questionnaire before the final survey.

Questionnaire Design

The questionnaire is divided into 3 main sections :

Section 1:General profile of companies participating in this research

Section 2:Level of TQM practices

Section 3:Level of business performance

The respondents have been asked to evaluate the extent to which they agreed with statements that addressed the perception on TQM and business performance in their company on a seven-point Likert scale that ranges from [7] Very High to [1] Very Low.

Chapter 9

DESCRIPTIVE ANALYSIS

Descriptive Statistics of Respondents

This chapter explains descriptive analysis for final survey. The first aspect investigated was the general background of the respondents, which included respondents' position, duration of service in current position, ownership, number of employees, types of product manufactured, types of certification, and award of the company. The result are summarised in Table 9.1 in the form of percentage and frequency. Based on the result, 87.5% of the respondents were quality assurance and quality control managers and 68.3% of the respondents had worked more than 3 years in the current position. 47.6% of the respondents were Japanese companies and 52.4% of the respondents were non-Japanese companies. The type of products was quite diverse among the respondents. Metal and plastic parts showed the highest percentage with 29.2% and 19.4%, respectively. 51.4% of the companies were Small and Medium-Sized Enterprises (SMEs) and followed by large companies, 48.6%. In addition, in terms of quality certification, 80.3% of the respondents had MS ISO 9001 and followed by ISO 14001 and TS 16949 with 64.9% and 49.5% respectively. Industry Excellence award and Quality Management award were the two highest certifications among the respondents, with 12.9% for Industry Excellence award and 6.3% for Quality Management award. Others than that, 59.6% were mostly customer quality award from buyers.

Chapter 10

MEASUREMENT MODEL AND CONFIRMATORY FACTOR ANALYSIS (CFA)

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) has been done to examine the hypothesised factor structure and to assess its fit to the data (Martínez-Costa et al., 2008). CFA is the most comprehensive method for assessing construct validity as it provides statistical evidence (e.g. Chi-square test for the overall fit of the model). CFA has been performed to test the construct validity of unidimensionality and convergent validity (Prajogo & Hong, 2008) and to support the result of EFA. At this stage, the items loading of higher than 0.6 has been accepted (Hair, 1998).

Goodness of Measures

Validity and reliability are two criteria for measure of goodness (Ramayah et al., 2011). Reliability is a test of how consistently a measuring instrument measures whatever concept it is measuring, whereas validity is a test of how well an instrument that is developed measures the particular concept it is intended to measure (Sekaran & Bougie, 2010; Hair, 2010).

Validity

The validity has been tested using first order and second order measurement model. Empirical studies have shown that TQM elements are closely related to each other (Teeravarapug et al., 2011). The study by Prajogo & Hong (2008) empirically supports the validity of the second order factor model of TQM. According to Hair (2010), validity of each construct must be tested before testing the overall validity of

Chapter 11

MEASUREMENT MODEL: FIRST ORDER CONFIRMATORY FACTOR ANALYSIS (CFA)

Prior to structural equation modelling (SEM), testing on unidimensionality, validity, and reliability was performed. This stage of analysis is called confirmatory factor analysis (CFA) with multiple factors. This stage is also known as measurement model testing in which TQM and business performance were tested using the first order confirmatory factor model. The items resulting from EFA were confirmed by conducting CFA to determine whether the items were belonging the constructs (Hair, 2010). The functions of CFA were to reconfirm the items that were grouped in EFA and to assess unidimensionality and convergent validity (Byrne, 2010; Sadikoglu & Zehir, 2010). Hair (2010) highlights the importance of performing CFA for the measurement model. If the measurement model is found acceptable, then the structural model can be tested next (Hair, 2010; Sekaran & Bougie, 2010). Hair (2010) also highlights that measurement model is crucial for confirming reliability and validity of a model. Measurement model for individual construct is not important, but measurement model with multiple constructs has higher priority (Hair, 2010). In this study, the measurement model for following variables was conducted:

1. Exogenous variable: TQM (ten constructs)
2. Endogenous variable: Business performance (six constructs)

Exogenous Variable: TQM

The first model tested showed that TQM had ten constructs with 47 items after EFA. The ten constructs were as follows: (1) top management leadership (TML), (2) human resource development (HRD), (3) work process (WP), (4) customer focus (CF), (5) information and analysis

Chapter 12

MEASUREMENT MODEL: SECOND ORDER CONFIRMATORY FACTOR ANALYSIS (CFA)

The validity has been tested using second order measurement model. Empirical studies have shown that TQM elements are closely related to each other (Teeravaraprug, Kitiwanwong, & SaeTong, 2011). The study by Prajogo & Hong (2008) empirically supports the validity of the second order factor model of TQM. According to Hair (2010), validity of each construct must be tested before testing the overall validity of the full model. Validity of instrument can be divided into three types: construct validity, convergent validity, and discriminant validity. The Cronbach's alpha coefficient is used to assess the inter-item consistency for measurement items in a construct, in which the alpha values should be above 0.6, as suggested by Nunnally & Bernstein (1994). In specific, 0.6 is satisfying for a relatively new measurement instrument while 0.7 is sufficient (Nunally, 1978). The alpha value of above 0.70 indicates that the scales are internally consistent (Chi et al., 2011; Hair, 2010). A composite reliability (CR) of 0.70 or greater is acceptable (Fornell and Larcker, 1981), which shows that the measurements are reliable.

In order to measure the second-order CFA, the author used the method commonly applied in the literature (e.g., Bock et al., 2005; Fuller et al., 2006), as suggested by Chin et al., (2003). First, each first-order factor (i.e., top management and human resource) was modeled to the second-order factor (TQM) based on first order CFA analysis. Then, the first-order factors were pulled together as the reflective measure of TQM in AMOS for the measurement model. Initially, the measurement model provided a poor fit for the 5 second order factors model with 26 items as shown in Figure 12.1. The chi-square/df was 3.972 ($\chi^2=1147.921$, $df=289$). Furthermore, the GFI was .776, AGFI=.727, TLI=.873, CFI=.887, and RMSEA=.097.

Chapter 13

STRUCTURAL MODEL

Relationship between TQM and Business Performance

Covariance-based SEM, developed by Jöreskog in the early 1970's (Jöreskog & Wold, 1982), is the most widely known method. This technique uses software such as LISREL, EQS, AMOS, SEPATH, and ROMANA (Vinci et al., 2010). This approach uses the maximum likelihood that minimises the difference between the sample covariance and theoretical model (Hair, 2010). Hence, the aim is to achieve the best goodness-of-fit of the model proposed in a study. However, goodness-of-fit cannot infer the model if the model is not supported by the theory.

Second order factor was used to examine the relationship between TQM and BP using structural model, as shown in Figure 13.1. Hair (2010) emphasises on using one-tailed test for testing paths in the structural model. The goodness-of-fit indices showed that this model fitted the data adequately. The chi-square/df was 2.37 ($\chi^2=246.898$, $df=104$). The GFI was .915, AGFI=.905, TLI=.957, CFI=.967, and RSMEA=.066. The model that fitted the criteria for the path model was satisfactory, thus the model was accepted to fit the data. The standardised rc for the relationships between TQM and BP was 0.81, as shown in Table 13.1. Based on the path analysis, H11 was supported as the rc^2 value was 0.66, suggesting that 66% of the variance in BP can be explained by TQM. The result showed a positive and significant relationship ($\beta=0.81$, $CR=13.774$, $p<0.01$) between extent of TQM and BP. The following suggested values for low, medium, and high effects for rc were based on Cohen (1988): (1) $rc>0.10$: Small effect; (2) $rc>0.30$: Moderate effect; and (3) $rc>0.50$: High effect. Thus, TQM practice had strong and significant effect, which contributed to the business performance (Cohen, 1988). This hypothesis was thus supported.

Chapter 14

MEDIATOR EFFECT

A mediator is a variable that determines the association between independent variable (IV) and dependent variable (Bennett, 2000). The mediator effect will only be tested when there are significant relationships between independent variables (IV) and the dependent variable (DV), but at the same time the variable should occur in between independent variables and the dependent variable. A mediator effect is as shown in Figure 14.1. Mediator effect exists if the following criteria are met: The independent variable predicts the mediator variable. The mediator variable predicts variations in the dependent variable.

When the relationships in (a) and (b) are controlled in the model, the direct relationship between the independent variable and the dependent variable becomes nonsignificant (Baron & Kenny, 1986).

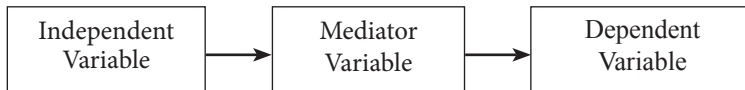


Figure 14.1: Conceptual model of a mediator effect.

TPM mediates the relationship between TQM and BP

In this study, TPM (Total Productive Maintenance) have been identified as mediator based on previous works. TPM as the mediator variable was included into the model, as shown in Figure 14.2. Table 14.1 shows that the relationship between TQM and BP was reduced when TPM was included in the model, but the relationship was still significant with r_c from 0.81 (CR=13.177, $p < 0.01$) to 0.55 (CR=7.449, $p < 0.01$). The result also showed that TQM had a significant and direct effect on TPM with $r_c = 0.80$ (CR=14.346, $p < 0.01$). In addition, TPM had a significant and direct effect on BP with $r_c = 0.31$ (CR=4.334, $p < 0.01$).

Chapter 15

MODERATOR EFFECT

Moderators are independent variables that can alter the strength of relationship between IV and DV (Bennett, 2000). Moderators that interact with the IV will result in DV and IV relationships to become stronger or weaker at different levels (Bennett, 2000; Hair, 2010; Hair et al., 2011). Therefore, consideration moderators and mediators allow more precise results between IV and DV, as shown Figure 15.1.

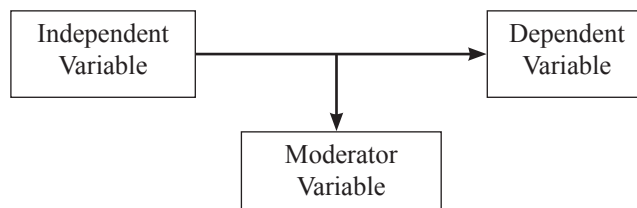


Figure 15.1: Conceptual model of a moderator effect.

Ownership moderates the relationship between TQM and BP

The structural equation modelling (SEM) for testing ownership as a moderator between TQM and BP is shown in Figure 15.2.

BIBLIOGRAPHY

- Abdul, J., & Shaari, N. (2010). Barriers to Implement TQM in Japanese Way : A Study on Companies in Malaysia. *International Review of Business Research Papers*, 6(5), 400-410.
- Abdullah, R., Lall, M. K., & Tatsuo, K. (2008). Supplier Development Framework in the Malaysian Automotive Industry : Proton's Experience. *Int. Journal of Economics and Management*, 2(1), 29-58.
- Abo-Alhol, T. R., Ismail, M. Y., Sapuan, S. M., & Hamdan, M. M. (2005). The Effectiveness of Quality Circle Participation in Industrial and Service Organizations in Malaysia. *Journal of Social Sciences*, 1(1), 25-30.
- Agarwal, Erramilli, & Dev. (2003). Market orientation and performance in service firms: Role of innovation. *Journal of Services Marketing*, 17(1), 68-82.
- Agus, A. (2004). TQM as a focus for improving overall service performance and customer satisfaction: An empirical study on a public service sector in Malaysia. *Total Quality Management & Business Excellence*, 15(5-6), 615-628.
- Agus, A., & Hassan, Z. F. (2011). Enhancing Production Performance and Customer Performance Through Total Quality Management (TQM): Strategies For Competitive Advantage. *Procedia - Social and Behavioral Sciences*, 24(2011), 1650-1662.
- Ahire, S.L., Golhar, D. Y., & Waller, M. A. (1996). Development and validation of TQM implementation constructs. *Decision Sciences*, 27, 23-56.
- Ahire, Sanjay L., & Dreyfus, P. (2000). The impact of design management and process management on quality: an empirical investigation. *Journal of Operations Management*, 18(5), 549-575.
- Ahmad, M. F., Ariff, M. S. M., Zakuan, N., Takala, J., & Jusoh, A. (2013a). Relationship amongst TQM , Business Performance , Tools and Techniques : Qualitative Study Result. *Business Engineering and Industrial Applications Colloquium (BEIAC)*, Langkawi: IEEE, pp. 22-27.
- Ahmad, M. F. B., & Yusof, S. M. (2010). Comparative study of TQM practices between Japanese and non-Japanese electrical and electronics companies in Malaysia: Survey results. *Total Quality*

- Management & Business Excellence*, 21(1), 11-20.
- Ahmad, M. F., Zakuan, N., Jusoh, A., & Takala, J. (2012). Relationship of TQM and Business Performance with Mediators of SPC, Lean Production and TPM. *Procedia - Social and Behavioral Sciences*, 65(2012), 186-191.
- Ahmad, M. F., Zakuan, N., Jusoh, A., & Takala, J. (2013b). Review of Relationship between TQM and Business Performance. *Applied Mechanics and Materials*, 315(2013), 166-170.
- Ahmad, M. F., Zakuan, N., Jusoh, A., Tasir, Z., & Takala, J. (2013c). Meta-analysis of the relationship between TQM and Business Performance. *IOP Conference Series: Materials Science and Engineering*, Bandung: IOP Publishing, 46 (1), 120.
- Ahmad, M., Yusof, S., & Yusof, N. (2008). Comparative study of quality practices between Japanese and non-Japanese base electrical and electronic companies in Malaysia: A Survey. *Jurnal teknologi*, 47(A), 75-89.
- Anschutz, E. E. (1995). *TQM America: How America's most Successful Companies Profit from Total Quality Management*. Bradenton, FL: McGuinn & McGuinn Publishing.
- Armstrong, J., & Overton, T. (1977). Estimating non-response bias in mail surveys. *Journal of Marketing Research*, 14(August), 396-402.
- Arumugam, V, Ooi, K.-B., & Fong, T.-C. (2008). TQM practices and quality management performance: An investigation of their relationship using data from ISO 9001:2000 firms in Malaysia. *The TQM Journal*, 20(6), 636-650.
- Awang, Z. (2012). *A Handbook on SEM* (5th ed.). Kota Bharu: UITM.
- Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, 16(1), 74-94.
- Baletic Bos, Z. (Ed). (1995). *Ekonomski leksikon [Lexicon of economic terms]*. Zagreb: Lexicographical Institute.
- Bateman, T. S., & Snell, S. A. (2002). *Management: competing in the new era* (5th ed.). New York: McGraw-Hill Higher Education.
- Bayo-Moriones, A., Bello-Pintado, A., & de Cerio, J. M. D. (2010). 5S use in manufacturing plants: contextual factors and impact on operating performance. *International Journal of Quality &*

- Reliability Management*, 27(2), 217-230.
- Berry, T. (1991). *Managing the Total Quality Transformation*. New York: McGraw-Hill.
- Besterfield, D. H. (2004). *Quality Control*. USA: Prentice-Hall.
- Besterfield, D. H. (2009). *Quality Control* (8th ed.). New Jersey: Pearson Prentice Hall.
- Black, S. A., & Porter, L. J. (1996). Identification of the critical factors of TQM. *Decision Sciences*, 27(1), 1-21.
- Bock, G. W., Zmud, R. W., & Kim, Y. G. (2005). Behavioural intention formation in knowledge sharing: examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly*, 29(1), 87-111.
- Bou, J. C., & Beltrán, I. (2005). Total Quality Management, human resource strategy and firm performance : an empirical study. *Total Quality Management*, 16(1), 37-41.
- Byrne, B. . (1998). *Structural Equation Modeling with LISREL, PRELIS, and SIMPLIS*. New Jersey: Lawrence Erlbaum Associates.
- Byrne, B. . (2010). *Structural Equation Modeling with AMOS. Structural Equation Modeling* (2nd ed.). New York: Routledge Francis & Taylor.
- Chang, C. C., Chiu, C. M., & Chen, C. A. (2010). The effect of TQM practices on employee satisfaction and loyalty in government. *Total Quality Management & Business Excellence*, 21(12), 1299-1314.
- Chang, T. L. (2002). *Six Sigma: A framework for small and medium sized enterprises to achieve total quality*. PhD Dissertation. Cleveland State University.
- Chi, A., Bahjat, A., & Matsui, Y. (2011). Quality management practices and competitive performance : Empirical evidence from Japanese manufacturing companies. *International Journal of Production Economics*, 133(2), 518-529.
- Chin, K. S., Tummala, V. M. R., & Chan, K. M. (2003). Quality management practices in Hong Kong industries: A comparison between electronics and toys manufacturing industries. *International Journal of Quality & Reliability Management*, 20(9), 1051-1083.

- Claver-Cortés, E., Pereira-Moliner, J., Tarí, J. J., & Molina-Azorín, J. F. (2007). TQM, managerial factors and performance in the Spanish hotel industry. *Industrial Management & Data Systems*, 108(2), 228-244.
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Lawrence Erlbaum.
- Cooper, D. R., & Schindler, P. S. (2003). *Business research methods* (8th ed.). Singapore: McGraw-Hill Book.
- Corredor, P., & Goñi, S. (2011). TQM and performance: Is the relationship so obvious? *Journal of Business Research*, 64(8), 830-838.
- Crosby, P. B. (1979). *Quality is Free: The Art of Making Quality Certain*. New York: McGraw-Hill.
- Dahlgaard, J. J., Kristensen, K., Kanji, G. K., Juhl, H. J., & Sohal, A. S. (1998). Quality Management Practices: a comparative study between East and West. *International Journal of Quality & Reliability Management*, 15(8/9), 812-826.
- Dean, J. W., & Bowen, D. E. (1994). Management theory and total quality: improving research and practice through theory development. *Academy of Management Review*, 19(3), 418.
- Deming, E. (1986). *Out of the Crisis*. Cambridge, Massachusetts: MIT.
- Deming, E. (2004). *The Guide for The Deming Application Prize For Overseas*. Massachusetts: MIT.
- Demirbag, M., Tatoglu, E., Tekinkus, M., & Zaim, S. (2006). An analysis of the relationship between TQM implementation and organizational performance: Evidence from Turkish SMEs. *Journal of Manufacturing Technology Management*, 17(6), 829-847.
- Dewettinck, K., & Ameijde, M. V. (2011). Linking leadership empowerment behaviour to employee attitudes and behavioural intentions. *Personnel Review*, 40(3), 284-305.
- Dicken, P. (1998). Transnational corporations and nation-states. *International Social Science Journal*, 49(1), 77-91.
- Duncan, R. B. (1972). Characteristics of organizational environments and perceived environmental uncertainty. *Administrative Science Quarterly*, 17(3), 313-327.

- Eng, Q. E., & Yusof, M. (2003). Comparison of TQM implementation practices in Malaysian electrical and electronic industry – A Survey. *Total Quality Management and Business Excellence*, 1(14), 63-78.
- Feigenbaum, A.V.(1986). Total Quality Control. Singapore: McGRAW-HILL.
- Feng, J., Prajogo, D. I., Tan, K. C., & Sohal, A. S. (2006). The impact of TQM practices on performance: A comparative study between Australian and Singaporean organizations. *European Journal of Innovation Management*, 9(3), 269-278.
- Field, A. (2009). *Discovering Statistics Using SPSS. Statistics* (2nd ed.). London: Sage Publication.
- Flynn, B. B., Sakakibara, S., Schroeder, R. G., Bates, K. A., & Flynn, E. J. (1990). Empirical research methods in operations management. *Journal of operations management*, 9(2), 250-284.
- Fotopoulos, C. V., & Psomas, E. L. (2010). The structural relationships between TQM factors and organizational performance. *The TQM Journal*, 22(5), 539-552.
- Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing Moderator and Mediator Effects in Counseling Psychology. *Journal of Counseling Psychology*, 51(1), 115-134.
- Fuentes, M. M. F., Montes, F. J. L., & Luis, M. (2006). Total Quality Management & Business Total Quality Management , strategic orientation and organizational performance : the case of Spanish companies, *Total Quality Management*, 17(3), 303-323.
- Fuller, M. A., Hardin, A. M., & Davison, R. M. (2006). Efficacy in technology-mediated distributed teams. *Journal of Management Information Systems*, 23(3), 209-235.
- Fynes, B., & De Búrca, S. (2005). The effects of design quality on quality performance. *International Journal of Production Economics*, 96(1), 1-14.
- Fynes, B., de Búrca, S., & Mangan, J. (2008). The effect of relationship characteristics on relationship quality and performance. *International Journal of Production Economics*, 111(1), 56-69.
- Garvin, A. G. (1988). *Managing Quality*. New York: The Free Press.
- Govindan, S., & Ahmad, Z. A. (2003). Managing manufacturing professional's job satisfaction via human resource management

- practices. *The Fifth Asian Academy of Management Conference: Conference Proceedings*, 10 – 13 September, Pahang, Malaysia, pp. 5.
- Grando, A., & Belvedere, V. (2006). District's manufacturing performances: A comparison among large, small-to-medium-sized and district enterprises. *International Journal of Production Economics*, 104(1), 85-99.
- Guimaraes, T. (1997). Assessing employee turnover intentions before and after TQM. *International Journal of Quality & Reliability Management*, 14(1), 46-63.
- Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International journal of operations & production Management*, 21(1/2), 71-87.
- Gunday, G., Ulusoy, G., Kilic, K., & Alpkan, L. (2011). Effects of innovation types on firm performance. *International Journal of Production Economics*, 133(2), 662-676.
- Hair, J.F. (2010). *Multivariate Data Analysis*. New York: Pearson Prentice Hall.
- Ho, S. K., & Fung, C. K. (1995). The Japanese 5-S practice and TQM training. *Training for Quality*, 3(4), 19-24.
- Hoang, D. T., Igel, B., & Laosirihongthong, T. (2006). The impact of total quality management on innovation: Findings from a developing country. *International Journal of Quality & Reliability Management*, 23(9), 1092-1117.
- Holjevac, I. A. (2008). Business ethics in tourism – As a dimension of TQM. *Total Quality Management & Business Excellence*, 19(10), 1029-1041.
- Holme, C. (2008). Business ethics – Part One: Does it matter? *Industrial and Commercial Training*, 40(5), 248-252.
- Imai, M. (1986). *Kaizen: The Key to Japan's Competitive Success*. Business. New York: Random House Business Division.
- Imai, M. (1997). *Gemba Kaizen: a common sense; low-cost approach to management*. Singapore: McGraw-Hill.
- Irani, Z., Beskese, A., & Love, P. E. D. (2004). Total quality management and corporate culture: constructs of organizational excellence. *Technovation*, 24, 643-50.

- Ishikawa, K. (1981). *What is total quality control : The Japanese way* . New York (5th ed). New York: McGraw.
- Ishikawa, K. (1995). *What is Total Quality Management*. USA: Prentice-Hall.
- Ismail, M. Y., Baradie, M. E., & Hashmi, M. S. J. (1998). Quality management in the manufacturing industry: Practice vs performance. *Computers & Industrial Engineering*, 35(3), 519–522.
- Ismail, M. Y., & Hashmi, M. S. J. (1999). The state of quality management in the Irish manufacturing industry. *Total Quality Management & Business Excellence*, 10(6), 100-115.
- Jayaram, J., Ahire, S. L., & Dreyfus, P. (2010). Contingency relationships of firm size, TQM duration, unionization, and industry context on TQM implementation—A focus on total effects. *Journal of Operations Management*, 28(4), 345-356.
- Jiménez-Jiménez, D., & Martínez-Costa, M. (2009). The performance effect of HRM and TQM: a study in Spanish organizations. *International Journal of Operations & Production Management*, 29(12), 1266-1289.
- Johnson, M. D., & Gustafsson. (2000). *Improving customer satisfaction, loyalty and profit: an integrated measurement and management system*. San Francisco, CA: Jossey-Bass.
- Joiner, T. A. (2007). Total quality management and performance: The role of organization support and co-worker support. *International Journal of Quality & Reliability Management*, 24(6), 617-627.
- Joreskog, K., & Sorbom, D. (1993). *Lisrel 8: Structural Equation Modeling with the Simplis Command Language*. Lincolnwood, IL.: Scientific Software International, Inc.
- Jun, M., Cai, S., & Shin, H. (2006). TQM practice in maquiladora: Antecedents of employee satisfaction and loyalty. *Journal of Operations Management*, 24(6), 791-812.
- Jung, J. Y., & Hong, S. (2008). Organizational citizenship behaviour (OCB), TQM and performance at the maquiladora. *International Journal of Quality & Reliability Management*, 25(8), 793-808.
- Juran, J. M. (1998). *Juran's Quality Handbook*. Singapore: McGRAW-

HILL.

- Kakkar, S., & Narag, A. . (2007). Recommending a TQM model for Indian organizations. *The TQM Magazine*, 19(4), 328-353.
- Kanji, G. K. (1998). Measurement of business excellence. *Total Quality Management*, 9(7), 633-43.
- Karim, M. a., Smith, A. J. R., Halgamuge, S. K., & Islam, M. M. (2008). A comparative study of manufacturing practices and performance variables. *International Journal of Production Economics*, 112(2), 841-859.
- Kaynak, H. (2003). The relationship between total quality management practices and their effects of firm performance. *Journal of Operations Management*, 21(4), 405-435.
- Khaliq, A. A. (1996). Quality management foundation: An agenda for Islamization of management knowledge. *Malaysian Management Review*, 31(1), 10-20.
- Kline, R. . (2011). *Principles and practices of structural equation modeling* (3rd ed.). New York: The Guilford Press.
- Koh, H. C., & Boo, E. H. Y. (2004). Organisational ethics and employee satisfaction and commitment. *Management Decision*, 42(5), 677-693.
- Konecny, P. A., & Thun, J. H. (2011). Do it separately or simultaneously— An empirical analysis of a conjoint implementation of TQM and TPM on plant performance. *International Journal of Production Economics*, 133(2), 496-507.
- Koura, K., & Talwar. (2008). Comparing the UBEM Vedic matrix and the TQM elements deployment model using principal component analysis. *The TQM Journal*, 20(5), 413-435.
- Kowang, T. O., & Rasli, A. (2011). New product development in multi-location R & D organization: A concurrent engineering approach. *African Journal of Business Management*, 5(6), 2264-2275.
- Labich, K. (1992). The New Crisis in Business Ethics. *Fortune*, 125(8),167-176.
- Lam, S.-H., Lee, V.-H., & Ooi, K.-B. (2011). The relationship between TQM , learning orientation and market performance in service organisations : an empirical analysis. *Total Quality Management*, 22(12), 1277-1297.

- Liker, J.K., & Wu, Y. C. (2000). Japanese automakers, US suppliers and supply-chain superiority. *Sloan Management Review*, 42(1), 81-93.
- Lin, C., & Chang, S. (2006). Exploring TQM's impact on the causal linkage between manufacturing objective and organizational performance. *Total Quality Management*, 17(4), 465-484.
- Lin, C., Chow, W. S., Madu, C. N., Kuei, C.-H., & Pei Yu, P. (2005). A structural equation model of supply chain quality management and organizational performance. *International Journal of Production Economics*, 96(3), 355-365.
- Mangione, T. W. (1995). *Mail Surveys – Improving the quality*. London: Sage Publications.
- McGuire, S. J., & Dilts, D. M. (2008). The financial impact of standard stringency: An event study of successive generations of the ISO 9000 standard. *International Journal of Production Economics*, 113(1), 3-22.
- McNair, C. J., & Mosconi, W. (1987). Measuring performance in an advanced manufacturing environment. *Management Accounting*, 69(1), 28-31.
- Menezes, L. M. de, Wood, S., & Gelade, G. (2010). The integration of human resource and operation management practices and its link with performance: A longitudinal latent class study. *Journal of Operations Management*, 28(6), 455-471.
- Ministry of International Trade and Industry (2012). AFTA [Website]. URL: <http://www.miti.gov.my>. [Accessed on 14th June 2012]
- Ministry of International Trade and Industry (2014). AFTA [Website]. URL: <http://www.miti.gov.my>. [Accessed on 14th June 2014]
- MIDA (2013). Performance of the Manufacturing and Related Services Sectors in 2004 [Website]. URL: <http://www.mida.gov.my>. [Accessed on 10th January 2013]
- Miller, J. C., Meyer, A. D., & Nakane, J. (1992). *Benchmarking Global Manufacturing*. Irwin, Homewood, IL: Business One.
- Miyagawa, M., & Yoshida, K. (2010). TQM practices of Japanese-owned manufacturers in the USA and China. *International Journal of Quality & Reliability Management*, 27(7), 736-755.
- Nair, A. (2006). Meta-analysis of the relationship between quality management practices and firm performance - implications for

- quality management theory development. *Journal of Operations Management*, 24(6), 948-975.
- Neely, A., Gregory, M., & Platts, K. (1995). Performance measurement system design: A literature review and research agenda. *International Journal of Operations and Production Management*, 15(4), 80-116.
- Nunnally, J. C. (1978). *Psychometric Theory* (Second ed.). New York: McGRAW-HILL.
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric Theory* (3rd edition). New York: McGRAW-HILL.
- Oakland, J. S., & Porter, J. L. (1995). *Total Quality Management: Text with Cases*. Butterworth Heinemann: Oxford.
- Ooi, K. B., Arumugam, V., Teh, P. L., & Chong, A. Y. L. (2008). TQM practices and its association with production workers. *Industrial Management & Data Systems*, 108(7), 909-927.
- Osada, H. (2009). Quality management practices in Japanese company – special issue. *Quality Management*, 60(1), 10-24.
- Osland, A. (1997). Impact of total quality attitude management and training and work context on attitude supervisor. *Journal of Organizational Analysis*, 5(3), 291-301.
- Ou, C. X. J., Davison, R. M., Zhong, X., & Liang, Y. (2010). Empowering employees through instant messaging. *Information Technology & People*, 23(2), 193-211.
- Parast, M. M., & Adams, S. G. (2011). Corporate social responsibility, benchmarking, and organizational performance in the petroleum industry: A quality management perspective. *International Journal of Production Economics*, 139(2), 447-458.
- Performance Management and Delivery Unit, Pemandu (2013). Overview of ETP [Website]. URL: <http://etp.pemandu.gov.my>. [Accessed on 14th January 2013]
- Phan, A. C., Abdallah, A. B., & Matsui, Y. (2011). Quality management practices and competitive performance: Empirical evidence from Japanese manufacturing companies. *International Journal of Production Economics*, 133(2), 518-529.
- Piaw, C. Y. (2009). *Advance Research Statistic: Regression, Factor Analysis and SEM* (p. 29). Kuala Lumpur: Malaysia: McGraw-Hill.

- Pinho, J. C. (2008). TQM and performance in small medium enterprises: The mediating effect of customer orientation and innovation. *International Journal of Quality & Reliability Management*, 25(3), 256-275.
- Podsakoff, Philip M, MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *The Journal of applied psychology*, 88(5), 879-903.
- Podsakoff, P.M., & Organ, D. W. (1986). Self-reports in organizational research: problems and prospects. *Journal of Management*, 12(4), 531-544.
- Polakoff, J. C. (1992). How to design a performance measurement program. *Corporate Controller*, 4(3), 49-53.
- Prajogo, D., Chowdhury, M., Yeung, A. C. L., & Cheng, T. C. E. (2012). The relationship between supplier management and firm's operational performance: A multi-dimensional perspective. *International Journal of Production Economics*, 136(1), 123-130.
- Prajogo, & Hong, S. W. (2008). The effect of TQM on performance in R&D environments: A perspective from South Korean firms. *Technovation*, 28(12), 855-863.
- Reis, D., Pena, L., & Lopes, P. A. (2003). Customer satisfaction: the historical perspective. *Management Decision*, 41(2), 195-198.
- Robbins, S. P., DeCenzo, D. A., & Coulter, M. (2011). *Fundamentals of Management*. New Jersey: Pearson.
- Rouse, W. B. (2005). A theory of enterprise transformation. *Systems Engineering*, 8(4), 279-295.
- Sadikoglu, E., & Zehir, C. (2010). Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance: An empirical study of Turkish firms. *International Journal of Production Economics*, 127(1), 13-26.
- Salaheldin, S. I. (2009). Critical success factors for TQM implementation and their impact on performance of SMEs. *International Journal of Productivity and Performance Management*, 58(3), 215-237.
- Salleh, N. A. M., Kasolang, S., & Jaafar, H. A. (2012). Review study of developing an integrated TQM with LM framework model in Malaysian automotive industry. *The TQM Journal*, 24(5), 399-417.

- Samat, N., Ramayah, T., & Saad, N. M. (2006). TQM practices, service quality, and market orientation: Some empirical evidence from a developing country. *Management Research News*, 29(11), 713-728.
- Sandholm, L. (2005). *Strategic plan for sustainable excellence. Total Quality Management and Business Excellence*, 16(8-9), 1061-1068.
- Sanjoy, K. (1991). Survey of various statistical process control methods. Texas: IEEE.
- Saraph, J. V., Benson, G. P., & Schroeder, R. G. (1989). An instrument for measuring the critical factors of quality management. *Decision Sciences*, 20(4), 810-829.
- Sardy, M., Munoz, J. M., Sun, J. J., & Alon, I. (2010). Dimensionality of business ethics in China. *Competitiveness Review: An International Business Journal incorporating Journal of Global Competitiveness*, 20(1), 6-30.
- Sebastianelli, R., & Tamimi, N. (2003). Understanding the Obstacles to TQM Success. *Quality Management Journal*, 10(3), 45-56.
- Seibert, S. E., Silver, S. R., & Randolph, W. A. (2004). Taking empowerment to the next level: A multiple-level model of empowerment, performance, and satisfaction. *Academy of management Journal*, 47(3), 332-349.
- Sharma, R. K., Kumar, D., & Kumar, P. (2006). Manufacturing excellence through TPM implementation: a practical analysis. *Industrial Management & Data Systems*, 106(2), 256-280.
- Siddiqui, J., & Rahman, Z. (2007). TQM principles' application on information systems for empirical goals. A study of Indian organizations. *The TQM Magazine*, 19(1), 76-87.
- Sila, I. (2007). Examining the effects of contextual factors on TQM and performance through the lens of organizational theories: An empirical study. *Journal of Operations Management*, 25(1), 83-109.
- Singh, B., Garg, S. K., Sharma, S. K., & Grewal, C. (2010). Lean implementation and its benefits to production industry. *International Journal of Lean Six Sigma*, 1(2), 157-168.
- Singh, P. J. (2008). Empirical assessment of ISO 9000 related management practices and performance relationships. *International Journal*

- of Production Economics*, 113(1), 40-59.
- Soltani, E., Lai, P.-C., & Gharneh, N. S. (2005). Breaking through barriers to TQM effectiveness : Lack of commitment of upper-level management. *Total Quality Management*, 16(8-9), 37-41.
- Sousa, S. D., Aspinwall, E., Sampaio, P. A., & Rodrigues, A. G. (2005). Performance measures and quality tools in Portuguese small and medium enterprises: survey results. *Total Quality Management and Business Excellence*, 16(2), 277-307.
- Spithoven, A. H. G. M. (2005). Lean production and disability. *International Journal of Social Economics*, 28(9), 725-741.
- Sun, H., & Zhao, Y. (2010). The empirical relationship between quality management and the speed of new product development. *Total Quality Management & Business Excellence*, 21(4), 351-361.
- Svensson, G., & Wood, G. (2005). Business ethics in TQM: The qualities and spectrum zones of a case illustration. *The TQM Magazine*, 17(1), 19-34.
- Talib, F., Rahman, Z., & Qureshi, M. N. (2011). Assessing the awareness of total quality management in Indian service industries: An empirical investigation. *Asian Journal on Quality*, 12(3), 228-243.
- Talib, N.A., & Senin, A.A. (2008). *Technology Management Theory & Practices* (1st ed.). Johor Bahru: UTM Press.
- Tan, O. K., & Rasli, A. (2011). Prediction of New Product Development (NPD) Performance in Research and Development (R & D). *3rd International Conference on Advanced Management Science*, Singapore, pp. 192-200.
- Tanninen, K., Puumalainen, K., & Sandström, J. (2010). The power of TQM: analysis of its effects on profitability, productivity and customer satisfaction. *Total Quality Management & Business Excellence*, 21(2), 171-184.
- Tari, J. J., Molina, J. F., & Castejón, J. L. (2007). The relationship between quality management practices and their effects on quality outcomes. *European Journal of Operational Research*, 183(2), 483-501.
- Teeravaraprug, J., Kitiwanwong, K., & Saetong, N. (2011). Relationship model and supporting activities of JIT , TQM and TPM. *Total Quality Management*, 33(1), 101-106.

- Temponi, C., Marcos, T. S. U.-san, & Marcos, S. (2005). Continuous improvement framework : implications for academia. *Quality Assurance in Education*, 13(1), 17-36.
- Terziovski, A., & Samson, D. (1994). The effect of company size on the relationship between TQM strategy and organisational performance. *The TQM Magazine*, 12(2), 144-148.
- Transparency International (2012). Corruption Perceptions Index 2011 [Website]. URL: <http://www.transparency.org/cpi2011/results> [Accessed on 18th October 2012]
- Vanichchinchai, A., & Igel, B. (2011). The impact of total quality management on supply chain management and firm's supply performance. *International Journal of Production Research*, 49(11), 3405-3424.
- Vinci, V. E., Chin, W. W., Henseler, J., & Wang, H. (2010). *Handbooks of Computational Statistics Series Editors*. New York: Springer.
- Wang, C.-H., Chen, K.-Y., & Chen, S.-C. (2012). Total quality management, market orientation and hotel performance: The moderating effects of external environmental factors. *International Journal of Hospitality Management*, 31(1), 119-129.
- Wong, C. W. Y., Lai, K.-hung, Shang, K.-C., Lu, C.-S., & Leung, T. K. P. (2011). Green operations and the moderating role of environmental management capability of suppliers on manufacturing firm performance. *International Journal of Production Economics*, 140(1), 283-294
- Wong, Y. C., Wong, K. Y., & Ali, A. (2009). A Study on Lean Manufacturing Implementation in the Malaysian Electrical and Electronics Industry. *European Journal of Scientific Research*, 38(4), 521-535.
- Yeung, A. C. L. (2008). Strategic supply management, quality initiatives, and organizational performance. *Journal of Operations Management*, 26(4), 490-502.
- Yoshida, K. (2000). *Kokusai-Kyousouryoka no Saisei (Rebuilding International Competitiveness)*. Tokyo: Nikka-Gren.
- Yusof, S. M., & Aspinwall, E. (2000). A conceptual framework for TQM implementation for SMEs. *The TQM Magazine*, 12(1), 31-37.
- Yusuf, Y., Gunasekaran, A., & Dan, G. (2007). Implementation of

- TQM in China and Organisation Performance: An Empirical Investigation. *Total Quality Management & Business Excellence*, 18(5), 509-530.
- Zadry, H. R., & Yusof, S. M. (2007). Total quality management and theory of constraints implementation in Malaysian automotive suppliers: a survey result. *Total Quality Management*, 17(8), 999-1020.
- Zakuan, N. M., Yusof, S. M., & Laosirihongthong, T. (2008). Reflective Review of Relationship between Total Quality Management and Organizational Performance. *International Conference on Mechanical & Manufacturing Engineering (ICME2008)*. 21– 23 May 2008, Johor Bahru, pp. 21-23.
- Zakuan, N. M., Yusof, S. M., Laosirihongthong, T., & Shahraroun, A. M. (2010). Proposed relationship of TQM and organisational performance using structured equation modelling. *Total Quality Management*, 21(2), 185-203.
- Zakuan, Norhayati, Yusof, S. M., Saman, M. Z. M., Shahraroun, A. M., & Laosirihongthong, T. (2012). The Moderator Effects of ISO/TS16949 Certification in Thailand Automotive Industry. *Procedia - Social and Behavioral Sciences*, 40(2012), 141-145.
- Zhang, Z. (2000). *Implementation of Total Quality Management: an empirical study of Chinese manufacturing firms*. PhD unpublished thesis, University of Groningen.