The effects of TQM Critical Success Factors on Organizational Performance
An empirical study on small and medium sized Danish manufacturing companies

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Abstract

The purpose of this thesis is to identify the critical success factors of Total Quality Management and to evaluate their impact on the organizational performance of small and medium-sized Danish companies, operating within the manufacturing industry. Despite numerous studies investigating the relations between Total Quality management practices and organizational performance, sparse research has been conducted on Danish SMEs, rendering this a vastly unexplored field.

The data underlying this study was collected using a self-administered questionnaire, distributed to 330 small and medium sized Danish companies, operating within the manufacturing industry and certified with the ISO 9001 standard. Of the 330 questionnaires posted, a total of 115 questionnaires were returned. The data was employed to test the proposed theoretical model, established with the objective of assessing the impact of six empirically identified TQM critical success factors on the organizational performance of Danish SMEs.

The non-parametric multivariate estimation technique, Partial Least Squares - Structural Equation Modeling (PLS-SEM), is found particularly applicable, as it enables the indirect measurement of latent variables through a number of indicators and as it rests on no distributional assumptions.

Applying PLS-SEM, two empirically validated relations between the TQM critical success factors and organizational performance were identified. The empirical analysis confirmed a strong and positive relationship between the TQM construct, Customer focus, and organizational performance. The same is in evidence with the construct, Top management commitment, and organizational performance. The findings thus suggest that having a distinct customer focus, encompassing the current and future preferences of customers, the active use of feedback in the product development process and customer satisfaction as a focal point, is positively related to organizational performance. In continuation hereof, a visible and concentrated effort by management, with the objective of improving quality and setting up a corporate culture encompassing the quality missions and vision of the organization, is found to be positively associated with organizational performance.

An extensive analysis of the reliability and validity of the model was conducted, revealing no concerns regarding the quality of the model put forward.

The empirical results of the thesis help identify areas in which Danish SMEs, operating within the manufacturing industry, ought to pay special attention. Despite some insignificant results, the findings though suggest the notion that the identified TQM critical success factors should be implemented holistically, in order to exploit the full potential of TQM.

The thesis is subject to the common limitations of survey research. The study applies perceptual data provided by managers, quality managers and production managers. When the possibility of extracting complete and comparable objective data for the organizations under observation is present, it is thus recommendable for further research to complement the analysis with objective data.
# Contents

I Introduction

1 Research design
   1.1 Purpose and research questions .................................................. 3
   1.2 Delimitations .............................................................................. 4
   1.3 Structure .................................................................................. 4

II Theoretical framework and literature review

2 Total Quality Management .................................................................. 7
   2.1 The concept of TQM .................................................................. 7
   2.2 Historical development of TQM .................................................... 9
   2.3 Business improvement frameworks - a comparison ......................... 10
   2.4 Motives for pursuing TQM .......................................................... 12
      2.4.1 Pursuing TQM in small and medium sized companies ............... 13
   2.5 Failures and obstacles of adopting TQM ......................................... 14
      2.5.1 Adopting TQM in small and medium sized companies ............... 15

3 Critical success factors of TQM and organizational performance ...... 17
   3.1 Critical success factors of TQM ................................................... 17
      3.1.1 Top management commitment ............................................. 17
      3.1.2 Supplier quality management ............................................. 18
      3.1.3 People management ............................................................ 19
      3.1.4 Customer focus ................................................................. 20
      3.1.5 Process management .......................................................... 21
      3.1.6 Quality data and reporting .................................................. 22
      3.1.7 Summary of TQM critical success factors ............................... 23
   3.2 Measuring organizational performance .......................................... 23
   3.3 TQM implementation and organizational performance ................. 25

III Methodology

4 Research methodology ................................................................. 28
   4.1 Research methods ..................................................................... 28
      4.1.1 Measuring the variables of TQM and organizational performance .. 28
         4.1.1.1 Operationalization of variables ...................................... 29
      4.1.2 Model development .............................................................. 31
      4.1.3 Data ................................................................................... 32
         4.1.3.1 Methodological approach .............................................. 32
         4.1.3.2 Sample ....................................................................... 32
4.1.3.3 Survey structure ................................. 34
4.1.3.4 Distribution ....................................... 36
4.1.3.5 Response rates ..................................... 36
4.1.3.6 Omission of data .................................. 36

5 Statistical methodology ................................. 38
  5.1 Partial Least Squares - Structural Equation Modeling ................................. 38
     5.1.1 PLS-SEM as statistical instrument ............................................. 41
        5.1.1.1 The structural model (inner model) ....................................... 41
        5.1.1.2 The measurement models (outer model) .................................... 42
        5.1.1.3 Weight relations ............................................................... 43
     5.1.2 The PLS-SEM algorithm ......................................................... 43
     5.1.3 Sample size requirements in PLS-SEM ........................................ 44

IV Empirical results ........................................... 46

6 Analysis ....................................................... 47
  6.1 Statistical analysis ........................................... 47
     6.1.1 Preliminary data processing ................................................ 47
        6.1.1.1 Data distribution .............................................................. 48
        6.1.1.2 Missing data ................................................................. 48
        6.1.1.3 Non-response bias ............................................................. 49
        6.1.1.4 Descriptive statistics of the final sample ................................ 50
     6.1.2 Unidimensionality ...................................................... 51
     6.1.3 Quality of the measurement models ....................................... 51
        6.1.3.1 Reliability of the measurement models .................................. 51
        6.1.3.2 Validity of the measurement models ..................................... 53
     6.1.4 Quality of the structural model ....................................... 56
     6.1.5 Modeling heterogeneity ................................................. 60
     6.1.6 Overall model fit ....................................................... 62
  6.2 Interpretations of results ........................................ 64
     6.2.1 Significant relations ...................................................... 64
        6.2.1.1 Customer focus and Organizational performance ....................... 64
        6.2.1.2 Top management commitment and Organizational performance .......... 66
     6.2.2 Insignificant relations ..................................................... 67

V Concluding remarks ........................................... 69

7 Conclusion ..................................................... 70

8 Reflections ..................................................... 72
  8.1 Implications and limitations ............................................... 72
  8.2 Recommendations for further research ........................................ 73
## List of Tables

3.1 Summary of empirically identified critical success factors of TQM ................................. 23  
3.2 Summary of empirically identified performance measures of TQM ................................. 24  

6.1 Observations according to company size ................................................................. 50  
6.2 Observations across industries ................................................................................ 50  
6.3 Composite reliability of the latent variables ......................................................... 52  
6.4 AVE measures for the latent variables .................................................................... 54  
6.5 AVE compared to the squared correlations ............................................................ 55  
6.6 VIF values of the exogenous variables ................................................................... 56  
6.7 Effect size $f^2$ of the exogenous variables ............................................................ 58  
6.8 Path coefficients and t-values for structural relations in the hypothesized model ........ 58  
6.9 Path coefficients and t-values for structural relations in the final model ................. 59  
6.10 Outline of the results of the empirical analysis ....................................................... 64
List of Figures

4.1 Theoretical model enclosing the effects of TQM practices on organizational performance . 31
5.1 Illustration of a PLS-model . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 41
6.1 Final model encompassing the identified significant structural relations . . . . . . . . . 63
Part I

Introduction
Chapter 1

Research design

“A system must be managed. It will not manage itself.” (Deming, W. Edwards 1993)

Intensified global competition and increasing demand for higher quality by customers have instigated an increasing number of organizations to invest substantial resources in adapting and implementing Total Quality Management procedures, tools and techniques (Demirbag et al., 2006). Total Quality Management is defined as an integrative management philosophy and a set of guiding principles, representing the foundation of a continuously improving organization. It constitutes the application of sound management principles, quantitative measurement methods and human resources with an underlying aspiration of improving all processes within an organization, surpassing the current and future needs of the customer and increasing organizational performance. It thus incorporates the importance of viewing all processes within an organization as a combined system of integrated quality practices.

Over the past few decades, paramount figures in the field of quality management, like Crosby (1979), Deming (1986) and Juran (1988), have developed and advocated abundant prescriptions in the area of Total Quality Management. Their insight into the field of Total Quality Management has provided a useful understanding of the underlying principles of Total Quality Management and has formed the basis against which subsequent researchers have formulated and verified critical success factors of Total Quality Management (Karuppusami & Gandhinathan, 2006).

Since the renowned work of the above mentioned quality gurus, empirical studies of Total Quality Management started to increase in the late 1980s, alongside the first operationalization of the critical success factors of Total Quality Management, conducted by Saraph et al. (1989). Subsequent empirical studies have focused on the relationship between Total quality management practices and organizational performance and have in many instances found supportance of a positive link between quality practices and organizational performance.

Despite various studies examining the link between Total Quality Management practices and organizational performance (Demirbag et al., 2006; Powell, 1995; Terziovski et al., 1999; Fotopoulos & Psomas, 2009; Salaheldin, 2009), there is negligible research investigating the relationship between the adoption of Total quality Management practices and the organizational performance of small and medium sized companies (Prajogo & Brown, 2006). It is thus imperative that this issue is subject to further investigation, as differences in characteristics between large organizations and small and medium sized organizations may affect the use and effects of Total Quality Management practices.
In continuation hereof, most empirical studies investigating the effects of Total Quality Management on organizational performance have been conducted in the US and in European regions outside of Denmark, leaving the subject of investigation a fairly unexplored area.

A further contribution of this thesis is to help disseminate the application of Partial Least Squares - Structural Equation Modeling in the area of Total Quality management, as the use of this non-parametric estimation technique yet has been relatively unexplored within this area.

1.1 Purpose and research questions

The purpose of this thesis is to provide a comprehensive study on the critical success factors of Total Quality Management and their effect on organizational performance. Special emphasis is placed on identifying the relationships between the most prominent critical success factors of TQM and organizational performance, based on a sample of small and medium sized Danish companies, operating in the manufacturing industry. A thorough exposition of Total Quality Management is provided, in order to establish an understanding of the concept and its development, as well as an in depth coverage of previous findings on critical success factors of Total Quality Management. When possible, the theory includes literature findings established on the basis of small and medium sized manufacturing companies, as well as Danish companies.

With point of departure in the literature, an empirical study is conducted, examining the effects of Total Quality Management practices on organizational performance. A model for testing this relationship is developed and a questionnaire based hereon is distributed to ISO 9001 certified Danish manufacturing companies. The data, forming the foundation of the model, is processed applying the statistical estimation method, Partial Least Squares - Structural Equation Modeling. The applicability of this statistical method has hence been examined thoroughly. An in depth evaluation of the model quality is furthermore emphasized prior to the interpretation of the results.

Unlike most studies, the Partial Least Squares - Structural Equation Modeling method has been applied in order to examine the relationship between critical success factors and organizational performance of small and medium sized Danish manufacturing companies. With the exception of a handful of dedicated Danish researcher, this still remains a relatively unexplored area in need of further examination. The results obtained in this study thus provide small and medium sized Danish manufacturing companies, with valuable knowledge of which critical success factors of Total Quality Management to pay special attention, when striving to improve organizational performance.

In conclusion, this thesis seeks to provide answers to the following three research questions:

1. What is the theoretical foundation of Total Quality Management and what are the critical success factors underlying this concept?

2. What is the applicability of Partial Least Squares - Structural Equation Modeling when examining the relations between the critical success factors of Total Quality Management and organizational performance?

3. Which critical success factors of Total Quality Management are found to have the highest impact on the organizational performance of small and medium sized Danish manufacturing companies?
1.2 Delimitations

A wide range of perspectives within the concept of Total Quality Management are considered interesting as well as in need of further exploration. However, in order to focus attention and limit the scope of the study, several delimitations have to be outlined.

In the empirical study focus relies on Total Quality Management and its effect on organizational performance. Other aspects considered to be associated with the employment of Total Quality Management are consequently not taken into account.

The study is grounded in a quantitative research approach aiming at collecting data and content on the basis of many companies, thereby increasing the transferability to the population in focus. As a result hereof, focus thus relies on increasing the external validity, acknowledging that this is increased at the expense of conducting in depth qualitative research.

The population in focus is limited to cover small and medium sized Danish manufacturing companies. This is chosen with reference to the above mentioned limited amount of research conducted within this area. The population is furthermore selected in order to increase homogeneity, due to a larger degree of alignment between companies of similar size, operating within the same country. In order to increase homogeneity within the sample, it is furthermore chosen to focus on private companies. Lastly, all companies encompassed in the sample are certified with the quality management standard, ISO 9001, with the purpose of reaching companies familiar with the concept of Total Quality Management and thus capable of reflecting on the subject matter. Further elaborations of the specific delimitations are provided as they are introduced in the paper.

1.3 Structure

The thesis is structured in three superordinate parts covering the theoretical framework of the thesis, the methodology of the empirical study and an analysis of the empirical results. These main parts are enclosed by a conclusion and reflections of the obtained results. Each part is divided into chapters which leads to the following structure of the paper:

Part II - Theoretical framework and literature review

- Chapter 2: The chapter provides an introduction to the philosophy of Total Quality Management including the definitions hereof, its historical background and comparison to other business improvement concepts. It furthermore encompasses motives and obstacles underlying the employment of quality management.

- Chapter 3: The chapter presents the underlying critical success factors of Total Quality Management grounded in the empirical literature. This is followed by a description of performance measures applied in previous empirical studies, evaluating the effects of Total Quality Management on organizational performance.
Part III - Methodology

• Chapter 4: In this chapter the methodology of the empirical study is outlined. This comprises the operationalization of variables as well as a presentation of the research model. In addition hereto, a description of the underlying study population is provided. Fundamental methodological decisions concerning the survey structure as well as the data collection process will furthermore be accounted for.

• Chapter 5: The chapter provides an overview of the statistical methodology employed in the paper, Partial Least Squares – Structural Equation Modeling. Special emphasis is placed on the benefits and limitations related to the method, in connection with the sample size of the thesis.

Part IV - Empirical results

• Chapter 6: This chapter includes an analysis of the survey results which are divided in two sections. The first section comprises the quality of the model focusing on the model’s reliability and validity, whereas the second section covers an interpretation and discussion of the survey results.

Part V - Concluding remarks

• Chapter 7: In this chapter the main findings of the thesis are summarized.

• Chapter 8: The chapter covers the implications and limitations of the thesis. In addition hereto, the contribution and application of the empirical results are proposed, as well as ideas for further research.
Part II

Theoretical framework and literature review
Chapter 2

Total Quality Management

The purpose of this chapter is to provide an introduction to the philosophy of Total Quality Management (TQM) including definitions of the concept, its historical background and comparison to other business improvement concepts. In addition hereto the chapter encompasses a description of motives and obstacles underlying the employment of TQM. Due to the focus on small and medium sized enterprises (SMEs), special emphasis is placed on incorporating this element, when possible.

2.1 The concept of TQM

Revisiting the literature of quality management, it is evident that no clear agreement exists when it comes to defining the concept of TQM. Numerous authors and practitioners have addressed the concept which has resulted in abundant definitions of the concept. In the following, overall elements and similarities are outlined in order to establish an understanding of the concept.

Though no general agreed definition of TQM prevails and the concept has been blamed for being vague (Knights & McCabe, 1997)[136], perspectives of authors and practitioners within the TQM literature share several common elements. Among others it is widely accepted that TQM is a holistic management approach encompassing external as well as internal stakeholders, in the effort of optimizing the organization as well as its responsiveness to its surroundings. As described by Porter and Tanner (2005)[143]:

“Total Quality Management is an approach which focuses on improving the organization’s effectiveness, efficiency and responsiveness to customers’ and other stakeholders’ needs by actively harnessing people’s skills and competencies in the pursuit of achieving sustained improvements to organizational performance. “ (Porter & Tanner, 2005)

Ishikawa (1985)[87] likewise underpins the holistic element in TQM in his definition of the concept. He describes TQM as a total system approach and an integral part of high level strategy that works horizontally across functions and departments, involving all employees, top to bottom, and extends backwards and forwards to include the supply- and customer chain. Rallabandi et al. (2010)[149] similarly emphasize the holistic perspective of TQM and in extension hereof focus on waste reduction. They describe TQM as a way of planning, organizing and understanding each activity in the organization, and a way to remove all the wasted effort that is routinely spent in organizations.
Chapter 2. Total Quality Management

Despite many authors describing TQM comprehensively and in many words, TQM has additionally been defined in few words, as of Jarrod (2012)[93]:

“TQM is just what the name suggests, a total look at the quality of the organization.” (Jarrod, 2012)

Naturally, quality is a focal point of TQM. In the contemporary TQM literature the importance of applying an universal quality focus wherein stakeholders are involved on several levels is emphasized. Stakeholders such as managers, employees, suppliers and customers are all key players when it comes to quality management. This view is shared by Jafar et al. (2010)[92], who combine quality and a holistic perspective when defining TQM:

“Today, paying attention to quality is no longer the responsibility of a small group of people who monitor performances and remove defected products from the assembly line. Instead, all ranks and files are considered as effective elements of quality.” (Jafar, 2010)

Besides being a holistic approach emphasizing quality, general improvements is an established theme within the TQM literature. Many authors have defined TQM by means of the expression, “continuous improvements”. Decenzo et al. (2010)[44] perceive in this matter TQM as a synonymous to continuous improvement. According to their article, total quality management represents a commitment to constantly improving the quality of products. Ahire (1997)[3] defines TQM as an integrative philosophy of management for continuously improving the quality of products and processes. Feigenbaum (1991)[53] defines TQM as both a philosophy and a set of guiding principles which represent the basis for continuously improving an organization. He furthermore put forward the importance of applying quantitative methods and involving people in order to improve all processes within an organization and to exceed customer needs. Kanji and Yui (1997)[101] embrace a focus on continuous improvement, culture as well as a customer perspective in their definition of TQM, as they describe TQM as the culture of an organization committed to customer satisfaction through continuous improvement. Idris and Zairi (2006)[85] have also chosen to focus on elements encompassing the customer- and improvement perspective in their description of TQM. They define TQM as an approach implemented in order to achieve a balance between conforming to customer satisfaction and internal process improvement, without losing flexibility and creativity in business improvement. As can be seen from the above definitions, a customer perspective also constitutes an important element in many definitions of TQM.

Hellesten and Klevsjo (2000)[78] define TQM as a continuously evolving management system based on a foundation of values, methodologies and tools which are applied in order to increase internal and external customer satisfaction as well as to reduce the amount of resources. This illustrates yet another definition of TQM. According to Kanji (2002)[99], the definitions of TQM and its central focus areas can furthermore vary across countries and cultures, as differences in the perceived importance of elements across countries prevail. However, he put forward that these differences have decreased over the years concurrently with globalization.

From the above definitions it becomes evident that TQM is a broad perspective which may be interpreted differently in accordance to the perspectives of the author or practitioner covering the concept. In spite of this, perspectives of authors and practitioners within the TQM literature largely originate from the same set of values and beliefs and thus share many common elements (Sharma & Talwar, 2007)[159].
There thus appears to be an implicit agreement supporting the characterisation of contemporary TQM as a holistic framework applied in order to develop organization-wide quality.

2.2 Historical development of TQM

In the following a short introduction of the history of quality management is provided, focusing on the evolution of its historical phases. This is followed by an introduction of prevalent authors and practitioners operating within the field of quality management.

Quality Management can historically be traced back to the Egyptians who made use of inspections when building the pyramids (Kanji, 2002)[99]. Thus the focus on organizational quality is not a new phenomenon and the principles which have developed into contemporary TQM are consequently established on the basis of a long time history of quality management.

Quality management is in the literature often described in terms of four phases - Quality Inspection, Quality Control, Quality Assurance and Total Quality Management, respectively (Dale, 1999; Kanji & Ascher, 1993; Klefsjö, 2007)[35][100][108]. In the beginning of the 19th century, quality management was to a large extent characterized as an inspection approach where products, services or activities were examined, measured, tested and compared to specified requirements, in order to assess conformity with a performance standard (Dale, 1999)[35]. In time, the inspection approach changed towards quality control. This among others encompassed quality manuals, document control, product testing and in extension hereof the application of statistics in quality management. With quality control, the basic inspection activity was hereby developed in terms of sophistication of systems, use of information and the techniques employed (Dale, 1999)[35]. The concept of quality management eventually developed from an inspection and control approach to quality assurance, which involved a shift towards emphasis on prevention of non-conformances. More emphasis was thus placed on advanced quality planning, training, critical problem-solving tasks and the involvement and motivation of people (Dale, 1999)[35]. Quality assurance gradually introduced the use of non-operational elements to quality management and from quality assurance, the concept developed into Total Quality Management, as it is described in section 2.1. Consequently TQM refers to a holistic management approach encompassing quality management principles in all aspects of the organization, external as well as internal. The shifts in the phases described above merely change focus towards a new way of interpreting the concept, building upon the preceding development of the concept. The elements of earlier phases are thus to a large extent encompassed in the subsequent phases.

The evolution of the phases above has to a large extent been dominated by authors and practitioners from Northern America and Japan, who were the first to embrace the concept of quality management in depth. In time, the concept has though gradually made its entry globally and has become a focus area for organizations across the globe. One of the earliest prominent contributors to modern quality management is Walter Shewart who was a pioneer in exploring the possibilities of applying statistical measures to quality management (Kristensen et al., 2004)[114]. In 1924 he developed the so called quality control chart which helps determining whether a manufacturing process is in a state of statistical control (Shewhart, 1931)[160]. Shewart and other Americans such as Edwards Deming and Joseph Juran were to
become great inspiration and help for the Japanese and the country’s development of quality management. Following the Second World War, quality became a strong focus in Japan when rebuilding their economy and in time this focus resulted in significantly improved quality for many Japanese manufacturers. In the late 1970s North American manufacturers were losing market share to Japanese companies which among others were subscribed to superior quality of Japanese goods. As a consequence hereof, Phillip Crosby published the book ‘Quality is free’ (Crosby, 1979)[31] in 1979 and put forward the principle of TQM and the importance of “doing it right the first time”. Like Crosby, Edwards Deming published a book in response to the downturn of the American manufacturers named “Out of the Crisis”, which was published in 1986 (Deming, 1986)[40]. Deming is perhaps best known for the ‘Plan-Do-Check-Act’ cycle applied to support continuous improvements. Deming however named it the “Shewhart cycle”, in order to recognize Shewart as the founder of the cycle and as an inspirational mentor. Deming is furthermore well-known for his 14 key principles of management which were developed to assist managers with transforming business effectiveness. The latter has later been credited for starting the contemporary TQM movement as it strongly increased the quality focus in the 1980s (Radziwill, 2013)[147]. The expression “total quality” was though already formally communicated in a paper by Armand Feigenbaum presented at the international conference on quality control in 1969, sponsored by Japan, America and Europe. In the Paper, total quality was referred to as broad quality issues encompassing elements such as organization, planning and management responsibility (Feigenbaum, 1969)[52].

Owing to Deming and his contemporaries including Feigenbaum, Juran and Crosby, the human aspect was brought into the quality concept, which resulted in the management philosophy today known as TQM (Kristensen et al. 2004)[114].

2.3 Business improvement frameworks - a comparison

Several business improvement frameworks are prevalent such as TQM, Six Sigma, Lean, Business Process Reengineering, Business Excellence and the like. As with the concept of TQM, disagreement exists in the literature when it comes to defining the concepts and in extension hereof determining the differences between them. In the following, the above selection of frameworks will briefly be introduced and compared to the concept of TQM, in order to provide an overview of similarities and overlapping elements.

One of the business improvement frameworks sharing many common elements with TQM is Six Sigma. Six Sigma aims at improving the quality of products or process outputs by identifying and removing the causes of defects and minimizing the variability in manufacturing and business processes (Jiju, 2004)[94]. The name of the concept underpins this philosophy as Six Sigma equals 3.4 defects per million product or process opportunities. Aspects of Six Sigma can thus be traced back to earlier perceptions of TQM which to a large extent build upon quality inspection and control (Porter & Tanner, 2005)[143]. Though Six Sigma had its emergence at Motorola in the early 1980s, several authors argue that Six Sigma is seeing a renascence and some in this matter equates the concept of Six Sigma with TQM. This among others is proposed by Porter and Tanner[143]:

“Whilst the interest in explicit TQM programs has declined in some countries in recent years, its successor in all but name, Six Sigma has seen a dramatic increase in application.” (Porter & Tanner, 2005)
In addition hereto, Rallabandi et al. (2010)[149] argue that the concept of Six Sigma and TQM share many similarities. As an example hereof it is argued that the important Six Sigma tool, the DMAIC procedure (Define – Measure – Analyse – Improve – Control), is simply a more sophisticated version of the older improvement cycle (Plan - Do - Check – Act) developed by Shewart and refined by Deming. Quality management techniques such as Lean, Business Process Reengineering and the Balanced Scorecard, which became popular in the 1990s, also shared many basic elements with TQM. Lean emphasizes an organization-wide perspective, focusing on creating value adding processes for the customers and eliminating costs (Womack et al., 1990)[186]. Business Process Reengineering is, as many of the other frameworks, emphasizing a holistic organizational perspective. As its name suggest, Business Process Reengineering aims at rethinking organizational processes in order to improve customer service, cut operational costs and become world class competitors (Hammer, 1990)[76]. The Balanced Scorecard can be applied to translate the strategy of an organization into measurable performance measures by emphasizing the cause and effect relationships between the dimensions of finance, people, processes and customers (Kaplan & Norton, 1996)[104]. In this regard it should be emphasized that the Balanced Scorecard may be argued to possess the characteristics of a quality management model rather than being a concept, due to its practical character.

From above it is evident that many business improvement frameworks share similarities with TQM in their proposed methods for improving and optimizing organizations. Some even argue that they cannot be distinguished from each other due to a shared underlying philosophy. However, the concept of Business Excellence or simply Excellence is perhaps the concept most similar to TQM. A precise distinction between the concepts is not agreed upon in the literature and many practitioners view Business Excellence as a synonym for TQM. According to Kanji (2002)[99] the term “business” or “organizational” excellence has become frequently cited in the quality management literature. He argues that Business Excellence, as applied by many authors of quality management literature, has the same or similar meaning as TQM. In extension hereof, Kanji (2002)[99] put forward that Business Excellence can be perceived as an evolution of TQM. He argues that TQM maintains a stronger focus on customer satisfaction compared to Business Excellence, whereas Business Excellence may be characterized as taking on a more total approach with focus on all stakeholders’ expectations, as it is apparent in the European Foundation for Quality Management (EFQM) Excellence Model and the Malcolm Baldrige National Quality Award (MBNQA). In this connection it is noteworthy to underline that quality awards and associated business excellence models such as the EFQM Excellence Model, the Malcolm Baldrige framework and the Japanese Deeming framework may be seen as practical pendants to TQM. This may be argued as a general concensus to a large extent prevails in the quality management literature, between the elements incorporated in the quality awards, the elements underlying the concept of TQM as well as the eight quality management principles included in the ISO 9000 quality standard (Porter & Tanner, 2005)[143]. As a result hereof these quality awards and their associated business excellence models, as well as the ISO 9000 quality standard, have been described thoroughly in appendix A, providing an understanding of their coherence with TQM.

Porter and Tanner (2005)[143] argue that the achievement of business or organizational excellence is at the core of TQM. Peters (2000)[142] however proposes that the concept of quality is perceived as old-fashioned and argues that excellence more or less has outdated the concept of quality. The discussion on the application of the term Business Excellence versus TQM in the literature was largely incited by

1The eight management principles of ISO 9000 are as follows: Customer focus, Leadership, Involvement of people, Process approach, System approach to management, Continual improvement, Factual approach to decision making and Mutually beneficial supplier relationships (ISO, 2012)[89].
the 1999 EFQM model. The model is primarily based upon the concept of TQM as a holistic approach, however in 1999 the model was revised which among others led to a change in wording from “quality” to “excellence”. In the revised model the term “quality” did not appear and the model became known as the EFQM Excellence Model (Nabitz et al., 1999)[134]. This change in focus has according to Adebanjo (2001)[2] led to considerable concerns among traditional TQM practitioners. He questions why Business Excellence has gained a footing in the quality literature at the expense of TQM, if the two concepts to a large degree share the same elements. According to Dale (2000)[36] Business Excellence and Excellence have likewise been applied indiscriminately in the EFQM model. In addition hereto, there is no rigorous definition of Excellence or how it differs from Business Excellence in the EFQM guidelines and as a result hereof he argues that it is merely a play on words. Regarding the choice of wording and the above mentioned concepts’ relation to TQM, Dale put forward:

“There exists considerably confusion over the use of terms. As a consequence, there are not only numerous interpretations and definitions but also a variety of concepts, instruments and organizational arrangements, and tools and techniques which underpin TQM.” (Dale, 2000)

This statement supports the difficulties in describing TQM and the differences between evolving concepts - if any. Throughout this paper the terms “TQM” and “Quality Management” are applied and cover TQM as a broad Quality Management concept, as described in section 2.1.

### 2.4 Motives for pursuing TQM

TQM has been widely applied by organizations across the world and companies have to a great extent emphasized that quality must be put in place and integrated into all aspects of the organization, in order to harvest the benefits associated herewith (Mallur et al., 2012)[127].

With point of departure in the TQM theory, motives for implementing TQM are in the following addressed.

From above it became evident that TQM has been defined in various ways in the literature and the arguments for applying TQM are similarly manifold. TQM is by many perceived as means of obtaining competitive advantages in an organization (Tobin, 1990)[176], and according to Fotopoulos and Psomas (2009)[61] TQM is an effective way to do this. Conversely it has been argued that for organizations operating in a global market, the implementation of TQM is a necessity in order to be competitive. Advocates of this arguments thus suggest that implementing quality management only enables the organizations to stay in the competition and does not create a lead in the competition. Salaheldin (2009)[153] and Ghorghina (2008)[67] argue that with the rapid globalization, organizations need to implement a set of quality management practices in order to compete at a global level. Others have chosen not to describe the effects of TQM implementation as either a competitive advantage or a necessity to stay in the competition, but instead describe it in relative terms as a way of increasing the competitive position of the company. Kristensen et al. (2004)[114] in this manner describe the purpose of TQM as being an enhancement of the company’s competitive position by means of obtaining satisfied customers at the lowest possible costs.
Chapter 2. Total Quality Management

Whether TQM has been implemented as a result of internal initiatives or pressure from external surroundings, there seems to be agreement in the TQM literature concerning the potential benefits derived from employment of TQM. As examples hereof, Hellesten and Klefsjö (2000)[78] argue that increased internal and external customer satisfaction as well as reduced costs are some of the main benefits achieved from implementing quality management. Cerio (2003)[21] likewise argues that a significant relationship exists between an increased level of quality management and an improved company performance in terms of costs, quality and flexibility. In addition hereto, Porter and Tanner (2005)[143] argue that several studies suggest a strong and identifiable link between well-implemented TQM programs and superior financial performance. In the literature many arguments for employing TQM has been put forward, encompassing different cause and effect relations embracing the benefits associated with TQM. In this matter, Kristensen et al. (2004)[114] argue that a well-implemented TQM program may entail direct as well as indirect quality improvements through increased focus on control of company processes and employees. Likewise, they argue that TQM programs may exert direct and indirect influence on economic results in the form of cost and revenue improvements. These cause and effect relations have in the literature been described in many ways, confer among others Das et al. (2000)[37], Fotopoulos & Psomas (2009)[61] and Fynes and Voss (2001)[64].

When examining the performance of Danish companies applying holistic management models such as the Balanced Scorecard, the Excellence model and ISO 9000, previously denoted as the practical pendants to TQM, positive results likewise prevail. Kristensen et al. (2005) [115] thus find that Danish companies applying holistic management models achieve better results compared to companies which do not make use thereof. This represents an apparent motive for employing TQM, seen from a Danish perspective.

As evident from above, many benefits associated with the employment of TQM have been put forward. The motives for employing TQM however may vary in accordance with company size, which will be elaborated upon below.

2.4.1 Pursuing TQM in small and medium sized companies

Many of the above mentioned benefits of TQM are likewise in evidence for SMEs, the benefits and objectives for SMEs adopting TQM may however differ in some respects. As argued by Lee (2004)[123], small companies may be very different from large ones in many aspects such as management style, production processes, available resources, negotiation power and customer relations. As a result hereof, the adoption of TQM may be perceived differently by SMEs. Gobell and Shea (1995)[68] examined the reasons for adopting TQM in ten small companies. They found that the reasons among others comprised an aspiration to improve company performance, as management believed that TQM was an avenue for survival in competitive environments. Promotion of growth, including the use of TQM as a marketing tool, was furthermore put forward as a reason for implementing TQM. Likewise, a desire to change customer expectations, with reference to the close client relationship prevailing in small companies, was argued to constitute an important factor. In a study by Ahire and Golhar (1996)[4], based on the auto part industry, findings reveal that small companies which have adopted TQM, reported a high product quality.

However, the decision of whether to follow a TQM approach might not stem from the company itself. According to Sun and Chen (2002)[169], many SMEs implement TQM mainly due to market and customer demands or external pressure, rather than as a result of internal initiation. In addition hereto, Turkyilmaz
et al. (2010) argue that large companies recently have had a greater tendency to focus on their core business areas and as a result thereof have relied extensively on outsourcing. As the quality of products and services is highly dependent on the quality of input stemming from suppliers, large companies encourage the application of TQM practices by their suppliers - often constituting SMEs.

From above it can be concluded that many motives exist for implementing quality management and putting one reason forward does not necessarily exclude the others, as the elements often are intercorrelated. The reasons for implementing quality management are moreover to a large extent linked to the specific focus areas of quality management in organizations. These focus areas as well as organizational performance improvements related to the adoption of TQM will in the following chapter be thoroughly elaborated upon. Beforehand, the implementation as well as failures and obstacles associated with TQM adoption is addressed, as the success of TQM strongly hinges upon the premise of TQM being properly planned and implemented (Black and Porter, 1996; Flynn and Saladin, 2006; Oakland, 2001). Different explanations are however put forward regarding how to define “properly planned and implemented”, which will be addressed in the following section.

2.5 Failures and obstacles of adopting TQM

In the following, the adoption of TQM, including common failures and obstacles associated herewith, will be addressed. As argued above, various benefits are associated with the adoption of TQM, many organizations however fail in obtaining the benefits which the concept holds out prospects of. These failures as well as common obstacles associated with employment of TQM have been widely discussed in the TQM literature (Allen and Kilmann, 2001; Brah et al., 2002; Cao et al., 2000). According to Carlos and Santos (2011), the TQM literature has seen a flood of critical findings referring to failures in implementing TQM. They therefore argue that TQM has lost part of its momentum as well as users - both existing and potential. In extension hereof, Carlos and Santos (2011) made a comprehensive literature review on failure rates associated with the implementation of TQM. In doing this they found diversifying results from studies, proposing failure rates ranging from 8%-80%. When comparing with failure rates associated with other business strategies they found similar varying results. They thus argue that there is no reason to assume that TQM is more difficult to implement compared to other business strategies.

Whether there seems to be more or less obstacles related to the adoption of TQM compared to other business strategies, well known obstacles are attached to the adoption of TQM. As examples hereof Ahire et al. (1996) argue that a common failure is to disregard the links between TQM elements and thus failing to incorporate the concept holistically. Ljungström and Klefsjö (2002) stress that when implementing a TQM program, many companies face unique problems resulting from their own specific environments – internal as well as external. In addition hereto, Harrington (2004) argues that when it comes to the implementation of TQM, no universal best practices exist, applicable to all organizations. Best practices differ according to the specific company in focus and especially in accordance with size and industry. As example hereof, North et al. (1998) find that SMEs in the manufacturing industry use inspection and testing as a mechanism for quality control, while in the service sector skilled staff and training tend to be employed.
Organizations can however benefit from drawing on general experience from earlier discovered obstacles associated with the employment of TQM. A common obstacle associated with the implementation of TQM is the fact that TQM is far from an overnight project. It is generally accepted that TQM takes a long time to implement as it requires large organizational changes (Rallabandi et al., 2010)[149]. Rallabandi et al. (2010)[149] argue that TQM can increase performance in the long run. However, in order to obtain the perceived benefits from TQM one must be patient. Johnson and Kleiner (2013)[96] stress that organizations often do not show improvement in the bottom line until after a year or more following a wide-ranging TQM implementation. They furthermore argue that managers often feel disappointed when no immediate improvements in profitability or competitive advantages show. They underline that this may represent a serious obstacle to the continuing use of TQM practices, since managers might decide to discontinue TQM programs as a result hereof. In addition hereto they emphasize the need for managers to understand that a lack of immediate results is not tantamount to failure of implementation.

In extention hereof, Ahire et al. (1995)[5] stress that often cited reasons for TQM failures among others encompass unrealistic expectations regarding the time-frame and costs associated with TQM implementation, lack of top management commitment, over- or under-reliance on statistical methods, and failure to build and sustain a quality-oriented culture. Cao et al. (2000)[17] argue that the reason for failures of TQM implementation may often be subscribed to a general lack of understanding of the TQM concept. When managers have difficulties in understanding and interpreting TQM, it is difficult to secure a successful implementation throughout the organization. Cao et al. (2000)[17] additionally emphasize the need of linking TQM with a change management focus. They put forward that a wholly implementation of TQM undoubtedly will entail sizable organizational changes. When implementing TQM, changes are likely to occur within processes, functions, values and power structures. They argue that TQM is an approach which focuses primarily on changes in processes, lacking the power to deal adequately with the other dimensions. In order for TQM to be applied successfully, either an approach which adequately addresses all types of change contexts is required, or its application needs to be restricted to those contexts where processes dominate. In extension hereof, Johnson and Kleiner (2013)[96] argue that a successful implementation of TQM principles often requires several changes of organizational perspectives and actions, which might be perceived as a complete redesign of the organizational culture.

2.5.1 Adopting TQM in small and medium sized companies

As described above, TQM often entails a redesign of the organizational culture. In connection hereto, Axland (1992)[8] argues that small companies have an advantage when it comes to redesigning the organization in relation to a TQM implementation. He argues that a conversion of small companies can be accomplished in a faster manner owing to fewer management layers, the ability to make decisions in a faster pace, fewer staff to train and the ease of communication. In addition hereto he argues that it is easier for the CEO of a small organization to emphasize the importance of quality on a daily basis. Yusof & Aspinwall (2000)[187] likewise argue that small companies are more flexible and capable of responding more rapidly to changes in the organization and its surroundings compared to large companies, which may be subscribed to less complex structures. According to the study of Ahire and Golhar (1996)[4], small companies are by the opinion that they implement TQM elements as effectively as large companies, despite a lack of capital, market clout and managerial expertise. In extension hereof, Ahire and Golhar put forward that in order for small companies to implement TQM elements at least as effectively as their counterparts, small companies should capitalize on their strengths within employee involvement and
participation. However, studies examining the effect of Danish companies applying holistic management models\(^2\), referred to in section 2.4, showed that the effects of applying management models increased with company size (Kristensen et al., 2001 c)[118]. In addition hereto, Ahire et al. (1996)[6] stress that a number of disadvantages furthermore are attached to the implementation of TQM in small companies. As an example hereof, they argue that many small companies experience difficulties in obtaining supplier involvement due to a lower market clout, while Brah et al. (2002)[15] argue that small companies may suffer from a lack of information infrastructure and a general lack of resources.

With reference to the above literature, it can be assessed that implementing and adapting to a TQM-oriented culture demands many resources, time and efforts. However, when acknowledging and acting upon the obstacles and the above mentioned pitfalls associated herewith, the possibility of achieving the benefits associated with TQM increases.

\(^2\)Holistic management models refer to the Balanced Scorecard, the Excellence model and ISO 9000 (Kristensen et al., 2001 c)[118].
Chapter 3

Critical success factors of TQM and organizational performance

Having depicted the historical development of the TQM framework and practices, it is important to establish an understanding and knowledge of the underlying critical success factors of TQM. This with the purpose of facilitating the development of reliable instruments, capable of measuring the impact of TQM on organizational performance (Karuppusami & Gandhinathan, 2006). The following sections therefore encompass a description of the underlying critical success factors of TQM empirically identified in numerous studies including Saraph et al. (1989), Flynn et al. (1995), Salaheldin (2009), Demirbag (2006), Turkyilmaz et al. (2010) and many others. This overview is followed by a presentation of an assortment of performance measures used in past empirical studies evaluating the effects of TQM on organizational performance. Lastly, an overview of empirical studies examining the effects of TQM critical success factor on organizational performance, will be provided.

3.1 Critical success factors of TQM

As with the lack of congruence of a single theoretical definition of TQM, many researchers have likewise expressed the same intricacy in their effort to identify the practices and constituents, required to ensure a successful implementation of quality management. Revisiting the literature, it is however possible to identify a group of TQM constructs in which conformity to a large extent has been reached. In the following, each of these constructs will be explained thoroughly, with point of departure in the existing empirical literature. On the basis of this literature review and the theoretical quality framework, hypotheses are developed and included in the description of each of the elements underlying TQM. A summary table containing an overview of the empirical evidence will be provided subsequently.

3.1.1 Top management commitment

According to existing literature, Top management commitment is unarguably one of the most important factors underlying the success of TQM. At the same time, the lack hereof is an often cited shortcoming in many empirical studies.

In a renowned study conducted by Saraph et al. (1989), investigating a sample of manufacturing
companies in the US, a thorough synthesis of the quality literature is provided. In this, eight critical success factors of quality management are identified, among these the role of management leadership and management engagement in quality performance. Flynn et al. (1995)[57] and Powell (1995)[144] likewise argued for the necessity of Top management commitment, as top management has a large influence on the overall attitude and strategic direction of the organization.

The importance of Top management commitment and communication is furthermore acknowledged in newer empirical literature. A general consensus appears to be prevailing - top management commitment to quality must be verified and demonstrated, by actively communicating the mission and vision throughout the entire organization (Demirbag, 2006; Salaheldin, 2009; Fotopoulos & Psomas, 2009; Turkyilmaz et al., 2010) [42] [153] [61] [178]. This, among other aspects, implies that managers ought to focus on aligning the quality objectives with the vision, commence quality as a corporate culture and create a culture in which continuous improvements are supported and reluctance towards change is minimized. Establishing a quality culture in alignment with the overall business strategy is thus essential for the success of the organization.

Despite the lack of existing research investing the TQM implementation in SMEs, results from a study conducted by Ahire & Golhar (1996)[4] underpin the importance of Top management commitment in SMEs and find no statistically significant differences in the importance of Top management commitment between small and large companies.

However, the responsibility of quality alignment and improvements does not rely solely on the top management. Another important aspect is the ability of top management to allow and encourage employees throughout the organization to conduct necessary actions on their own initiatives and thus be actively involved in organizational improvements. This, in turn, may often be associated with the provision of adequate resources to foster new ideas and organizational improvement opportunities.

Despite most studies agreeing upon the importance of management communicating the vision and quality objectives, solely conveying the strategy is insufficient. Vision and mission statements have to be operationalized into daily activities that must be carried out. As described in the study by Fuentes et al. (2006)[62], the role of management must be focused towards driving, involving and assessing, rather than planning and controlling.

Based on the above depiction of empirical studies addressing the importance of Top management commitment, the following hypothesis is developed:

$$H1: \text{Top management commitment is positively related to organizational performance}$$

### 3.1.2 Supplier quality management

The success of TQM is vastly depending upon the organization’s ability to satisfy and fulfill the interests of various stakeholders. Suppliers’ ability to fulfill the needs of the organization, in terms of delivering quality input, is however also crucial for the organization. The importance of creating and sustaining superior supplier relationships is widely emphasized in empirical studies, as the quality of input, such as purchased raw materials, is directly related to the final product. As a result of this interrelatedness, keeping record and providing feedback on quality performance is often considered highly important for
Chapter 3. Critical success factors of TQM and organizational performance

the purpose of problem identification and supplier process improvements (Saraph et al., 1989; Turkyilmaz et al., 2010; Demirbag, 2006) [154] [178] [42]. In continuation hereof, having a close vendor and supplier cooperation in combination with the creation of long term mutually beneficial relationships with reliable suppliers, is accentuated in several studies as an important factor underlying the success of TQM (Flynn et al., 1995; Turkyilmaz et al., 2010) [57] [178]. As stated by Saraph et al. (1989) [154], suppliers should be selected on quality instead of price or delivery schedule. This especially applies to manufacturing organizations.

Besides addressing the importance of mutual beneficially supplier relationships, Flynn et al. (1995) [57] among others, acknowledge the importance of involving the organization’s suppliers in the product development process and establishing clarity of the specifications provided to suppliers, in order to ensure that quality standards are met.

As mentioned previously, Ahire and Golhar (1996) [4] argue that a lack of market clout may impact the ability of small companies to obtain a satisfactory level of supplier involvement in designing quality into the product and ensuring reliable deliveries of high quality raw materials. In spite of this argument, the analysis revealed no significant differences in the importance of Supplier quality management documented between small and large companies.

With point of departure in the above studies supporting the importance of Supplier quality management, the following hypothesis is developed:

\[ H2: \text{Supplier quality management is positively related to organizational performance} \]

3.1.3 People management

People management, also referred to as employee focus and employee relationship, is in numerous studies referred to as one of the most important factors underlying a successful employment of TQM, as TQM implies involving the whole organization, i.e. each employee at all levels.

In the TQM philosophy, the importance of internal and external information sharing is widely emphasized. Sharing information across functional groups of the organization, is in several studies seen as a way of encouraging employees and making them feel responsibility for quality decisions and improvements. Likewise, involving employees by heartening them to come up with suggestions related to quality development and improvements, is by many seen as an essential element underlying a successful implementation of TQM and performance enhancement. It is by Sun et al. (2000) [168] argued, that the essence of involving employees in the decision making process, is that the employees nearest a potential opportunity or a problem are in the best position of making the necessary decisions, if they have control over the process. Ensuring an efficient flow of feedback is thus essential to remove barriers to performance improvements. As highlighted previously, SMEs often have a flatter organizational structure and a shorter decision making process, enabling a faster information flow and improved communication (Yusof & Aspinwall, 2000) [187].

Besides involving employees in the decision making process, continuous focus on education and training of employees is an important factor underlying the sustainability and enhancement of organizational
Chapter 3. Critical success factors of TQM and organizational performance

Growth. Training is argued to provide employees with knowledge of quality concepts and statistical methods as well as managerial skills, with the aim of improving processes, preventing errors and for idea generation purposes. As the provision of employee training and empowerment is associated with costs for the organization, it must be aligned with employee evaluations in order to examine the effects hereof (Hendricks & Singhal, 1997)[79].

Based on past empirical studies arguing for the importance of People management and employee involvement, the following hypothesis is stated:

\[ H3: \text{People management is positively related to organizational performance} \]

3.1.4 Customer focus

An extensively covered element within the TQM literature is customer focus and in association herewith, customer satisfaction. Given the increasing focus on the creation of competitive advantages it is argued, that quality ought to be defined from an external perspective of customer expectations, rather than from predetermined internal specifications (Karuppusami & Gandhinathan, 2006)[105].

Several researchers have in their definition of TQM emphasized the importance of customer focus, as it was put forward in the previous chapter. In a study conducted by Turkyilmaz et al. (2010)[178], the definition of TQM is grounded in and based upon a distinctive focus on the customer:

"TQM is an integrated management philosophy aiming at continuous improvement in all functions of an organization to produce and deliver commodities or services in line with customers' needs and requirements." Turkyilmaz et al. (2010)

Throughout the empirical literature, there is a general agreement that quality does not solely rely on the organization’s ability to produce products with correct technical specifications. In order to stay competitive, the organization must be able to respond and adapt to changing customer preferences and needs (Saravanan & Rao, 2006)[155]. It is thus important that every employee in the organization is involved and committed towards establishing and sustaining a high level of customer satisfaction.

The supportance of having a high degree of customer focus in SMEs is likewise addressed in the study conducted by Ahire and Golhar (1996)[4], who furthermore argue that the focus on customers may be stronger in SMEs due to their proximity to and close relationship with the customers.

According to Rahman and Bullock (2005)[148], it is a necessity that both current as well as future needs of the customers are understood and met, when creating and sustaining a customer oriented organization. This implies that the organization actively must establish a variety of mechanisms, enabling efficient ways of letting customers contact the organization with product inquiries and related questions, as well as establishing channels from which the organization can obtain knowledge about customer preferences. In order to gain full advantage of this knowledge, it is important that incoming information and changes in customer preferences are analyzed and understood (Rahman & Bullock, 2005)[148].
Overall, the importance of having a customer-focused culture throughout the organization is widely emphasized in several studies, as an understanding of customer needs and preferences is essential for the competitiveness of an organization. According to Bartley et al. (2007)[9], moving towards a customer-focused culture requires listening to customers’ view, analysing, understanding, integrating and developing their expectations.

With point of departure in empirical studies addressing the importance of gaining knowledge of and adapting to customer preferences, the following hypothesis is stated:

\[ H_4: \text{Customer focus is positively related to organizational performance} \]

### 3.1.5 Process management

The underlying idea behind process management, is that an organization should be seen as a set of interrelated processes and that continuous improvement of each process is a step towards performance improvements. (Crosby, 1979)[31] likewise stated, that every activity within the organization may be broken down into underlying processes, defined as the transformation of a set of input into output, which are combined into a quality chain. All processes will thus exert influence on one another.

Within the philosophy of TQM, having a process oriented approach underlines the necessity of having processes designed to meet quality requirements. Furthermore, it is essential that critical and core processes are recognized and supported, in order to ensure an appropriate resource allocation to map, inspect and improve these processes.

Process improvement is in a study by Ravishandran and Rai (2000)[150] said to be grounded in statistical process control theories and has developed to comprise practices aiming at eliminating waste by continuous improvement. Preventive actions, such as waste reduction and error prevention is thus highlighted as an essential premise when designing TQM processes (Kanji, 2002)[99]. The importance of applying adequate statistical methods to secure a high level of process control and in continuation hereof using the assessment results to gain knowledge of the processes, is likewise emphasized as important factors in several empirical studies (Saraph et al., 1989; Flynn et al., 1995; Claver & Tari, 2003)[154] [57] [25]. The importance of process management for SMEs is likewise acknowledged in the article by Yusof and Aspinwall (2000)[187], it is though argued that fewer resources in small firms may have an influence on the investment decisions in new processes and the optimization efforts in existing processes.

Given the focus on process management in past empirical studies, embracing continuous improvements and process optimization, the following hypothesis is put forward:

\[ H_5: \text{Process management is positively related to organizational performance} \]
3.1.6 Quality data and reporting

In the study conducted by Saraph et al. (1989)[154], the importance of quality data and reporting is appointed an important factor underlying a successful TQM implementation.

The elements underlying Quality data and reporting should be included in continuation of the above mentioned critical factor, Process management. Where Process management addresses the aspect of continuous improvement and process mapping, Quality data and reporting incorporates the importance of reporting and integrating quality data in the strategic planning.

Quality data and reporting involves a high degree of documentation, tracking and feedback. Clearly documenting various process procedures and waste and defect rates in the manufacturing process, as well as keeping the information readily available to every employee, is argued to be an important factor underlying the success of the organization (Kaynak, 2003)[103]. Saraph et al. (1989)[154] likewise stresses the importance of providing information on quality data to employees and managers, for problem solving and prevention. In continuation hereof, applying quality data furthermore enables the possibility of evaluating employees and managers based on quality performance. Ahire and Golhar (1996)[4] document no differences in the importance of Quality data and reporting with respect to company size.

In several studies the importance of quality data is thus emphasized as a useful tool of monitoring performance and managing quality.

With point of departure in the above studies, the following hypothesis is stated:

\[ H6: \text{Quality data and reporting is positively related to organizational performance} \]
Chapter 3. Critical success factors of TQM and organizational performance

3.1.7 Summary of TQM critical success factors

Investigating the empirical literature, it becomes evident that the critical success factors of TQM differ somewhat in scope from one study to another. This being said, several common elements and practices are observed throughout the literature, as documented in the section above.

The table below provides an overview of the critical success factors according to the empirical literature:

<table>
<thead>
<tr>
<th>Critical success factors of TQM</th>
<th>Supportive literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management commitment</td>
<td>Saraph et al. (1989); Flynn et al. (1989); Salaheldin (2009); Turkyilmaz et al. (2010); Demirbag et al. (2006); Fuentes et al. (2006); Ahire et al. (1996); Powell (1995)</td>
</tr>
<tr>
<td>Supplier management</td>
<td>Karuppusami (2006); Saraph et al. (1989); Flynn et al. (1989); Demirbag et al. (2006); Salaheldin (2009); Ahire &amp; Golhar (1996)</td>
</tr>
<tr>
<td>People management</td>
<td>Terziovski et al. (1999); Saraph et al. (1989); Flynn et al. (1989); Sun (2000); Ahire et al. (1996); Powell (1995); Yusof &amp; Aspinwall (2000); Hendricks &amp; Singhal (1997)</td>
</tr>
<tr>
<td>Customer focus</td>
<td>Salaheldin (2009); Karuppusami (2006); Bartley et al. (2007); Saravanan &amp; Rao (2006); Rahman &amp; Bullock (2005); Flynn et al. (1989); Turkyilmaz et al. (2010)</td>
</tr>
<tr>
<td>Process management</td>
<td>Ravichandran &amp; Rai (2000); Kanji (2000); Flynn et al. (1989); Claver &amp; Tari (2003); Yusof &amp; Aspinwall (2000)</td>
</tr>
<tr>
<td>Quality data and reporting</td>
<td>Saraph et al. (1989); Kaynak (2003); Ahire &amp; Golhar (2006); Flynn et al. (1989); Salaheldin (2009)</td>
</tr>
</tbody>
</table>

Based on the table above it is evident that the six proposed TQM elements in this paper are strongly grounded in the empirical literature. Agreement likewise appears to be present between the TQM elements identified in older as well as newer empirical studies. Lastly it is noteworthy that there to a large extent is a general consensus between the elements described above and the elements underlying the concept of TQM.

3.2 Measuring organizational performance

In addition to applying relevant TQM practices, the question of which measures to deploy when evaluating organizational performance, arises. Revisiting the literature, various dimensions and measures of organizational performance have been applied when estimating the effect and economic impact of implementing TQM. No clear conformity on how to define and measure organizational performance thus exists.

In the following, an overview of empirical studies measuring organizational performance within the field of TQM, is provided.
Slack et al. (2010)[162] define performance as the degree to which an operation fulfills the performance objectives - the primary measures - in order to meet the needs of the customers - the secondary measures. Performance measurement is a critical factor underlying effective management. As it is argued by Demirbag (2006)[42], without measuring something, it is difficult to improve it. Improving performance thus requires identifying and measuring the influence of TQM practices hereon.

While financial performance previously has been seen by many as the ultimate aim of any organization, other non-financial indicators may be equally important in implementing TQM principles, as they may have a mediating effect on organizational performance (Demirbag, 2006)[42]. Several recent studies likewise acknowledge the importance of looking at financial as well as non-financial performance measures. Employing both financial as well as non-financial performance measures furthermore follows the work of Kaplan & Norton (1996)[104], who emphasized the need to overcome potential shortcomings of traditional performance measurement systems, employing only financial measures.

Revisiting the literature, it becomes evident that the most commonly used methods for measuring organizational performance may roughly be placed within operational, financial and non-financial performance. Operational performance concerns the internal operations of the organizations, financial performance comprises financial measures whereas non-financial performance includes elements such as competitive profile and successful product development.

The table below provides a summary of the performance measures applied in past empirical studies, measuring the effect of TQM on organizational performance.

<table>
<thead>
<tr>
<th>Dimensions of organizational performance</th>
<th>Key performance indicators</th>
<th>Supportive literature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operational performance</strong></td>
<td>(1) Cost reduction</td>
<td>Flynn et al. (1995);</td>
</tr>
<tr>
<td></td>
<td>(2) Waste reduction</td>
<td>Terziovski et al. (1997);</td>
</tr>
<tr>
<td></td>
<td>(3) Product quality</td>
<td>Powell (1995);</td>
</tr>
<tr>
<td></td>
<td>(4) Productivity</td>
<td>Rahman &amp; Bullock (2005);</td>
</tr>
<tr>
<td></td>
<td>(5) Quality conformance</td>
<td>Fuentes et al. (2006);</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ahire et al. (1996);</td>
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<td></td>
<td></td>
<td>Forza &amp; Flippini (1998);</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Salaheldin (2009)</td>
</tr>
<tr>
<td><strong>Financial performance</strong></td>
<td>(1) Revenue</td>
<td>Powell (1995);</td>
</tr>
<tr>
<td></td>
<td>(2) Net profit</td>
<td>Grandzol &amp; Gershon (1997);</td>
</tr>
<tr>
<td></td>
<td>(3) Overall profitability</td>
<td>Terziovski et al. (1997);</td>
</tr>
<tr>
<td></td>
<td>(4) Return on Assets</td>
<td>Idris &amp; Zairi (2006);</td>
</tr>
<tr>
<td></td>
<td>(5) Market share growth</td>
<td>Fuentes et al. (2006);</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adam et al. (1997);</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kaynak (2003)</td>
</tr>
<tr>
<td><strong>Non-financial performance</strong></td>
<td>(1) Customer relations</td>
<td>Dow et al. (1999);</td>
</tr>
<tr>
<td></td>
<td>(2) Successful product</td>
<td>Flynn et al. (1995);</td>
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<td>development</td>
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<td>(3) Employee morale</td>
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<td>(5) Competitive profile</td>
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Chapter 3. Critical success factors of TQM and organizational performance

Investigating the literature, it becomes evident that no clear agreement on the definition of organizational performance exists. Several authors argue for the importance of using comprehensive measurement indicators, able to encompass qualitative as well as quantitative performance measures and able to incorporate changes in the internal and external environment of organizations. Applying a set of comprehensive indicators is thus argued to provide a more holistic appraisal of the strength and sustainability of the performance of the organization (Fuentes et al., 2006)[62].

3.3 TQM implementation and organizational performance

Having identified the critical success factors underlying a successful employment of TQM and examined the performance measures applied in empirical studies, it is pertinent to investigate the relationship between TQM employment and organizational performance identified in the empirical literature. As mentioned previously, the underlying objectives of implementing quality programs may be diverging, spanning over maintaining a competitive profile, surviving in a highly competitive market and increasing performance and productivity.

The section below provides an overview of an extract of empirical studies investigating the effects of TQM on organizational performance, seen from a quantitative as well as a qualitative viewpoint.

Studies investigating the relationship between TQM factors and organizational performance have revealed somewhat diverging results. It is though noticeable that a part of this nonconformity may be attributed to the focus on different TQM constructs, the examination of diverse populations as well as the use of different methods for measuring organizational performance across different studies.

Despite the existence of nonconformity, there seems to be an agreement about the positive effects of TQM implementation on financial results. As previously mentioned, Porter and Tanner (2005)[143] argue, that many studies have suggested and found a strong and identifiable link between a TQM approach and superior financial performance. As examples hereof, the studies by Terziovski et al. (1999)[175] and Hendricks and Singhal (1997)[79] found that business performance, measured by various financial and operational measures like operating income, return on assets and the like, was enhanced by the employment of TQM practices. In a meta-analysis conducted by Jitpaiboon and Rao (2007)[95], investigating 421 items relating to TQM practices in 50 refereed articles, it was found that the adoption of TQM had a high impact on both financial performance and productivity. In continuation hereof, Salaheldin (2009)[153] examined a sample of 139 SMEs and found that operational factors are not only related to the effectiveness of TQM, as expressed by operational performance, but that they are also drivers of the success of TQM, as expressed by financial performance.

Grandzon and Gershon (1997)[71] investigated at set of multidimensional constructs and found that financial performance was a function of operating performance, while operating performance among others was proved to be a function of continuous improvements. Thus, several interrelationships between the various TQM constructs employed, are found in the empirical literature.

As stated previously, a successful implementation of TQM has not only proven to exert a positive influence on financial and operational performance. In point of fact, Dermirbag et al. (2006)[42] examined the impact of TQM implementation on the performance of manufacturing SMEs and reported a highly positive impact on non financial performance but a vastly lower impact on financial performance. Several
other studies are found to be in alignment with this observation.

Customer satisfaction is an often cited reason for implementing a quality management system and is often perceived as one of the enablers for improving financial results. In the above definitions of TQM, it is apparent that many authors and practitioners perceive customer satisfaction as a focus area of TQM, thus naturally there is a great possibility that implementing TQM leads to increased customer satisfaction. Hellesten & Klefsjö (2000) [78] argue that increased customer satisfaction as well as reduced costs are some of the benefits underlying the implementation of quality management.

In a study conducted by Powell (1995) [144], behavioural factors such as top management commitment, employee empowerment and a quality oriented and open-minded culture were found to produce competitive advantages more strongly than the application of data and analysis. Dow et al. (1999) [45] found that the combination of employee commitment, shared vision and customer focus has a large positive impact on the performance of organizations. In continuation hereof, Lau and Idris (2001) [120] and Fuentes et al. (2006) [62] likewise stressed the importance of people management and alignment of strategies and TQM objectives as essential factors underlying and sustaining business growth.

In summary, based on an extensive literature review, six critical success factors underlying the employment of TQM practices have been identified. In the efforts of identifying the impact of TQM critical success factors on organizational performance, researchers have employed various performance measures related to operational, financial- as well as non financial performance. Despite some diverging results on the impact of TQM critical success factors on organizational performance, there is a general empirical agreement, that the adoption of TQM practices exerts a positive influence on the performance of organizations.

The purpose of the following chapter is to describe how each of the identified TQM critical success factors are operationalized. This is followed by a description of the fundamental methodological considerations.
Part III

Methodology
Chapter 4

Research methodology

4.1 Research methods

The underlying purpose of this chapter is to elucidate and account for the choices made regarding the methodological approach of this paper. The choice of research method is based upon the intention to ensure the utmost satisfactory answers to the research questions posed in this paper.

The chapter is commenced with a description of how the underlying constructs of TQM and the performance variable are operationalized to fit the survey structure of this paper. In continuation hereof, the model embracing the TQM constructs and the performance variable is depicted. This description is followed by a presentation of the underlying study population. The fundamental methodological decisions concerning the survey structure as well as the data collection process, will furthermore be accounted for.

4.1.1 Measuring the variables of TQM and organizational performance

As previously underlined, the main focus of this study is to examine the effects of TQM on organizational performance in small and medium sized Danish manufacturing companies. Based on the extensive study of previous empirical literature, the following six TQM constructs have in this paper been recognized as critical success factors underlying a successful implementation of TQM:

- Top management commitment
- Supplier quality management
- People management
- Customer focus
- Process management
- Quality data and reporting

With reference to the previous chapter, there appears to be a general consensus concerning the effects on organizational performance, resulting from the employment of the above outlined TQM principles.
The purpose of the following sections is to provide an overview of the operationalization of the above mentioned independent TQM variables and the dependent performance measurement variable.

4.1.1.1 Operationalization of variables

As the further empirical analysis in this paper will be conducted with point of departure in a questionnaire survey, each of the identified TQM constructs must be operationalized in order to fit the questionnaire survey. According to Das et al. (2000)[37], each variable included in this study should be operationalized by following a four step procedure: 1) Provide a theoretical definition, 2) Identify the dimensions, 3) Form appropriate measures and 4) Specify the relation between the measures and the constructs. As the theoretical definition and the dimension of each construct have been provided in the literature review, the next step is to form the appropriate measures for each of the TQM constructs.

In this paper, the operationalization of variables, and thus the choice of measures encompassed in each TQM construct, is based upon an extensive research and review of previous empirical studies, with the purpose of finding adequate measures which are both theoretically grounded as well as generally agreed upon by the various authors within the field of TQM.

In the following, deliberations and descriptions of the measures of each variable are provided. The exact measures underlying each TQM construct are afterwards put together in the visualization of the model in the consecutive section. The full questionnaire containing the exact measures is provided in appendix C. Further elaborations upon the contents and structure of the questionnaire survey is contained in section 4.1.3.

The construct Top management commitment is measured by a number of items covering the following aspects:
The involvement of top management in founding and communicating the vision, mission and future quality objectives of the organization; the role of top management in maintaining reliable information sharing across the organization; management’s allocation of adequate resources towards the improvement of quality; the degree to which the evaluation of the top management is based upon quality performance and their ability to make quality responsibility visible and complied with throughout the organization.

Customer focus is measured by a subset of items related to:
The communication base and established mechanisms for customer interaction; mechanisms set up to gain knowledge of customer needs, expectations and requirements; the availability of procedures to deal with customer complaints and proposals; the focus on customer relationships and the ability to understand and comply with key customer requirements.

The elements of Supplier quality management are measured by a set of underlying items concerning:
The establishment of long term relationships with key suppliers; the recognition of quality as an important supplier assessment factor; provision of feedback related to the performance of suppliers; collection and active use of data regarding quality performance and lastly the inclusion of suppliers in the quality related activities of the company.
People management is measured by a subset of items covering:
The degree of employee responsibility for quality; the emphasis and supply of employee development plans; the recognition and reward granted to employees for their performance related to quality and the inclusion of employee opinions with regards to quality decisions.

Process management is measured through a set of items covering:
The allocation of resources related to the improvement and optimization of processes; standardization and documentation of operating procedures; the use of counselling with respect to the quality level in the organization; identification of core processes and their interrelationship and the importance of having an organizational wide focus on quality and optimization of all products, services and processes.

Lastly, Quality data and reporting is measured by items related to:
The extent of documentation, reporting and use of quality data throughout the organization; the availability and active use of quality data in strategic oriented decisions and the use of quality data in the assessment of employees and management.

Having provided an insight to the various measures used to form and assess the TQM constructs, the dependent variable, i.e. Organizational performance, is operationalized by the use of five performance measures. The various performance measures described in the literature review have thus been circumscribed and consolidated, in order to secure that the possibility of overlapping is eliminated.

These measures are chosen, based on an assessment of the empirical literature review in chapter 3, with the aim of identifying measures which are both valid and able to cover multiple aspects of organizational performance, that is financial, non-financial as well as operational performance. This paper thus seeks to overcome potential shortcomings of several former studies within the field of TQM, as many of the previous studies only investigate the financial performance of organizations.

The five measures employed in this study to cover organizational performance are: 1) Product quality, 2) Productivity, 3) Return on assets (ROA), 4) Competitive profile and 5) Successful product development. Operational performance is covered within the first two measures; product quality and productivity, as these are part of the internal activities of a company. Financial performance is measured by Return on Assets. Relying on only one measure to cover financial performance is presumed to be satisfactory, as Return on Assets incorporates the Net income as well as the assets, i.e. invested capital, recorded within each organization. Return on Assets thus provides a good standard of reference between organizations. Lastly, non-financial performance is assessed by the last two measures; Competitive profile and Successful product development.
4.1.2 Model development

The assortment of the six TQM elements and the operationalization of the respective elements, enables the development of the model to be tested and validated in this paper.

It may be argued, grounded in the extensive literature review conducted in the previous chapter, that the six TQM elements each exert a positive influence on organizational performance. Based on this assessment, the model to be employed in the empirical analysis of this paper, is visualized as follows:

Figure 4.1: Theoretical model enclosing the effects of TQM practices on organizational performance

The indicators pointing at each construct, i.e. TMC1-TMC6 pointing at the construct Top management commitment, each represent a question posed in the questionnaire to reflect the construct. The decision regarding the number of indicators, i.e. questions to be posed when measuring each TQM construct, is based upon the objective of minimizing the possibility of bias effects arising in the statistical analysis. Based on the recommendation in Kristensen and Eskildsen (2005)[110], a minimum of four indicators, i.e. questions related to each TQM construct, have been employed per construct. This number is furthermore supported in the study by Hair et al. (2012)[74]. Due to the amount of questions posed in the questionnaire, the exact questions related to each constructs may be found in the full questionnaire provided in appendix C, as mentioned previously.

As underlined in the theory and literature review, TQM is by many researchers seen as a holistic management approach, implying that the elements and critical success factors underlying TQM are often viewed as a collection of interrelated constituents. As previously mentioned, numerous models encompassing
different causal relationships between the TQM factors have been suggested in the empirical literature. No definitive model has however gained a footing by the various researchers. Due to the difficulty in putting one specified model forward another, the aim of the study has focused on identifying the direct effects on performance, resulting from an adoption of TQM practices. Thus, analyses will be conducted on the basis of the model above, with the objective of identifying the direct relationships between the critical success factors of TQM and organizational performance of Danish SMEs, operating in the manufacturing industry.

4.1.3 Data

The methodological approach of collecting data will in the following be outlined. This comprises among others a description of the data collection instruments applied, the survey structure, the survey distribution and data requirements. The data presented in this section is forming the foundation of the analysis, thus a high degree of reliability and validity is important. As a result hereof, this will be commented upon throughout the section.

4.1.3.1 Methodological approach

The data collection is primarily grounded in a quantitative research approach as data is collected by means of a structured questionnaire. This approach is chosen as it provides a strong foundation for the generalisation of survey results to the study population, being Danish manufacturing SMEs (Malhotra & Birks, 2007)[126]. Furthermore, it provides a solid foundation for applying statistical methods and increasing the objectivity (Blumberg, 2011)[13]. By employing this approach, the degree of in-depth research naturally will be limited compared to a study grounded in a qualitative oriented approach. However, bearing in mind the focus on developing a conclusion applicable for Danish manufacturing SMEs in general, a quantitative approach is applied.

The questionnaire builds upon the respondents’ perception concerning the degree of TQM implementation and organizational performance in the respective companies. This is in parallel to most empirical quantitative studies within performance related TQM studies, see among others; Ahire & Golhar (1996)[4], Kristensen et al. (2005)[115], Salaheldin (2009)[153], Saraph et al. (1989)[154] and Turkyilmaz et al. (2010)[178]. The method of stating perceptual questions can be questioned, the alternative of collecting objective information is however not optimal either. According to Ahire and Golhar (1996)[4], the information compiled from the perceptions of key respondents is often closer to reality, compared to an artificial reconstruction of the objective reality based on a limited collection of incomplete data gathered independently by researchers themselves. Furthermore it can be difficult, and in many cases impossible, to obtain objective and comparable data of the TQM constructs. When evaluating the organizational performance on the basis of financial accounting results, varying dates of annual account publications as well as differences in account entries might result in limited comparability between the companies (Kristensen et al. 2005)[115]. In addition hereto, many small and medium sized companies may not be subject to disclosure requirements (KPMG, 2013)[109].

4.1.3.2 Sample

ISO 9001 certified companies are chosen to form the foundation of the data, as ISO 9001 is a global
Chapter 4. Research methodology

acknowledged quality standard with point of departure in TQM fundamentals. By addressing ISO 9001 certified companies, the possibility of obtaining data from companies with a prior understanding of quality management and with the ability to respond to questions covering TQM is increased. This is argued as there to a large extent is a general consensus between the TQM critical success factors and the eight quality management principles included in ISO 9001, for further elaboration confer appendix A.

ISO certified companies have furthermore constituted the data foundation of several TQM studies, see among others Das et al. (2008)[38], Fotopoulous & Psomas (2009)[61] and Kumar et al. (2012)[119]. No exhaustive public list on Danish ISO certified companies is available. In order to receive information on Danish ISO 9001 certified companies, a cooperation with the Danish commercial foundation, Dansk Standard, has been established. Dansk Standard develops and publishes a variety of standards applicable for companies and organizations operating in a broad range of industries. Data for this thesis was received by means of Dansk Standard’s subsidiary, DS Certificering A/S. DS Certificering A/S is among others responsible for company certification within the international quality management standard, ISO 9001. A list containing the names of 1212 ISO 9001 certified companies was received from DS Certificering, confer CD appendix V.

With reference to the objective of the study, focus relies on small and medium sized companies. No global definition of SMEs is established, as variations between countries and sectors exist. In several studies the companies are classified according to either number of employees or turnover, see among others Dermibag (2006)[42], Kristensen et. al. (2005)[115] and Salaheldin (2009)[153]. It is chosen to define company size according to the European commission’s current enterprise classification of small and medium sized companies (EU-Comission, 2003)[51]. The European Commission classifies company size according to number of employees and annual turnover or balance sheet total. Small companies are categorized as employing between 10 and 49 people and generating an annual turnover or balance sheet total of above EUR two million and below EUR ten million, equivalent to approximately DKK 15 million and DKK 75 million 1. Medium sized companies are categorized as employing between 50 and 249 people and generating an annual turnover or balance sheet total of above EUR ten million and below EUR 50 million, equivalent to approximately DKK 75 million and DKK 375 million. It is chosen to classify company size according to number of employees and annual turnover, as it is believed that respondents are more familiar with the value of annual turnover compared to the balance sheet total. The omission of companies not belonging to this category is covered in section 4.1.3.6.

In order to increase homogeneity within the sample and hereby the internal validity (Ahire & Golhar, 1996)[4], it has been chosen solely to focus on manufacturing companies.

In the early phases of TQM, TQM was primarily applied in manufacturing companies and consequently has a long history in the manufacturing industry (Saraph et al., 1989)[154]. This may be the reason why many studies on TQM base their data foundation on manufacturing companies, see among others Das et al (2008)[38], Flynn et al. (1993)[56] and Ismail and Ebrahimpour (2005)[88]. However, some authors have chosen to confine the subject of analysis further. As examples hereof, Ahire et al. (1995)[5] study the effects of TQM on the basis of the automotive industry and Turkyilmaz et al. (2010)[178] solely focus on the textile industry. If the level of analysis in the present study was confined from manufacturing companies to a subgroup within this industry, it would increase the internal validity even further, this would however be at the expense of the external validity (Ahire & Golhar (1996)[4]. In addition hereto

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1 DKK/EUR exchange rate July 15th retrieved from www.euroinvestor.com
Chapter 4. Research methodology

it is argued that the sample comprised of small and medium sized Danish manufacturing companies would be too small to encompass a single sub-industry. Other authors have opposite chosen to expand their sample to cover both manufacturing as well as service companies, see among others Kumar et al. (2012) [119] and Saraph et al. (1989) [154]. Though this approach would increase the sample size, it is chosen to include only manufacturing companies as it is believed that Danish manufacturing- and service companies are too diverging in their focus on TQM elements.

A comprehensive sorting of data was undertaken prior to distribution of the survey, selecting Danish manufacturing companies in the list provided and sorting out non-Danish companies not belonging to the manufacturing industry. With the purpose of further increasing the internal validity only private companies were included in the sample. Duplicates as well as companies which were represented more than once by different subsidiaries, were furthermore excluded in order to avoid bias from uniform answers within related companies.

Contact information on the remaining companies was collected and whenever possible, e-mail addresses and telephone numbers on managing directors, quality assurance managers or production managers was obtained. In the empirical TQM literature, people possessing the above mentioned positions are perceived best capable of answering questions concerning the overall TQM and performance level in their respective companies (Ahire et al., 1995; Das et al., 2000; Demirbag, 2006; Kaynak, 2003; Kristensen et al. 2005; Salaheldin, 2009; Saraph et al., 1989) [5] [37] [42] [103] [115] [153] [154].

A total number of 140 e-mail addresses and telephone numbers were collected on either managing directors, quality assurance managers, or production managers. Additionally, 190 company wide e-mail addresses were compiled. In total, the sample prior to survey distribution thus comprise 330 private Danish manufacturing companies all certified with the ISO 9001 quality standard.

4.1.3.3 Survey structure

The design and distribution of a questionnaire can exert significant influence on the response rate and consequently the validity of the results. When operating with a limited sample, a high response rate becomes even more vital in order to ensure generalisable results (Blumberg et al., 2011) [13]. As a result hereof, the design and distribution of the questionnaire has been given careful consideration in the following.

The questionnaire is structured in three parts which cover demographic variables related to the company and the respondents, the company’s degree of TQM implementation and the company’s performance. Special attention has been given to the order of variables in the questionnaire, in accordance with the recommendations of Kristensen and Eskildsen (2010) [111]. It is often recommend that sensitive questions are placed at the end of a survey (Tourangeau & Yan, 2007) [177]. In this specific study no questions are identified as being highly sensitive. It is however expected that the respondents to a certain degree will perceive TQM and performance related questions as sensitive. This is expected due to the likelihood that respondents may perceive these questions as reflections of their own job performance, which likewise increases the risk of self-reporting bias (Ahire & Golhar, 1996) [4] - bearing in mind that the questionnaire is solely completed by managers. Furthermore, the respondents might feel obliged to indicate a certain level of TQM when the company is ISO certified. As a result hereof, the data is expected to depict a somewhat positive picture of the TQM level and performance in the company compared to the actual situation.
Chapter 4. Research methodology

The demographic section covers questions regarding the respondents’ job position, the year of ISO certification, number of employees, annual turnover within a predefined range and the industry wherein the companies’ are operating. It is presumed that these variables are less sensitive and thus exert a minor influence on the respondents’ fulfillment of the rest of the questionnaire. Consequently, the demographic variables are stated at the beginning of the questionnaire. Furthermore, certain demographic variables sort out companies which are not included in the target group described above and those companies are consequently exempted from filling out the rest of the questionnaire.

It is presumed that an indication of the performance level prior to fulfillment of the TQM related questions has the potential of exerting a higher influence on the fulfillment of the remaining questionnaire, contrary to stating TQM related questions at first. As a result hereof, the performance related questions are stated at the end of the questionnaire. The order of the questions is thus characterized by encompassing demographic questions at the beginning of the questionnaire followed by TQM related questions and finally questions covering company performance. In support hereof, numerous studies covering the influence of TQM practices on performance have employed a similar questionnaire structure, see among others Ismail & Ibrahimpour (2005)[88], Martinez-Costa et al. (2009)[128], Salaheldin (2009)[153] and Turkyilmaz et al. (2010)[178].

The original version of the questionnaire is developed in English as it to a large extent is based on questions and terminologies applied in global empirical TQM studies. The questionnaire is however to be distributed in a Danish version. For translation purposes, a back reversing technique is applied. The questionnaire was consequently translated to Danish and back translated to English by another person in order to ensure that the two versions are comparable. The two versions of the questionnaire are displayed in appendix C.

When developing the questionnaire, a strong focus has been put on formulating the questions in an easy and understandable language while still maintaining the conceptual content underlying the questions. The respondents are guided through the questionnaire by means of text pieces and the questions are gathered in question batteries according to the constructs which they underpin. A process bar is additionally displayed in the bottom of the questionnaire which indicates the degree of completion. The above initiatives should all motivate the respondents to complete the questionnaire and thus minimize the drop-out rate (Fuglsang et al., 2010)[63].

In the opening texts of the TQM and performance related questions, the respondents are asked to indicate to which degree they can approve upon the listed statements on a Likert scale ranging from 1 (strongly disagree) to 10 (strongly agree). Respondents are furthermore provided with the opportunity of choosing the option “Don’t know” if they are incapable of stating their opinion according to the 10-point Likert scale. A Likert scale is chosen as it is easily understood by the respondents and due to the possibility of varying the answers (Malhotra & Birks, 2007)[126]. Likert scales as well as “Don’t know” categories have been widely applied in the TQM literature, however the size of the scales employed differs, see among others Flynn et al. (1995)[57], Kumar et al. (2012)[119] and Kristensen and Haffer (2008)[112]. Kristensen and Eskildsen (2010)[111] compare the application of a 5-point scale to a 10-point scale and find that a 10-point scale is preferable, as it results in smaller standard deviations. They furthermore argue that larger scales are closer to the continuous scale and thus closer to satisfying most assumptions of statistical techniques applied by practitioners. However, they did not find any differences in the mean
values of the standardized 5- and 10-point scales.

4.1.3.4 Distribution

Before distributing the questionnaire, a pilot survey was undertaken in order to receive feedback and to ensure that respondents understand and relate to the questions stated in the questionnaire. One managing director and one quality assurance manager each examined the questionnaire. The questionnaire was consecutively discussed with the authors of the thesis. This led to minor modifications of the questionnaire, mostly characterized by rewording of academic terminologies.

An invitational mail, directed to the subsample consisting of 140 managing directors, quality assurance managers or production managers, was developed. In the invitational mail, the respondents were informed about the purpose of the survey, the amount of time it takes to complete the questionnaire and the closing date of the questionnaire. The respondents were furthermore ensured anonymity in order to increase the possibility of receiving true answers reflecting the companies’ actual TQM and performance level. The invitational mail was shortened as much as possible in order to maintain the interest of the receivers. The respondents were given ten days to complete the survey and received a reminder if the time frame was overrun, followed by yet another reminder if necessary. The invitational mail as well as the reminder mails are presented in appendix B. From the subsample of the 140 managers, 63 respondents completed the questionnaire.

For those companies where contact information on people possessing the above mentioned positions was inaccessible, an information mail was sent to the companies. In the information mail they were introduced to the survey and enquired to provide contact information on a managing director, a quality assurance manager or a production manager. From the subsample of 190 companies, 64 companies provided contact information on one or more of the above mentioned persons. These persons hereafter received an invitational mail to the survey and were from this point subject to the same procedure as the persons in the above subsample. This resulted in completed questionnaires from 52 managing directors, quality assurance managers or production managers.

4.1.3.5 Response rates

The distribution of the survey resulted in an effective response rate of 35\%\(^2\). This is argued to be satisfactory when taking into consideration that the second sample was collected in two steps - collection of contact information followed by completion of questionnaires. In the empirical TQM literature similar response rate levels are dominating, though with some variation. As examples of response rates in renowned studies one may refer to Powel (1995)[144] who obtained a response rate of 25\%, Flynn et al. (1995)[57] who obtained a response rate of 60\% and Dermibag (2006)[42] who obtained a response rate of 28\%.

Upon closure of the survey, the sample included 115 respondents, this number was however further reduced as elaborated below.

4.1.3.6 Omission of data

As explained in section 4.1.3.2, focus relies on SMEs and large companies as well as micro companies are thus to be sorted out. From the obtained sample, ten companies were excluded due to their exceeding of

\(^{2}\)Effective response rate calculation: \((63+52)/(140+190) = 35\%\)
the predefined size requirements. One respondent was excluded because the questionnaire was completed by a HR manager, while another respondent was excluded from the survey as the mark of ten was assigned to all questions, indicating that the answers were reflected upon to a lesser extent. Finally two respondents have been excluded due to incomplete fulfillments of the questionnaire, in terms of a large number of missing values. Following the above mentioned omission of data, the final sample consists of 101 respondents. The sample size will be commented upon in section 5.1.3, where it is evaluated with point of departure in the statistical method applied.
Chapter 5

Statistical methodology

The purpose of this chapter is to provide an overview of the statistical methodology employed. With point of departure in the theoretical foundation of this thesis and the research method described in the preceding chapter, an argumentation for the choice of Partial Least Squares - Structural Equation Modeling, in the following designated PLS-SEM, will be presented. In this argumentation, special emphasis is placed on the benefits and limitations of PLS-SEM, in connection with the given sample size of this paper.

5.1 Partial Least Squares - Structural Equation Modeling

As the theoretical model described in this paper consists of causal relationships between a number of latent, i.e. unobservable, variables, the model estimation will be based upon Structural Equation Modeling. This approach is specially suitable, as SEM is a technique applied to estimate a specified theoretical model and as it enables the testing of hypotheses concerning relationships between observed and latent variables. It combines features of factor analysis as well as multiple regression, in order to study both the measurement and the structural properties of theoretical models. This among other aspects contributes to many researchers arguing for the superiority of SEM, as it provides the possibility of simultaneously testing each underlying relationship, when the phenomenon to be investigated is multidimensional and complex (Tabachnik & Fidell, 2007)[170].

Two common statistical approaches for structural model estimation are prevalent; the maximum likelihood based covariance structure analysis method, known as CB-SEM, which is often applied using the LISREL algorithm, and the non-parametric Partial Least Squares based variance analysis developed by Wold (Hair et al., 2011)[73]. The primary focus underlying CB-SEM is to validate and test a theoretical covarian/correlation structure. Opposite, the objective of PLS-SEM is not to recreate the covariance between the observed manifest variables, but to minimize the residual variance of the dependent latent constructs and thus increase the explanatory power.
When applying SEM, it is important that a thorough argumentation upon the choice of SEM approach is provided. According to Hair et al. (2011)[73], the choice of either PLS-SEM or CB-SEM is determined by the relevant research’s objective:

“In causal modeling situations, where prior theory is strong and further confirmation is the overall goal, CB-SEM is the most appropriate statistical methodology...In situations where theory is less developed, however, researchers need an alternative approach to examine structural models if the primary goal is not theory confirmation. Thus, because of its prediction orientation, PLS-SEM is the preferred method when the research objective is theory development and prediction.” Hair et al. (2011)

This statement is, with reference to Herman Wold, likewise supported in the paper by Fornell and Cha (1994)[58]:

“According to Wold, Maximum Likelihood methods are parameter oriented and give optimal parameter accuracy; PLS is prediction oriented and gives optimal prediction accuracy. Wold further maintains that there is a choice between parameter accuracy and prediction accuracy. We cannot have both, except for the special case when LISREL and PLS produce the same parameter estimates.” Fornell & Cha (1994)

With point of departure in the above statements and the research objectives of this paper, it may be argued that PLS-SEM is the appropriate method to employ, as the overall focus of this thesis rests upon predicting the object of research.

Another aspect may furthermore be underlined in favour of the use of PLS-SEM in this study. In order to provide robust results when using CB-SEM, several underlying assumptions and requirements regarding the distribution of the data and the sample size must be fulfilled. This implies that CB-SEM may be less applicable in practise, when data might not follow a multivariate normal distribution and in cases where the sample size requirements are difficult to fulfill (Fornell & Cha, 1994; Hair et al., 2011)[58][73]. Contrary to CB-SEM, PLS-SEM is a more robust estimation technique, less sensitive to skewed distributions, small sample sizes and the presence of multicollinearity. In comparison with CB-SEM results, which can be highly imprecise when the assumptions are violated, PLS-SEM thus often provides more robust estimations of the structural model (Hair et al., 2011)[73].

Based on the above considerations, the advantages of PLS-SEM thus comprise a large degree of flexibility underlying the model construction, valid results with fewer identification issues, robust findings despite small sample sizes and non-normal data and the possibility of handling a large degree of model complexity by simultaneously testing each underlying relation in the model.

The above mentioned advantages are though constrained by some disadvantages.

Despite PLS-SEM having several advantageous features, researchers in management and especially strategic management seem to predominantly rely on first-generation multivariate analysis techniques such as factor analysis, multiple linear regression and the like (Hair et al., 2012)[74]. Potential reasons may be that PLS-SEM suffers under its affiliation to the CB-SEM method and its restrictive assumptions and that the complexity of the PLS-SEM method necessitates a thoroughly evaluation and systematic assessment of the fundamental quality measures associated with the model (Hair et al., 2012)[74]. Other
researchers have argued for the lack of an adequate global measure of goodness of model fit to evaluate the combined model; several approximations though exist and will be employed in this thesis (Tenenhaus et al., 2005)[172]. Lastly, it ought to be mentioned that some researchers have stated that PLS-SEM parameter estimates are not optimal regarding bias and consistency, a property frequently referred to as PLS-SEM bias (Goodhue et al., 2012) [70]. Simulation studies have though shown that the differences between CB-SEM and PLS-SEM estimates are at very low levels (Hair et al., 2011)[73]. The extensively discussed PLS-SEM bias is thus often of minor relevance because estimates will be asymptotically correct under consistency at large conditions, i.e. at large sample sizes and large numbers of indicators per latent variable (Hair et al., 2012)[74].

As mentioned above, PLS-SEM rests on no distributional assumptions, at least only on very soft distributional assumptions. There is though one exception hereto, namely the assumption of predictor specification. Predictor specification implies the fulfillment of the equation below (Fornell & Cha, 1994) [58]:

\[ E[y \mid x_1, \ldots, x_k] = \beta_1 x_1 + \ldots + \beta_k x_k \]  

(5.1)

That is, the conditional expectation, i.e. the left hand side of the equation, equals the systematic part of y as given on the righthand side of the equation. This implies that \( E[\varepsilon] = 0 \) and \( \text{Cov}[x, \varepsilon] = 0 \).
5.1.1 PLS-SEM as statistical instrument

Having argued for the choice of PLS-SEM as statistical approach, the following section aims at describing the statistical technique underlying the method.

A PLS model may be decomposed into two components: the structural model, also referred to as the inner-model and the measurement models, referred to as the outer model in the PLS-SEM context.

The figure below represents an example of a PLS-SEM model, providing an overview of the two components and their interrelatedness.

Figure 5.1: Illustration of a PLS-model

With point of departure in the figure above, each of the components of the model will be described consecutively.

5.1.1.1 The structural model (inner model)

The structural model in a PLS-SEM context shows the relationships, i.e. paths, between the latent constructs in the model, corresponding to the theoretical model build up by the hypotheses stated in the literature review. In PLS-SEM, only recursive relationships in the structural model are permitted, implying that causal loops may not be present (Hair et al., 2011)[73].

In the structural model, there is a distinction between exogenous and endogenous latent constructs; exogenous latent constructs do not have any structural path relationships pointing at them, whereas the term endogenous latent constructs refer to constructs that are explained by other constructs via structural model relationships.

In statistical terms, Fornell and Cha (1994)[58] state the relationships of the inner model as below:

\[ \eta = B\eta + \Gamma\xi + \zeta \]  

(5.2)

-where \( \eta \) is a vector of the endogenous latent variables, \( \xi \) is a vector of the exogenous latent variables, \( \zeta \) is a vector of residuals and \( B \) and \( \Gamma \) are the path coefficient matrices.
5.1.1.2 The measurement models (outer model)

In a PLS-SEM context, the measurement models include the unidirectional predictive relationships between each latent construct and its associated observed manifest/indicator variables, corresponding to each question within the questionnaire, which together forms the latent variables. Multiple relations are not permitted and indicator variables are thus associated with only a single latent construct (Hair et al., 2011)[73].

PLS-SEM is able to handle both formative as well as reflective measurement models (Jöreskog & Wold, 1982)[97]. The choice of indicator model relies on the underlying theory of the model and thus the conceptualization of variables (Fornell & Cha, 1994)[58].

Reflective indicators are seen as functions of the latent constructs, and changes in the latent constructs are thus reflected in changes in the manifest variables. The block of manifest variables related to a latent variable is thus assumed to measure a unique underlying concept. In the reflective measurement model, each manifest variable is related to its latent variable by simple linear regression, with each manifest variable individually being the dependent variable and the latent construct the independent variable.

Contrary to reflective indicators, formative indicators are assumed to form a latent construct as a composite and changes in the indicators determine the changes in the value of the latent construct (Hair et al. 2011)[73]. Each manifest variable or each sub-block of manifest variables thus represents a different dimension of the underlying concept. In the formative measurement model, a multiple regression model is estimated with the latent construct as the dependent variable and the assigned indicators as independent variables.

As it in this paper may not be argued that the latent variables are to be fully explained by a specific set of manifest variables, the model in this paper will only be based on reflective relationships.

Statistically, the relationships between the latent variables and the manifest variables in the reflective model are defined as:

\[ y = \Lambda_y \eta + \epsilon_y \quad (5.3) \]

\[ x = \Lambda_x \xi + \epsilon_x \quad (5.4) \]

-where \( \eta \) and \( \xi \) are the endogenous and the exogenous latent variables respectively, \( y \) and \( x \) are the observed indicators (measurement variables) of \( \eta \) and \( \xi \), \( \Lambda_y \) and \( \Lambda_x \) are the given matrices of loadings, relating the latent variables to their measures. Lastly, the \( \epsilon \)'s constitute the measurement errors.
5.1.1.3 Weight relations

In addition to the two relations described above, one more relation is required to complete the PLS-SEM model, the weight relations. In PLS, each case value of the latent variables is estimated by weight relations through an iterative algorithm, as follows (Fornell & Cha, 1994) [58]:

\[
\hat{\eta} = \omega_{\eta} y \\
\hat{\xi} = \omega_{\xi} x
\]  

(5.5)  

(5.6)

-where the \(\omega's\) represent the weights.

The weight relations thus define estimated case-values or scores of the latent variables as weighted means of the manifest variables. It is noticeable that the weights \(\omega_{\eta}\) and \(\omega_{\xi}\) are determined in different ways, depending on the chosen measurement model. In a reflective measurement model, as is the case in this paper, the weights equal the loadings after rescaling, to make the variance of the latent variables equal to one.

5.1.2 The PLS-SEM algorithm

Estimating the PLS-SEM model takes place following the subsequent procedure consisting of two consecutive stages (Hair et al. 2011)[73]:

1. Stage one consists of an iterative estimation procedure, in three steps, with the purpose of estimating the latent construct scores.

2. In the second stage, the final estimates of coefficients, i.e the structural model relationships, are determined using the OLS method for each partial regression in the PLS-SEM model.

The section below provides a concise overview of the two stages.

AD 1. Estimation of the latent construct scores

Estimation of the latent construct scores follows, as described above, a three step procedure. This iterative procedure continues until the sum of the outer weights' changes between two iterations is sufficiently low. In Hair et al. (2011)[73], the recommended limit is a threshold value of \(10^{-5}\) to ensure convergence.

Step 1: Outer estimation/approximation of latent construct scores

In step one, case values of the latent variables’ outer proxies are estimated as weighted means of the indicators according to equation (5.5) or equation (5.6), which is done separately for each block of manifest variables and the related latent variable (Cassel et al., 1999)[20]. As the weights of the respective correlations, \(w_{\eta}\), are unknown, a uniform value of one as the initial value for each of the weights is often employed by software programs, like SmartPLS (Hair et al. 2011)[73].
Step 2: Inner estimation/approximation of latent construct scores
Having estimated the case-values of the latent variables, proxies for the structural model relationships may be computed. In order to estimate these proxies, different weighting schemes may be applied; the path weighting scheme, centroid weighting scheme and factor weighting scheme (Fornell & Cha, 1994)[58]. Hair et al. (2011)[73] recommends applying the path weighting scheme, which uses combinations of regression analysis and bivariate correlations based on the latent construct scores as proxies for the structural model relationships. This technique develops latent construct scores aimed at maximizing the final $R^2$ value estimations of the endogenous latent constructs.

The inner estimations of the latent construct scores are calculated as linear combinations of their respective latent construct outer proxies, calculated in step one, using the inner weights determined from above.

Step 3: Estimation of the outer weights
In step three, the outer weights are calculated. In the case of reflective measurement models, as in this thesis, the correlations between the inner proxy of each latent construct and its associated indicator variables is applied, referred to at the outer loadings.

As mentioned previously, these steps continues until convergence is reached and the latent variables are estimated.

AD 2. Estimation of the structural equations
Once convergence in stage one is reached, stage two seeks to estimate the structural model relations, i.e. the path coefficients, by the use of OLS regression. Despite PLS being able to compute the regression coefficients, PLS does not make use of distributional assumptions, implying that a complimentary analysis is necessary to evaluate the t-statistics and significance levels of the regressions. These t-statistics may be computed by the use of more advanced techniques like blindfolding or resampling techniques such as bootstrapping or jackknifing, of which bootstrapping is recommended as the preferred method according to Tenenhaus et al. (2005)[172] and Hair et al. (2011)[73].

The bootstrap approach represents a nonparametric approach for estimating the precision of the PLS estimates, i.e. the standard errors of the model parameters. Bootstrapping involves repeated random sampling with replacement from the original sample, in order to create a bootstrap sample. The repeated bootstrap parameter estimates are thus used to create an empirical sampling distribution for each model parameter and the distribution’s standard deviation is used as proxy for the empirical standard error of the parameter. The number of bootstrap samples should be high, but must be at least equal to the number of valid observations in the data set (Hair et al., 2013)[75]. The number of resamples have, in accordance with Hair et al. (2013)[75], in this thesis been specified and set to 5.000, in order to ensure reasonable standard error estimates (Hair et al. 2011)[73].

5.1.3 Sample size requirements in PLS-SEM
A general agreement of the applicability of PLS-SEM prevails, when analyzing the relationships between latent variables in minor sample sizes. Despite this agreement, no consistence regarding minimum requirements of the sample size are prevalent either in theory or in past empirical studies.
The most well-known rule of thumb regarding the sample size requirements in PLS-SEM is the “ten times rule of thumb” (Hair et al. 2012)[74]. This rule recommends a minimum sample size of ten times the maximum number of independent variables in the outer model and inner model. This approach is equivalent to using a sample size of ten times the largest number of formative indicators used to measure any construct in the outer model, or ten times the largest number of structural paths directed at a particular latent construct in the inner model. The sample size in this paper consists of 101 observations and the number of latent constructs pointing at the endogenous variable, organizational performance, amounts to six. The sample size in this paper may thus be argued to be sufficiently large according to the rule of thumb.

Some researchers though also argue that this rule of thumb has contributed to a misconception of the universal suitability of PLS-SEM to handle small sample sizes. In Hair et al. (2011)[73] it is pointed out that the rule of thumb does not consider effect size, the total number of indicators, reliability and other issues likely affecting the statistical power of the PLS-SEM method. In continuation hereof, it is appointed that the biasing effects of small sample sizes are likely to be accentuated when data is extremely non-normal. With these data inadequacies, the bootstrapping standard errors may be inflated, thereby reducing the statistical power of the method, i.e underestimating the inner model relationships (Hair et al., 2012)[74]. Supplementary to Hair et al. (2012), Cassel et al. (1999)[20] conducted a simulation study, investigating the robustness properties of the PLS-SEM method in the presence of data inadequacies like skewed distributions for manifest variables and misspecifications of the structural model. Their simulation results were found to be quite robust against these inadequacies, though they found that the bias caused by the inconsistency of PLS estimates, substantially increased for highly skewed distributions.

In addition to the “ten times rule of thumb”, other researchers have likewise addressed the aspect of sample size requirements. In Kristensen and Eskildsen (2005)[110] it is thus argued, that a sample size of 250 is sufficient to ensure a reasonable level of bias of the path coefficients in PLS-SEM.

Acknowledging what is stated above and the general incongruence with regards to sample size requirements in PLS-SEM, possible concerns underlying the sample size and distribution of the data employed in the analysis, will be included when appropriate in the consecutive chapter.
Part IV

Empirical results
Chapter 6

Analysis

The analysis of the survey results is in the following divided into two sections. The first section comprises the quality of the model, focusing on the model’s reliability and validity. This has to be taken into account before interpreting the model estimates, as it provides an indication of the trustworthiness of the model results. The second section covers a conceptual analysis of the survey results, in which the acceptance or rejection of the hypotheses put forward is discussed.

6.1 Statistical analysis

As mentioned in the previous chapter, the PLS-model is decomposed into two components, the measurement model and the structural model. The evaluation of the model will follow a two-step procedure which includes separate evaluations of the measurement- and the structural model. The first step includes an assessment of the reliability and validity of the measurement model, evaluated with point of departure in reflective measurement models, whereas the second step comprises an assessment of the quality of the structural model. The evaluation is divided in two steps, as the latter becomes redundant if the latent variables are not adequately reflected in the manifest variables. It furthermore has to be examined whether the latent variables’ domain may be characterized as unidimensional, as unidimensionality is a premise on which the model is based. The assumption of unidimensionality is therefore to be tested initially (Ismail & Ibrahimpour, 2005)[88].

However, before these steps are carried out, the data must be prepared.

6.1.1 Preliminary data processing

Data examination is important in all types of research but particular important when applying SEM. With first-generation statistical methods, the general assumption is that data is error free. With second-generation statistical methods, the measurement model stage attempts to identify the error component of the data and remove it from the analysis. This underlines the importance of ensuring that the data encompassed in the analysis is as valid and reliable as possible (Hair et al., 2013)[75]. In the following, data issues are thus approached, encompassing an examination of the distribution of data, missing data and non-response bias.
6.1.1.1 Data distribution

PLS-SEM does not require data to be normally distributed. Nevertheless, as described in chapter five, it is important to verify that the data is not too far from normal, as extremely non-normal data prove problematic in the assessment of the parameters' significance. Specifically, extremely non-normal data may inflate the standard errors obtained from bootstrapping and thus decrease the likelihood that some relationships will be assessed as significant (Hair et al., 2013)[75]. The missing value analysis conducted below is furthermore based on the specific distributions underlying the data and an examination thereof is consequently required (SPSS, 2011)[163]. As recommended by Hair et al. (2013)[75], the distribution of data is therefore examined based on the two distributional measures - skewness and kurtosis. A general guideline for skewness proposes that numbers greater than +1 or lower than -1, indicate a considerably skewed distribution. Kurtosis values greater than +1 indicate that the distribution is too peaked, whereas values below -1 indicate a distribution that is too flat. Distributions exhibiting skewness or kurtosis that surpass these levels are thus considered as non-normal (Hair et al., 2013)[75].

The examination of skewness in data indicates left skewed distributions. This implies, as expected, that most respondents have indicated high values on the questionnaire scale. The distributions furthermore demonstrated relatively high levels of kurtosis, implying that the observations are concentrated within a relatively narrow span, confer appendix E (Wooldridge, 2012)[185]. Though PLS-SEM studies are found applicable when data is non-normal, this may still influence the conclusions of the thesis and will as a result thereof be taken into consideration in the further analysis.

6.1.1.2 Missing data

In order to ensure that missing data does not give rise to type I and type II errors, the magnitude and systematization of the missing data is analyzed (Vriens & Sinharay 2006)[183]. The respondents are compelled to reply to all questions in the questionnaire in order to proceed to the next question. As a result thereof, the category of “Don’t know” answers represents the missing values in this thesis. In the data set, 45 missing values were located, equaling 1.32% of the total sample. Consequently, the magnitude does not seem to cause problems, the systematisation in the missing values however has to be taken into consideration as well. When the missing values exhibit no systematisation, they are distributed randomly across the sample, displaying no visible pattern (Tabachnick & Fidell, 2007)[170]. Systematisation in data may for instance occur if a considerable percentage of the respondents refrain from answering a question and as a result thereof, the quality of the question might be questioned. Alternatively, a respondent’s completion of a questionnaire may include numerous missing values, indicating that this person might not be qualified to answer the questionnaire. Hair et al. (2013)[75] recommend to include respondents demonstrating no more than 15% missing values.

None of the questions in the data exhibited a severe high number of missing values, two respondents did however select the “Don’t know” category in more than half of the questions related to Organizational performance. As a consequence thereof, these respondents were omitted from the survey, as explained in section 4.1.3.6. Following this omission, none of the respondents exhibited more than 12% missing values and the percentage of missing values composed 1.02% of the total sample, confer CD appendix E.

The little MCAR-test (Missing Completely At Random) is furthermore employed in order to statistically test whether data is systematised. By use of the data analysis program, SPSS, the null hypothesis, stating that the missing data is not systematised, is tested. This corresponds to postulating that the pos-

---

1 Type I error: The incorrect rejection of a true null hypothesis. Type II error: The failure to reject a false null hypothesis.
sibility of observing some components and not observing others does not depend neither on the observed data nor on the unobserved data (Cordeiro et al., 2010)[30]. The hypothesis is based on assumptions of the distribution underlying the data, which above was found to be left skewed. As the tails of the distribution are longer than those of a normal distribution, it is recommended to choose the procedure which constructs the likelihood function from a Student’s t distribution (SPSS, 2011)[163]. When conducting the test, the null hypothesis cannot be rejected (p-value = 0.125), thus it is presumed that the missing data is not systematised, see CD appendix G. Due to the limited numbers of missing values and the non-systematised data, the missing values can be replaced by an estimate without severely biasing data (Tabachnick & Fidell, 2007)[170].

Methods for substituting missing values have been thoroughly discussed in the literature, however little has been discussed in relation to PLS. Kristensen and Eskildsen (2005)[110] are some of the few testing the methods of handling non-responses in PLS models. In a study evaluating PLS-SEM procedures, a comparison of pairwise deletion, mean substitution, regression based substitution and EM- (Expectation-Maximization) substitution was undertaken. They here found that the regression technique and the EM algorithm outperform the other techniques. However, there is a tendency that the EM algorithm is to be preferred over the regression technique when the fraction of missing values is increasing.

When conducting the EM analysis each iteration consists of an E step and an M step. The E step finds the conditional expectation of the “missing” data, given the observed values and current estimates of the parameters. These expectations are thereafter substituted for the missing data. Second, the M step performs maximum likelihood estimation as though the missing data had been filled in. Finally, after convergence is achieved, the EM variance-covariance matrix is provided and the filled-in data saved in the data set (Hübner & Frohn, 2006)[84].

6.1.1.3 Non-response bias

In the survey, a response rate of 35% was obtained, providing the opportunity for drawing conclusions upon this group of respondents. However, less knowledge exists on the group not returning the questionnaire. It is thus interesting whether these respondents would have replied differently to the questionnaire. The answer hereto will remain unknown, tests on differences between groups may however help indicating whether there is a difference between those returning and not returning the questionnaire. Optimally, it ought to be tested whether large demographic differences are present between the two groups, however this was not possible as no available data base encompassing this information exists. Instead, non-response bias is tested with point of departure in the practice of Kannan et al. (1999)[102], and Ismail & Ebrahimipour (2005)[88]. The returned questionnaires were hence divided into two groups according to those received early (72) and those received late (29). In parallel to the studies of Kannan et al. and Ismail and Ebrahimipour, it was presumed that the questionnaires returned late represented an approximation of non-respondents. The early received questionnaires were specified as those received before launching the first reminder mail, correspondingly the late received questionnaires where specified as the questionnaires received following the first reminder mail. T-tests were conducted, testing the means of the two groups. This revealed no significant difference between the two groups. The analysis thus indicates that there is no evidence of non-response bias in the data and as a result hereof, the sample is considered representative for the population.
6.1.1.4 Descriptive statistics of the final sample

Having obtained a final data set to be employed in the analysis, a brief presentation of the distribution characteristics will be provided. The companies included in the sample are, as earlier stated, comprised of small and medium sized Danish manufacturing companies, all being private and certified with the quality standard, ISO 9001. Of the respondents completing the questionnaire, the majority are classified as quality assurance managers (60%), followed by managing directors (32%), whereas a minor portion of the respondents are classified as production managers (8%). In the below tables, descriptive statistics of the sample distribution across size and industry are provided.

Table 6.1: Observations according to company size

<table>
<thead>
<tr>
<th>Company size (employees)</th>
<th>Observations (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-49</td>
<td>48.5%</td>
</tr>
<tr>
<td>50-99</td>
<td>21.8%</td>
</tr>
<tr>
<td>100-149</td>
<td>10.9%</td>
</tr>
<tr>
<td>150-199</td>
<td>10.9%</td>
</tr>
<tr>
<td>200-249</td>
<td>7.9%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Note: Based on 101 observations

Table 6.2: Observations across industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Observations (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal industry</td>
<td>28.7%</td>
</tr>
<tr>
<td>Plastic-, glass- and concrete industry</td>
<td>13.9%</td>
</tr>
<tr>
<td>Machinery industry</td>
<td>10.9%</td>
</tr>
<tr>
<td>Electronic industry</td>
<td>9.9%</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>8.6%</td>
</tr>
<tr>
<td>Food-, drinking-, and tobacco industry</td>
<td>6.9%</td>
</tr>
<tr>
<td>Other industries</td>
<td>20.8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Note: Based on 101 observations

The companies represent a cross section of the manufacturing industry in terms of size and sub-industries. Small companies represent 49% of the total sample, whereas medium sized companies constitute 51% of the sample. The average number of people employed in the companies is 74 employees, confer CD appendix A. The sub-industries cover among others the metal industry, the plastic-, glass-, and concrete industry, the machinery industry, the electronic industry, the chemical industry and the food-, drinking- and tobacco industry. The metal industry is representing 29% of the sample, whereas the rest of the observations are distributed somewhat evenly across the remaining manufacturing industries.

From above it is presumed that the distribution of company size and industry is relatively evenly distributed in the sample, despite some industries representing a larger portion of the sample. The influence of the distributational characteristics on the results of the statistical analysis will be included in section 6.1.5. covering heterogeneity.
6.1.2 Unidimensionality

It will in the following be examined whether the latent variables are unidimensional, i.e. whether the manifest variables in a block measure the same unique underlying concept (Vinzi et al., 2010)[180].

PLS path modeling is a combination of a priori knowledge and data analysis. When operating with a reflective perspective, the a priori knowledge concerns the unidimensionality of the block and the signs of the loadings. If the data does not fit the model, the problem can be addressed by removing the manifest variables which are most detached from the model (Tenenhaus et al., 2005)[172]. To test for unidimensionality three instruments are available; principal component analysis of the block manifest variables, Cronbach’s $\alpha$ and Dillon–Goldsteins $\rho$, respectively (Tennenhaus et al., 2005)[172].

The unidimensionality will in the following be evaluated on the basis of a principal component analysis for each of the latent variables in accordance with several studies on TQM and performance, see among others Das et al. (2008)[38], Dermibag (2006)[42], Flynn et al. (1993)[56], Salaheldin (2009)[153] and Turkyilmaz et al. (2010)[178]. Dillon–Goldsteins $\rho$, also referred to as composite reliability, will however be included in the statistical analysis when examining the internal consistency in section 6.1.3.1 (Vinzi et al., 2010)[180]. In this section, the omission of Cronbach’s $\alpha$ will furthermore be accounted for.

According to Tenenhaus et al. (2005)[172], a block is characterized as unidimensional when the first eigenvalue of the correlation matrix of the block of manifest variables is above one and the second below one, or at least very far from the first one. If a manifest variable is negatively correlated with the first principal component it is according to Tenenhaus et al. (2005)[172] inadequate to measure the latent variable and as a result hereof an exclusion of the manifest variable is suggested.

When applying the principal component method on each of the latent variables, eigenvalues above one were generated for the first component, whereas the second component displayed eigenvalues below one, see appendix G. As a result hereof, it is considered that each block of manifest variables load on a single latent construct, indicating the presence of unidimensionality, which renders possible the subsequent analyses.

6.1.3 Quality of the measurement models

When evaluating the measurement model, the reliability and validity of the outer model are examined, which may provide an indication of how accurate, i.e. reliable, the measures are as well as an indication of their convergent and discriminant validities (Chin, 2010)[23]. As reflective and formative measurement models are evaluated differently, (Tenenhaus et al., 2005; Hair et al., 2011)[172][73] focus will in the following rest on evaluation of reflective measurement models, due to the model in this paper solely relying on these relationships.

6.1.3.1 Reliability of the measurement models

The reliability of the measurement models is evaluated on the basis of the collective reliability measure, composite reliability, as well as on the basis of each of the manifest variables’ individual reliability. The reliability of the manifest variables may exert a major influence on the results, including standard deviations and fit measures (Kristensen & Eskildsen, 2010)[111]. As a result hereof, the reliability is in the following examined thoroughly.
Composite reliability

Composite reliability developed by Werts, Linn, and Jöreskog (1974) is a measure of the internal consistency which is especially suitable for PLS-SEM based studies. This is due to the fact that PLS-SEM prioritises manifest variables according to their reliability during model estimation, opposite Cronbach’s $\alpha$ which assumes that all indicators are equally reliable (Hair et al., 2011). While Cronbach’s $\alpha$ tends to be a lower bound estimate of reliability, composite reliability is a closer approximation under the assumption that the parameter estimates are accurate (Chin, 2010). Below, the composite reliability measure is outlined, where $\lambda_i$ represents the standardized loadings between the latent variable and the $i^{th}$ manifest variable and $\Theta_i$ represents the error variance of the same manifest variable ($1 - \lambda_i^2$) (Götz et al., 2010).

$$p_c = \frac{\left(\sum_{i=1}^{p} \lambda_i \right)^2}{\left(\sum_{i=1}^{p} \lambda_i \right)^2 + \sum_{i=1}^{p} \Theta_i}$$ (6.1)

Nunnally and Bernstein (1994) argue that composite reliability values of 0.60 to 0.70 are regarded as acceptable in explorative research, whereas values below 0.60 according to Hair et al. (2011) indicate a lack of reliability. Nunnally and Bernstein furthermore advocate that values of 0.70 to 0.90 are demanded in more advanced stages of research.

In the table below, the composite reliability values of each of the constructs in the model are represented.

<table>
<thead>
<tr>
<th>Latent variable</th>
<th>Composite reliability value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management commitment</td>
<td>0.945</td>
</tr>
<tr>
<td>Supplier quality management</td>
<td>0.889</td>
</tr>
<tr>
<td>People management</td>
<td>0.914</td>
</tr>
<tr>
<td>Customer focus</td>
<td>0.921</td>
</tr>
<tr>
<td>Process management</td>
<td>0.897</td>
</tr>
<tr>
<td>Quality data &amp; reporting</td>
<td>0.887</td>
</tr>
<tr>
<td>Organizational performance</td>
<td>0.880</td>
</tr>
</tbody>
</table>

As it may be seen from the above table, composite reliability values are ranging from 0.880 to 0.945 and as a result hereof the internal reliability of the latent variables is considered satisfactory.

Loading reliability

In addition to assessing the collective reliability, the reliability of each of the manifest variables must be assessed by means of the individual correlations between the manifest variables and their theoretically associated latent variable. An adequate correlation between the manifest variables and the respective latent construct is important in order to ensure that the latent construct is reflected in the manifest variables. The reliability of the individual manifest variables is evaluated on the basis of how much each of the manifest variables load on the latent constructs (Hair, 2011). In the PLS-SEM literature, disagreement concerning the appropriate minimum level of manifest variables’ loadings on their respective latent variable is prevalent. Sarkar et al., (2001) argue, that in order to be considered for further
analyses, loadings should approach or exceed 0.70, whereas Hulland (1999)[83] deem values above 0.40 or 0.50 as appropriate. In parallel to Sarkar et al., Chin (1998)[22] argues that the loading optimally should exceed 0.70. In addition hereto, Hair et al. (2011)[73] recommend that manifest variables with loadings between 0.40 and 0.70 should only be considered for removal if this omission results in an increased composite reliability and additionally no loss of validity. Nevertheless, according to Hair et al. (2011)[73], manifest variables with loadings below 0.40 should always be eliminated from reflective scales, as the correlations might be subscribed to coincidences instead of true identifiable relations.

Three manifest variables displayed loadings below 0.70. Those were Quality data & reporting3, Customer focus1, Customer focus2 and Processes management2, respectively, confer appendix H. The variable, Quality data & reporting3 exhibited the lowest loadings and was consequently examined initially. Quality data & reporting3 concerns the use of quality data when evaluating employees and/or management. The variable is excluded from the model as it is presumed that the omission of the variable will not severely damage the content validity. This is based on the assessment that the other manifest variables included in the construct, Quality Data & Reporting, will be able to capture a reasonable part of the conceptual content encompassed in the construct. Following the exclusion of the variable the composite reliability, covered above, rose from 0.887 to 0.919, confer appendix J. Subsequently, Customer focus1, referring to the extent to which the companies request customer feedback on the product quality, exhibited the lowest loading. Customer focus1 was excluded based on a combined argumentation provided below and the PLS algorithm was carried out once more. Customer focus2, referring to the processes related to evaluation of customer satisfaction, consecutively exhibited a loading below 0.70 and was consequently examined. Initially, seven manifest variables composed the construct, Customer focus, and it is assessed that the omission of the two variables will not decrease the content validity severely. It is considered that the other variables are able to capture a reasonable part of the conceptual content encompassed in the variables, Customer focus1 and Customers focus2. The deletion of the variables furthermore resulted in an increased composite reliability of the latent construct, Customer focus, confer appendix J. Finally, the variable Process management2, referring to the continual usage of internal or external quality audits, is excluded from the model. This concept is likewise argued to be partly covered by the other variables. As a result of this omission, the composite reliability of Process management likewise increased from 0.897 to 0.913, confer appendix J. Following the omission of the above mentioned manifest variables, the individual correlations between the manifest variables and their theoretically associated latent variable are all above 0.70. The individual reliability related to the manifest variables is thus considered to be satisfactory, confer appendix H and J for loading values and composite reliability scores, before and after exclusion of variables.

6.1.3.2 Validity of the measurement models

In order to assess the quality of the measurement models, the validity of the model is furthermore subject to examination. When operating with reflective measurement models, the validity is primarily assessed with point of departure in the measures of convergent validity and discriminant validity (Hair et al., 2011; Chin, 2010; Hulland, 1999)[73][23][83].

Convergent validity
When a latent variable explains a sufficient part of the variance of the related manifest variables, convergent validity is argued to be present (Hair et al., 2011; Gefen, 2005)[73][66].
Chapter 6. Analysis

In order to evaluate convergent validity, the average variance extracted (AVE) is examined, which is a measure of the variance that a latent variable captures from its associated manifest variables relative to the total amount of variance, including the variance due to measurement error (Chin, 2010)[23].

\[
AVE = \frac{\sum_{i=1}^{p} \lambda_i^2}{\sum_{i=1}^{p} (\lambda_i^2 + \Theta_i)}
\]

(6.2)

-where \(\lambda_i\) represents the systematical variation, i.e. the variation shared with the the latent variable in the ith manifest variable, and \(\Theta_i\) represents the error variance of the same manifest variable \((1 - \lambda_i)\) (Götz et al., 2010)[72]. When all the manifest variables are standardized, it is equivalent to the average of the communalities in each block denoted as block communalities (Fornell & Cha, 1994)[58]. An AVE value of 0.50 is required in order to demonstrate a sufficient degree of convergent validity (Hair et al., 2011; Chin, 2010; Götz et al., 2010; Fornell and Larcker, 1981)[73][23][72][59]. At a level above 0.50, the latent variable explains more than half of its manifest variables’ variance. At this level it may be argued that the variation is not coincidental, i.e. error variance, and a “true” relation between the manifest variables and the latent variable may thus be argued to exist (Hair et al., 2011)[73].

In the table below, AVE measures of each construct encompassed in the model, are represented.

<table>
<thead>
<tr>
<th>Latent variable</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management commitment</td>
<td>0.742</td>
</tr>
<tr>
<td>Supplier quality management</td>
<td>0.616</td>
</tr>
<tr>
<td>People management</td>
<td>0.681</td>
</tr>
<tr>
<td>Customer focus</td>
<td>0.711</td>
</tr>
<tr>
<td>Process management</td>
<td>0.777</td>
</tr>
<tr>
<td>Quality data &amp; reporting</td>
<td>0.792</td>
</tr>
<tr>
<td>Organizational performance</td>
<td>0.596</td>
</tr>
</tbody>
</table>

As can be seen from the table above, the AVE measures of the model constructs are all above 0.50, ranging from 0.596 to 0.792. As a result hereof it may be argued that the latent variables explain a sufficient part of the variance of their related manifest variables and convergent validity is thus argued to be present.

**Discriminant validity**

The discriminant validity is evaluated on the basis of the Fornell-Larckers criterium (Fornell and Larcker, 1981)[59]. If a construct is more correlated with another construct than with its own manifest variables, there is a possibility that the two constructs share the same types of measures and are not conceptually distinct. Alternatively, it indicates that the two set of items cannot discriminate or differentiate the two underlying concepts hypothesized (Chin, 2010)[23]. The discriminant validity will be examined with point of departure in AVE and the correlation between the latent constructs. In the literature, the methods for measuring discriminant validity are diverging. Most researchers examine discriminant validity based on the assumption that the squared root of AVE of the latent constructs should exceed the latent construct’s highest correlation with any of the other constructs, confer among others Temme et al. (2010)[174], Duarte and Raposo (2010)[47], Ruiz et al. (2010)[151], Streukens et al. (2010)[167], Boßow-Thies and Albers...
Chapter 6. Analysis

(2010)\[14\]. Discriminant validity has additionally been evaluated based on the assumption that AVE should exceed the latent constructs’ highest squared correlation, confer Hair et al. (2011)\[73\] and Chin (2010)\[23\]. These two methods are equivalent, Chin (2010)\[23\] however advocates that the latter method possesses the advantages of providing a more intuitive interpretation as it represents the percentage overlap, i.e. shared variance, among constructs and constructs to the manifest variables, and as it tends to be easier to distinguish the difference.

When evaluating discriminant validity with point of departure in the latter method, the AVE values are greater than the associated latent constructs’ highest squared correlation to the remaining latent variables. The same results are in evidence when applying the first method, confer CD appendix Q. In the table below, AVE values of the latent variables are represented along with the squared correlations to the other latent variables.

Table 6.5: AVE compared to the squared correlations

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management com.</td>
<td>0.742</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplier quality man.</td>
<td>0.616</td>
<td>0.457</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>People man.</td>
<td>0.681</td>
<td>0.537</td>
<td>0.339</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer focus</td>
<td>0.711</td>
<td>0.503</td>
<td>0.475</td>
<td>0.480</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process man.</td>
<td>0.777</td>
<td>0.449</td>
<td>0.489</td>
<td>0.596</td>
<td>0.531</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality data &amp; rep.</td>
<td>0.792</td>
<td>0.507</td>
<td>0.275</td>
<td>0.407</td>
<td>0.547</td>
<td>0.468</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Organizational perf.</td>
<td>0.596</td>
<td>0.407</td>
<td>0.358</td>
<td>0.333</td>
<td>0.501</td>
<td>0.373</td>
<td>0.336</td>
<td>1</td>
</tr>
</tbody>
</table>

The above represented comparisons thus indicate that each latent construct shares more variance with its assigned manifest variables compared to any other latent variable in the model. As a result hereof, the level of discriminant validity is considered satisfactory.

Hair et al. (2011)\[73\], Chin (2010)\[23\] and Gefen (2005)\[66\] put forward yet another way of examining the discriminant validity. The discriminant validity may furthermore be evaluated on the basis of the manifest variables’ loadings on their theoretically associated latent constructs, i.e. the item loadings, which must be higher than their loadings with the remaining constructs, i.e. the cross loadings.

When assessing the cross loadings it was found that the variable, People management1, measuring the degree to which employees participate in quality decisions, correlates slightly higher with the latent construct, Process management, compared to its theoretically associated construct, People management. As a result hereof, it has been chosen to exclude the variable, People management1. Furthermore, People management1 is argued to be partly covered by other variables such as People management5, measuring the quality focus among employees. Following the exclusion of People management1, the AVE measure related to People management increased from 0.681 to 0.735 indicating an increased discriminant validity. All manifest variables’ loadings on their associated latent constructs are now higher than their loadings with the remaining constructs, consequently indicating an acceptable level of discriminant validity, confer CD appendix N. A considerable portion of the cross loadings are however relatively high, indicating that the manifest variables’ degree of unique attachment to their respective constructs may be questionable.
According to Ahire et al. (1996)[6], high cross correlations are however not uncommon in holistic management studies. In addition hereto they emphasize, that it underpins the synergy between TQM practices and the importance of employing a holistic approach when implementing TQM.

6.1.4 Quality of the structural model

Having evaluated the quality of the measurement models, the focus of the following analysis will concentrate on the structural model. The structural model consists of the relations between the latent variables encompassed in the model and thus provide evidence confirming or rejecting the proposed hypotheses in the thesis. Three criteria are applied in order to evaluate the inner model. The first criterion concerns the predictive power of the model, which is assessed on the basis of $R^2$, accounting for the variance explained. The second criterion represents effect size, measuring the impact of the exogenous variables on the endogenous variable. The last criterion is the Stone Geisser’s Q² measure of predictive relevance. Before these measures are examined, the structural model must however be examined for collinearity.

Collinearity Assessment

Collinearity is assessed initially, as the estimation of path coefficients in the structural model is based on OLS regressions of each endogenous latent variable on its corresponding predecessor constructs. Similarly to a regular multiple regression, the path coefficients might be biased if the estimation involves significant levels of collinearity among the exogenous constructs (Hair et al. 2013)[75]. When variables are strongly connected, it may be difficult to separate unique effects from one another, which can be reflected in high standard deviations. As a result hereof, even strong relations may appear insignificant (Wooldridge, 2012)[185]. In order to assess collinearity, VIF values are examined for each set of exogenous variables pointing at an endogenous variable. In this thesis there is only one set of exogenous variables containing six variables. In accordance with Hair et al. (2013)[75], VIF values above 5.00 in the exogenous constructs are generally considered as an indication of collinearity (O’Brien, 2007)[141]. If Collinearity is prevalent, one may consequently consider to eliminate constructs, merging exogenous variables into a single construct, or creating higher order constructs to treat collinearity problems (Hair et al., 2013)[75]. In order to obtain VIF values, the latent variable scores are extracted from SmartPLS and applied in SPSS in which the analysis is conducted. The generated VIF values of the exogenous variables are provided below as well as in appendix N.

Table 6.6: VIF values of the exogenous variables

<table>
<thead>
<tr>
<th>Latent variables</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management com.</td>
<td>3.732</td>
</tr>
<tr>
<td>Supplier quality man.</td>
<td>2.398</td>
</tr>
<tr>
<td>People man.</td>
<td>2.068</td>
</tr>
<tr>
<td>Customer focus</td>
<td>3.256</td>
</tr>
<tr>
<td>Process man.</td>
<td>3.821</td>
</tr>
<tr>
<td>Quality data &amp; rep.</td>
<td>2.727</td>
</tr>
</tbody>
</table>

With point of departure in the above table it is considered that collinearity does not constitute a severe problem in this thesis. All VIF values of the exogenous variables are below 5.00, however some collinearity still exists which may imply that weak significant relations are not detected in the model encompassing
Chapter 6. Analysis

all six constructs. Some collinearity was though expected due to the correlation among critical success factors encompassed in the holistic TQM concept.

Coefficient of determination
In PLS, $R^2$ represents the amount of variance in a specific endogenous latent construct that is explained by the exogenous latent variables pointing at this construct, which is in parallel to its counterpart in OLS regression (Chin, 2010)[23]. Due to the prediction-oriented nature of PLS-SEM, focus rests on maximizing the explained variance in the dependent construct (Chin & Dibbern, 2010)[24]. The acceptable level of $R^2$ however varies in accordance to the type of research discipline undertaken. According to Hair et al. (2011)[73] $R^2$ values of 0.20 are considered high in consumer behavior studies whereas $R^2$ values of 0.75 would be perceived as high in success driver studies. Additionally, in marketing research, $R^2$ values of 0.75, 0.50, or 0.25 for endogenous latent variables are as a rule of thumb characterized as substantial, moderate, or weak, respectively (Hair, 2011)[73].

The single $R^2$ generated in this paper resulted in a value of 0.548, indicating that the six independent constructs are capable of explaining 54.8% of the variance in the dependent variable, Organizational performance. The adjusted $R^2$, which will be used for later comparisons between models, equals 0.519, see appendix O. The $R^2$ level is considered satisfactory when evaluated with reference to the study’s objective of examining the influence of TQM practices on organizational performance and when comparing to similar PLS-SEM studies. As explained in the introduction, a limited number of studies applying a PLS-SEM approach have examined the influence of TQM practices on organizational performance. One may confer Turkyilmaz et al. (2010)[178] who find $R^2$ values ranging from 0.32 to 0.56 as satisfactory. However, one should bear in mind that these $R^2$ values are not adjusted.

Effect size
Besides evaluating $R^2$ values of the endogenous construct, the change in $R^2$, following an omission of a specified exogenous construct from the model, can be applied to evaluate whether the omitted construct has a considerable impact on the endogenous constructs. This measure is referred to as the $f^2$ effect size and is calculated as follows:

$$f^2 = \frac{R^2_{\text{included}} - R^2_{\text{excluded}}}{1 - R^2_{\text{included}}}$$

(6.3)

-where $R^2_{\text{included}}$ and $R^2_{\text{excluded}}$ are the values of $R^2$ for the endogenous latent variable when a designated exogenous latent variable is included in the model and excluded from the model, respectively. The change in $R^2$ is calculated by estimating the PLS path model including all constructs and alternating excluding an exogenous construct from the model. According to Cohen (1988)[26], $f^2$ effect size values of 0.02, 0.15 and 0.35, represent small, medium and large effects of the exogenous variable, respectively.

$R_{adj}^2 = 1 - (1 - R^2) \times \frac{n-1}{n-k-1}$

2
Below the $f^2$ effect size of each of the exogenous variables on Organizational performance is displayed.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$R^2$ included</td>
<td>0.548</td>
<td>0.548</td>
<td>0.548</td>
<td>0.548</td>
<td>0.548</td>
<td>0.548</td>
</tr>
<tr>
<td>$R^2$ excluded</td>
<td>0.540</td>
<td>0.538</td>
<td>0.546</td>
<td>0.496</td>
<td>0.548</td>
<td>0.547</td>
</tr>
<tr>
<td>Effect size</td>
<td>0.018</td>
<td>0.021</td>
<td>0.003</td>
<td>0.114</td>
<td>0.000</td>
<td>0.001</td>
</tr>
</tbody>
</table>

As can be seen from the table, Customer focus is demonstrating the largest effect size of 0.114 which, in accordance to the above levels, may be characterized as a medium effect. All of the remaining constructs are demonstrating rather low effect sizes.

**Path coefficients**

Having examined the explanatory power of the model, the significance of the inner model path coefficients must be assessed. The single path coefficients are to be interpreted as the standardized beta coefficients in ordinary least squares regressions and consequently, the signs indicate whether a positive or negative relation exists (Hair et al., 2011; Henseler & Fassott, 2010; Tenenhaus et al. 2005)[73] [81] [172]. In the study by Salaheldin (2009)[153], investigating the influence of TQM practices on organizational performance, it is argued that standardized path coefficients with absolute values of less than 0.10 are to be interpreted as small effects, values around 0.30 as medium effects and lastly values of 0.50 and above imply large effects.

As explained in chapter five, PLS applies a bootstrapping procedure which enables the estimated coefficients in PLS-SEM to be tested for their significance. A two-tailed test is applied in which the null hypothesis states that a coefficient equals zero (Hair et al., 2011) [73].

In the table below, the path coefficients as well as their respective t-values are provided.

<table>
<thead>
<tr>
<th>Structural relations</th>
<th>Path coefficients</th>
<th>t-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management commit</td>
<td>→ Org. performance</td>
<td>0.190</td>
</tr>
<tr>
<td>Supplier quality management</td>
<td>→ Org. performance</td>
<td>0.133</td>
</tr>
<tr>
<td>People management</td>
<td>→ Org. performance</td>
<td>0.056</td>
</tr>
<tr>
<td>Customer focus</td>
<td>→ Org. performance</td>
<td>0.434**</td>
</tr>
<tr>
<td>Process management</td>
<td>→ Org. performance</td>
<td>-0.008</td>
</tr>
<tr>
<td>Quality data &amp; reporting</td>
<td>→ Org. performance</td>
<td>0.028</td>
</tr>
</tbody>
</table>

* $P < 0.05$, ** $P < 0.001$

The table illustrates that only one of the theoretically developed paths is significant at a 1% significance level, assessed against a critical value of 2.576. None of the remaining variables are significant at a 10% significance level.³ This might be partly ascribed to skewed data as well as a relatively small sample size.

³The t-distribution is argued to be reasonably approximated to by the normal (Gaussian) distribution for more than 30 observations (Hair et al., 2013)[75]. As a result hereof the Gaussian quantiles are applied to determine critical t-values (or theoretical t-values) for significance testing. The critical t-values for significance levels of 10%, 5%, 1% (Two-tailed test) probability error are thus 1.645, 1.960, 2.576, respectively.
As explained in chapter five, small sample sizes may induce biasing effects which can be accentuated when data is non-normal. With these data inadequacies, the bootstrapping standard errors may be inflated, thereby reducing the statistical power, i.e. underestimating the inner model relationships. This will consequently be elaborated upon in the subsequent interpretation of the results.

The deletion of insignificant relations follows the procedure of backwards elimination, removing the least significant relationship first, until all remaining relationships are significant at the prespecified significance level. The exogenous construct demonstrating the least significant relation with Organizational performance is thus excluded from the model and the bootstrapping procedure is conducted again. This procedure is repeated until the relations encompassed in the model are significant at a 10% significance level. Initially, the exogenous latent variable, Process management, demonstrating an extremely low t-value, is omitted from the model. Secondly, Quality data & reporting is excluded displaying a t-value of 0.213 and thirdly the variable, People management, with a t-value of 0.581 is omitted. Following the exclusion of the above mentioned variables, Supplier quality management, with a t-value of 1.321, was likewise unable to be included in the model. The t-values of the excluded variables as well as the path coefficients for each consecutive stage of the elimination procedure, are outlined in appendix Q and R, respectively. Left with the exogenous constructs, Customer focus and Top management commitment, each of the variables' relation to Organizational performance is significant at a 1% significance level. Both Customer focus and Top management commitment are thus exhibiting significant relations to Organizational performance following the omission of the insignificant variables, compared to only Customer focus in the original model. As the omission of variables gave rise to an increased t-value of Top management commitment, it may be argued that a certain degree of cohesion exists among the exogenous variables, as it was expected. Path coefficients and their respective t-values are outlined below.

Table 6.9: Path coefficients and t-values for structural relations in the final model

<table>
<thead>
<tr>
<th>Structural relations</th>
<th>Path coefficients</th>
<th>t-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top management commitment → Organizational performance</td>
<td>0.273</td>
<td>2.840**</td>
</tr>
<tr>
<td>Customer focus → Organizational performance</td>
<td>0.512</td>
<td>3.914**</td>
</tr>
</tbody>
</table>

*P < 0.05, **P < 0.001

As it can be seen from the table, Customer focus which was demonstrating the highest effect size $f^2$ is also exhibiting the highest path coefficient of 0.512, whereas Top management commitment is showing a path coefficient of 0.273.

All of the above tests covering reliability, validity and explanatory power are reproduced for the new model comprising the constructs; Customer focus, Top management commitment and Organizational performance. The reliability and validity of the measurement models is once again satisfactory, including composite reliability and loading coefficients as well as convergent and discriminant validity, confer appendix J, H, K, M and CD appendix N, respectively.

The collinearity indicator, VIF, of the two exogenous constructs have decreased following the omission of the insignificant variables, confer appendix N. The explanatory power of the model measured by $R^2$ is 0.536, whereas the adjusted $R^2$ is 0.526, confer appendix O. It is thus found that the two constructs, Customer focus and Top management commitment, are capable of explaining the same amount of variation in the endogenous variable, Organizational performance, compared to the full model containing all six constructs. No explanatory power is thus lost at the expense of exclusion of insignificant variables.
when examining the adjusted $R^2$. When examining the effect size $f^2$ of the reduced new model, Customer focus exhibits an $f^2$ value of 0.277 whereas the value of Top management commitment is 0.079, confer appendix P.

**Predictive relevance**

The predictive relevance is, as above mentioned, evaluated on the basis of the non-parametric Stone–Geisser’s test (Geisser 1974; Stone 1974)[65][166], which measures how well the data collected empirically can be reconstructed with the help of the model and PLS parameters (Fornell & Cha, 1994)[58].

The Stone-Geisser’s $Q^2$ value is obtained by applying the so-called blindfolding procedure for a certain omission distance $d$. Blindfolding is a sample reuse technique which omits every $d$th data point in the endogenous construct’s indicators and estimates the parameters by use of the remaining data points (Chin, 1998; Tenenhaus et al., 2005) [22] [172]. The omitted data points are considered as missing values and treated accordingly, when running the PLS-SEM algorithm. The resulting estimates are hereafter applied to predict the omitted data points. The difference between the true, i.e. omitted, data points and the predicted ones is then used as input for the $Q^2$ measure. The blindfolding procedure is only applied to endogenous constructs that have a reflective measurement model specification as well as to endogenous single-item constructs (Hair et al., 2013)[75]. The omission distance, $d$, between observations must be chosen so that the number of valid observations divided by $d$ is not an integer, in order to avoid omitting the same set of observations. Research has furthermore shown that $d$-values between five and 10 are preferable (Hair et al., 2013)[75]. The measure of $Q^2$ is provided in two forms, the cross-validated redundancy and the cross-validated communality. Hair et al. (2011)[73] recommend to use the cross-validated redundancy which, unlike the cross-validated communality, makes use of the PLS-SEM estimates of both the structural model and the measurement models for data prediction, and thus fits the PLS-SEM approach (Hair et al., 2011)[73]. The sum of the squared observations (SSO) as well as the squared prediction errors (SSE) are used for the estimation of the predictive relevance, $Q^2$, which is calculated as $1 - \text{SSE}/\text{SSO}$. Values larger than zero for a certain reflective endogenous latent variable indicate the path model’s predictive relevance for this particular construct. For values below zero, the model cannot be granted predictive relevance (Chin, 1998; Fornell & Cha, 1994)[23][58].

As the sample in this paper consists of 101 respondents, $d$ has been set equal to seven. When generating the test, the measure of cross-validated redundancy for the endogenous variable, Organizational performance is 0.314 and thus above zero, confer appendix S. This implies that the exogenous latent variables Top management commitment and Customer focus exhibit predictive relevance.

### 6.1.5 Modeling heterogeneity

Cause-effect relationships in PLS path models imply that exogenous latent variables directly affect endogenous latent variables without any systematic influences of other underlying variables. This assumption may however not hold, as respondents across two or more groups are likely to be heterogeneous in their perceptions and evaluations of latent variables, yielding significant differences in path coefficients across groups. In continuation of the analysis conducted above, it appears interesting to explore potential differences in path coefficients, between small and medium-sized organizations. The purpose of the following is thus to investigate whether heterogeneity is present in the submitted responses from small and medium sized organizations. In accordance with the European Comission[51] and what has been described earlier,
small companies are defined as those employing 10-49 employees whereas medium sized organizations are defined as constituting 50-249 employees.

A multigroup analysis is conducted to compare parameters, i.e. path coefficients, between the two groups of data. Hair et al. (2013)[75] recommend to employ a modified version of a two-independent-samples t test, to compare path coefficients between the two groups. When executing the test, the standard PLS path modeling algorithm is conducted for each of the two groups, followed by the bootstrapping procedure in order to obtain the standard errors of the group-specific parameter estimates (Sarstedt et al., 2011)[158].

The choice of test statistic depends on whether the parameter estimates’ standard errors differ significantly across the groups, which may be assessed by means of Levene’s test. Applying Levene’s test for both paths, i.e. between Customer focus and Organizational performance and Top management commitment and Organizational performance, reveals no significant difference in the standard errors of the two groups. Calculations of Levene’s tests are provided in CD appendix U.

Given that the standard errors are found to be equal, the empirical test statistics is calculated as follows:

\[
\frac{|p^{(1)} - p^{(2)}|}{\sqrt{\frac{(n^{(1)}-1)^2}{(n^{(1)}+n^{(2)}-2)} \times \text{se}(p^{(1)})^2 + \frac{(n^{(2)}-1)^2}{(n^{(1)}+n^{(2)}-2)} \times \text{se}(p^{(2)})^2} + \sqrt{\frac{1}{n^{(1)}+1} + \frac{1}{n^{(2)}}}}}
\]  

- where \(p^{(1)}\) and \(p^{(2)}\) are the path coefficients of Group 1, consisting af small firms, and Group 2, medium sized firms, respectively. \(\text{se}(p^{(1)})\) and \(\text{se}(p^{(2)})\) denote the standard errors of the parameter estimates of Group 1 and Group 2 respectively. Lastly, \(n^{(1)}\) and \(n^{(2)}\) denote the number of observations in Group 1 and Group 2.

In order to reject the null hypothesis of equal path coefficients, the empirical t value must be larger than the critical value from a t distribution with \(n^{(1)} + n^{(2)} - 2\) degrees of freedom.

Investigating possible differences in the two path coefficients, i.e. between Customer focus and Organizational performance as well as Top management commitment and Organizational performance, across the two groups, no statistically significant differences are found. These findings thus imply, that there is no significant difference in the effect of Customer focus on organizational performance between small and medium sized organizations. The same is in evidence with Top management commitment.

An overview of input parameters is provided in appendix T, while calculations of the test statistics and critical value are found in CD appendix U.

A clear drawback of the above described test statistic is the assumption that the data follows a normal distribution, which is inconsistent with the distribution-free character of the PLS-SEM approach (Hair et al. 2013)[75]. New and more comprehensive approaches for PLS Multigroup analysis have recently been under development, among others by Sarstedt et al. (2011)[158]. These methods are however not yet available in software packages, which is why focus relies on the parametric approach, consistent with Hair et al. (2013)[75]. In continuation hereof, Sarstedt et al. (2011)[158] have likewise outlined a technique to compare more than two groups, parallel to the concept of an F test in regression. As between small and medium sized companies, heterogeneity and thus differences in path coefficients may likewise be present across industries. According to Hair et al. (2013)[75], one needs to ensure that the number of observations in each group meets the rules of thumb for minimum sample size requirements, as explained in section 5.1.3. Due to the vastly low number of respondents within the different industries, confer section 6.1.1.4,
it was however not possible to compare group of respondents across industries.
This sample size requirement was nearly fulfilled in the above analysis, covering company size, it was
however chosen to conduct the analysis, as the threshold value was nearly reached.

6.1.6 Overall model fit

Opposed to CB-SEM models, there is a lack of global goodness-of-fit measures for PLS-SEM models.
This aspect is traditionally considered as a major drawback of PLS-SEM (Hair et al., 2012)[74]. As
a result hereof, PLS-SEM based studies rely to a large extent on the previously mentioned measures
indicating the model's predictive abilities to judge the quality of the structural model, such as \( R^2 \) and
the Stone–Geisser's test (Hair et al., 2012)[74].

The Goodness of Fit measure (GoF) however, is an often applied operational solution to the missing
criteria when validating overall PLS-SEM models (Tenenhaus et al., 2005; Chin 2010)[172][23]. GoF
takes on values between zero and one and is defined as the geometric mean of the average communality
index multiplied by the mean of \( R^2 \):

\[
GoF = \sqrt{\text{Communality} \times \overline{R^2}}
\]

(6.5)

The GoF index has been developed in order to cover the model performance of both the structural model
and the measurement models. It thus provides a single measure for the overall prediction performance
of the model (Vinzi et al., 2010)[180]. The communality index is estimated as the average of the squared
correlations in a given block and consequently, it measures how much of the manifest variables’ variability,
which is explained by their corresponding latent variables. The average communality index is thus the
average of all the squared correlations between each manifest variable and their respective latent variables
in the model (Vinzi et al., 2010)[180]. As a result hereof, GoF can be interpreted as the average variance
in the variables explained by the global model (Tenenhaus et al., 2005)[172].

The GoF index has been substantially applied in PLS-SEM studies (Chin, 2010; Duarte & Raposso,
2010)[23][47], however, the index has recently encountered critique. Henseler and Sarstedt (2013)[80]
argue that GoF is not suitable for model validation as it is incapable of separating valid models from
invalid ones. With references to Henseler and Sarstedt, Hair et al. (2012)[74] furthermore recommend
not to make use of the measure. Due to limited follow up research and due to the comprehensive usage
of the GoF measure in PLS-SEM based studies, the measure is taken into consideration in spite of the
above critique.

When calculating the GoF measure it results in a value of 0.605\(^4\), meaning that the model is able to
take into account 60.5% of the achievable fit (Tenenhaus et al. 2004)[173]. No general criterion for an
acceptable GoF value is established, however, with references to the discussion of acceptable \( R^2 \) values
above, the GoF value is considered satisfactory.

Below, the final model is visualized, displaying the significant relations identified between the exogenous
latent variables, Top management commitment and Customer focus, and the endogenous latent variable,

\(^4GoF = \sqrt{0.683 \times 0.536}.\) For additional calculations, confer appendix U.
Organizational performance. The path coefficients as well as their associated significance level are provided, along the arrows connecting the exogenous variables to the endogenous variable. The loadings of the manifest variables are listed in the brackets next to their respective manifest variables. Finally, selected quality measures of the final model are provided beneath the illustration.

Figure 6.1: Final model encompassing the identified significant structural relations

Having examined the quality of the measurement models, the structural model and the overall model, the subsequent analysis will provide a comprehensive interpretation and discussion of the above identified relations.
6.2 Interpretations of results

With point of departure in the statistical analysis above, in which the quality of the model was evaluated and validated, the empirical results are analysed by assessing these in relation with the hypotheses put forward in this paper.

The model applied has sought to identify the direct effects of TQM practices on organizational performance. In the figure below, the model and the associated relations tested by the hypotheses proposed in the thesis, are illustrated.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Results</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1  Top management commitment is positively related to organizational performance</td>
<td>Accepted</td>
<td>**</td>
</tr>
<tr>
<td>H2  Supplier quality management is positively related to organizational performance</td>
<td>Rejected</td>
<td></td>
</tr>
<tr>
<td>H3  People management is positively related to organizational performance</td>
<td>Rejected</td>
<td></td>
</tr>
<tr>
<td>H4  Customer focus is positively related to organizational performance</td>
<td>Accepted</td>
<td>**</td>
</tr>
<tr>
<td>H5  Process management is positively related to organizational performance</td>
<td>Rejected</td>
<td></td>
</tr>
<tr>
<td>H6  Quality data and reporting is positively related to organizational performance</td>
<td>Rejected</td>
<td></td>
</tr>
</tbody>
</table>

Overall, several of the relations proposed in the model may be documented, despite only two of the relations being statistically significant. In the following, the significant relations will be discussed thoroughly. This will be followed by a discussion of the relations that could not be significantly documented in the analysis.

6.2.1 Significant relations

As the analysis disclosed, two statistically significant and positive relationships were confirmed in the final model - the influence of Customer focus and Top management commitment on Organizational performance. Below, an assessment of each significant relationship will be provided, including the implications of the empirical findings.

6.2.1.1 Customer focus and Organizational performance

In the statistical analysis, the strongest relationship, displaying a path coefficient of 0.512, was found between Customer focus and Organizational performance. Clear supportance of hypothesis H4 has therefore been documented, with a significance level of 1%. The relative importance of the exogenous variable, Customer focus, in predicting the endogenous variable, Organizational performance, is thus fairly high, compared to the predictive capabilities of the exogenous variable Top management commitment. Likewise, as documented in the statistical analysis, all of the manifest variables attached to the exogenous variable Customer focus exhibit fairly high and similar loadings hereon, and will thus be included in the following assessment.

Given the extensive focus on the importance of customer focus and customer satisfaction throughout the literature of TQM, it comes as no surprise that a significant and positive relationship between Customer focus and Organizational performance was found.
As provided and discussed in the literature review, several researchers have argued that an unambiguous link between TQM as a philosophy and the fulfillment of customer expectations and requirements is prevalent. Customer focus is thus considered a major driver of TQM practices, and it addresses a wide range of aspects. Based on an extensive literature review, the elements comprising Customer focus in this thesis cover how and how well an organization determines current and emerging customer requirements and expectations, and execute effective customer relationship management.

All activities of an organization must be planned and executed with the underlying aim of improving processes, ultimately leading to the manufacturing of quality products. It is however a necessity that quality is incorporated into these activities with a clear customer focus. Under increasing competitive pressure and escalating demands of consumers, the purpose of companies is to find ways to retain their customers and to differentiate themselves from competitors. Thus, determining and meeting customer requirements may be argued to be a necessary step to improve organizational performance. Clear support of this aspect is found in the analysis, as it revealed a strong and identifiable link between having an understanding of current as well as future customer needs and requirements and organizational performance. Delivering quality to customers and in relation hereto having an ultimate aim of sustaining a high degree of customer satisfaction, was likewise found to have a strong cohesion to the construct Customer focus and hereby a positive influence on the organizational performance of Danish SMEs within the manufacturing industry.

In continuation and supportance of what is written above, it is in a renowned study by Ahire et al. (1996)[6] argued, that organizations may outperform their competitors by being able to respond rapidly to customers’ demands with new ideas and technologies, produce products satisfying or exceeding the expectations of customers, and anticipate and respond to the evolving needs and preferences of customers. Addressing these criteria, it becomes evident that a customer focus does not solely address the external customer relations but also needs to be applied and reflected in the overall planning and execution of quality efforts inside the organization. Supportive evidence of this view is likewise found in the empirical results, as Customer focus, encompassing the active use of customer feedback in the internal product development processes, was found to have a positive influence on organizational performance. In alignment with other researchers, it may be argued that the flexibility and ability to incorporate and cope with changing customer needs and requirements could be further strengthened when dealing with small and medium sized organizations. As designated previously, many small businesses have the advantages of flat management structures and a high degree of flexibility which are factors that ought to facilitate the creation of a flexible working environment, more capable of responding quickly to changes in customer preferences.

In summary, it was found that focusing on the critical success factor of TQM, Customer focus, throughout the organization is essential, as it proved to have a positive influence on the organizational performance of Danish SMEs within the manufacturing industry. Elaborating, it was found that having an understanding of current— as well as an anticipation of future customer requirements and preferences proved to be positively aligned with organizational performance through the construct Customer focus. In continuation herewith, a positive link between having a distinct customer focus within the organization, dealing with external requirements as well as incorporating these requirements into the product development processes of the organization, and organizational performance was identified. Lastly, having customer satisfaction set
up as an essential goal throughout the organization, is positively aligned with Organizational performance through the construct Customer focus.

6.2.1.2 Top management commitment and Organizational performance

The hypothesis H1, concerning the relation between Top management commitment and Organizational performance, resulted in a path coefficient of 0.273 and the relationship was documented at a significance level of 1%. The exogenous variable and TQM critical success factor, Top management commitment, thus has a strong influence on the prediction of the endogenous variable Organizational performance, despite the influence being relatively smaller compared to Customer focus. Each manifest variable associated with the exogenous variable Top management commitment exhibited a high loading and will thus be included when appropriate in the subsequent description.

As it was documented in the literature review, a positive relationship between Top management commitment and Organizational performance was expected to prevail. Not surprisingly, many of the Quality frameworks rely on Top management commitment and leadership as a solid foundation within TQM, as it was underlined in chapter two. The importance of Top management commitment, as one of the most vital drivers underlying a successful adoption of TQM, has likewise been widely supported throughout the empirical literature.

The success of TQM employment hinges on strong leadership and commitment, elements that must be initiated by the top management. As argued below, going through the empirical findings, supportive evidence of this statement may be underlined.

It is confirmed that acceptance of responsibility by the top management, in determining a well-adapted and quality focused organizational culture, vision and overall quality policy, is positively linked to organizational performance of Danish SMEs within the manufacturing industry, through the construct Top management commitment. In continuation hereof, an organizational wide communication by top management of unambiguous quality objectives, as well as the allocation of adequate resources aimed at fulfilling these quality objectives, was likewise found to be an important aspect when determining the performance effects of TQM adoption. Lastly, a positive effect on organizational performance, from the use of assessments of managers based on the fulfilment of prespecified quality objectives, was indicated. It is thus found that quality is not solely to be incorporated into the internal production processes, management furthermore has to see through that it becomes an integrated part of the strategic planning of the organization. As indicated earlier in the literature review, it may be easier for the management of a small organization to emphasize the importance of quality throughout the organization, due to their ability to reach the entire organization.

As highlighted by several researchers within the field of TQM, a visible and concentrated effort by management, aimed at improving quality and setting up a corporate culture encompassing the quality missions and strategic direction of the organization, is essential for the performance of an organization. Clear supportance of these findings is found in the empirical investigation of Danish SMEs within the manufacturing industry.
6.2.2 Insignificant relations

As mentioned in the section above, supportive evidence of the hypotheses H1 and H4 is found, concerning Top management commitment and Customer focus respectively. Despite the general conformance existing in empirical literature, the hypotheses H2, H3, H5 and H6, referring to Supplier quality management, People management, Process management and Quality data and reporting, respectively, were not possible to document in this paper.

The consequences of the specified model in this paper being unable to capture the direct effects of Supplier quality management on Organizational performance imply that it was not possible to document a relation between the focus on pursuing long lasting supplier relationships, with a mission of sustaining a high product quality due to compliance with prespecified quality specifications, and Organizational performance. Taking into consideration the sample in this thesis, consisting of small and medium sized organizations, a lack of market clout may impact the ability of small firms to obtain suppliers’ involvement in the efforts of designing the quality into the product and enduring high quality raw input.

Likewise, the acknowledgement and incorporation of the opinions and suggestions arising from each employee regarding the quality decisions within the organization, in combination with a focus on the continuous development of employees, was not shown to be significantly linked to Organizational performance through the construct People management. This appears fairly surprising compared to the theoretical framework and previous empirical studies, indicating that the involvement and inclusion of the entire organization is an important asset in achieving the desired effects of TQM. However, due to a potentially limited amount of resources in small organizations, one might expect a relatively lower level of employee empowerment, use of employee involvement strategies and employee quality training. On the contrary, due to a smaller number of employees, it may be easier for each employee to contribute to the business development process.

Addressing Process management and Quality data and reporting, the analysis was shown to be unable to detect the effects arising from systematization and optimization of internal processes, as well as documentation of quality data. These findings were, as above, not expected, as TQM rests upon the philosophy of continuously seeking improvements in all aspects of the organization, in order to stay competitive in an competitive environment with changing customer preferences.

As it was covered earlier in this thesis, the data employed may have exerted some degree of influence on these insignificant results. When taking into account the non-normality of the data, which was investigated in the statistical analysis by looking at the skewness and kurtosis underlying the data, possible issues for concern arise. Referring to Hair et al. (2012), it has been put forward that the biasing effects of small sample sizes are likely to be accentuated when data is extremely non-normal. Thus, the bootstrapped standard errors in this paper might have been subject to inflation, hence resulting in an underestimation of the inner model relationships.

In continuation of the above, Hair et al. (2012)[74] likewise argue that relying on small sample sizes tends to capitalize on the idiosyncrasies of the sample. As it is quoted in the article:

“Researchers need to be aware that no statistical method can offset the fact that smaller sample sizes go hand in hand with higher sampling error, especially when the population and the sample are heterogeneous in composition.” (Hair et al., 2012)
The more heterogeneous the underlying population, the larger the required sample size necessary to provide adequate reflections of the population and to yield accurate estimates. Significant differences in the model relationships across the group of respondents in small and medium sized organization have been tested in the statistical analysis of this thesis, revealing no existence of heterogeneity. However, due to the small sample size in this thesis, heterogeneity across more than two groups, such as industries, has not been possible to examine. This is hence another aspect which one ought to bear in mind.

In summary, acknowledging the fact that PLS-SEM from a statistical standpoint can be applied with small sample sizes, possible concerns though arise if the data at the same time exhibits a highly skewed distribution, rendering a somewhat increased possibility of obtaining insignificant and inaccurate results.

In spite of the insignificant relations, it is important to bear in mind that the findings of this thesis do not imply that Supplier quality management, People management, Process management and Quality data and reporting exert no influence on the organizational performance of Danish SMEs within the manufacturing industry. The effects could simply not be statistically documented in the model put forward.

As underlined throughout this thesis, TQM is a holistic management approach, in which the importance of having a broad and holistic focus on the TQM critical success factors, has been widely emphasized by the various researchers within the field. Thus, solely focusing on a segment of the identified TQM critical success factors is not substantiated in theory. Furthermore, it is noteworthy that the companies composing the sample in this thesis, are expected to have a certain degree of focus on the TQM elements beforehand, with reference to their ISO 9001 certification. Thus, the results from the empirical study build on companies which to a greater or lesser extent hold a fundament within TQM.

Another aspect to consider when examining the significance of the model applied in this thesis, is that the model is unable to account for the possible interrelationships that may be prevalent between the identified critical success factors of TQM. Thus, as mentioned previously, only the direct effects of TQM critical success factor on organizational performance were subject for significance testing, due to the difficulty in choosing to model certain interrelations between selected constructs at the expense of others.
Part V

Concluding remarks
Chapter 7

Conclusion

With point of departure in the stated research questions, this thesis has sought to investigate the effects of the critical success factors underlying Total Quality Management on organizational performance. Special emphasis has been placed on identifying the effects on the organizational performance of small and medium sized Danish manufacturing companies, constituting the sample of this paper, as this is a field in which little research has been conducted.

A thorough literature review revealed that many definitions of TQM as a concept are prevalent. Despite no general agreed designation of TQM, conformity of the holistic disposition of contemporary TQM prevails among practitioners and researchers within the field. TQM is thus argued to encompass external as well as internal stakeholders, in the effort of optimizing the organization as well as its responsiveness to its surroundings.

An in-depth exposition and assessment of the critical success factors underlying a successful adoption of TQM, identified in past empirical studies, was conducted. As a result hereof, six critical success factors to be employed in the empirical analysis were identified; Top management commitment, Customer focus, People management, Supplier quality management, Process management and Quality data and reporting.

The application of the multivariate and non-parametric data analysis method, Partial Least Squares - Structural Equation Modeling, as estimation technique, was found to be highly suitable when answering the empirical research question put forward. PLS-SEM is especially applicable, as it enables the indirect measurement of latent variables through a number of indicators, as is the case when measuring the critical success factors of TQM and organizational performance. In continuation hereof, the estimation technique is useful when the objective is to predict a key target construct, in this thesis organizational performance, or identifying key driver constructs. Additional advantages of PLS-SEM were found to constitute the capability of providing efficient and reliable results, despite small sample sizes and non-normal data.

Though PLS was found to be highly applicable due to its reliance on no distributional assumptions, it was however found that the combination of small sample sizes and extremely non-normal data might lead to a certain degree of bias and inconsistency of the PLS-SEM estimates.

The empirical analysis, in which the effects of the TQM critical success factors on organizational performance were analyzed, revealed that only two out of the six proposed critical success factors were significantly related to organizational performance. Thus, by the use of backwards elimination, insignificant constructs were removed, leaving the constructs Customer focus and Top management commitment
in the model, capable of explaining 53.6% of the variation in organizational performance. An extensive analysis of the validity and reliability of the final model was carried out, revealing no concerns regarding the quality of the model.

The implications of the empirical analysis indicate that having a high degree of customer focus throughout the organization is essential, as it exerts a positive influence on organizational performance of Danish SMEs within the manufacturing industry. Particularly, having an understanding of the current and future preferences of customers, incorporating feedback and requirements into the production development process and having an ultimate objective of sustaining high degree of customer satisfaction were found to be positively associated with organizational performance, through the construct Customer focus.

The construct Top management commitment was likewise found to exert a positive influence on organizational performance, though to a lesser extent compared to Customer focus. It is hence found that a visible and concentrated effort by management, with the objective of improving quality and setting up a corporate culture encompassing the quality missions and desired strategic direction of the organization, exerts a positive influence on the performance of Danish SMEs, operating in the manufacturing industry.

The findings thus indicate that it may be beneficial for small and medium sized companies, operating within the manufacturing industry, to place special emphasis on Customer focus and Top management commitment.

Despite the empirical findings, TQM is argued to comprise a holistic management approach, in which the underlying elements and critical success factors are assumed to exert some degree of intercorrelation. In relation hereto, a small sample size and non-normal data may have contributed to the insignificant findings of this thesis. Thus, solely focusing on the statistically identified critical success factors in this study, may underestimate the possible gain resulting from a combined effort in all aspects of the organization.
Chapter 8

Reflections

8.1 Implications and limitations

This thesis recognises the relations between the critical success factors of TQM and organizational performance as drivers of the effectiveness and success of TQM practices in Danish SMEs, operating within the manufacturing industry. As only sparse research has been conducted within this specific area, the thesis provides a useful contribution hereto.

Despite the adoption of TQM practices often being associated with larger organizations, the findings of the thesis provide evidence, that SMEs may likewise achieve positive performance effects resulting from an employment of TQM practices. Thus, TQM should not be branded as a competitive strategy solely for large companies to incorporate. In continuation hereof, the adoption of TQM practices should not only be seen as a mean of satisfying external stakeholders, as a response to increasing competitive pressure - these practices may likewise prove beneficial in optimizing and improving internal processes of the organization.

Performance is a multifaceted concept and this study aimed at capturing performance dimensions from both operational, financial and non-financial perspectives. Despite the established relationships between the adoption of TQM practices and organizational performance put forward in this thesis, other factors such as organizational culture and market orientation may however also have an impact on organizational performance.

It should furthermore be acknowledged that this thesis is subject to some methodological limitations. A limitation of this thesis is the somewhat limited scope of the sample size, and thus the restriction to cover only a single industry - the manufacturing industry. This implies that the generalisability is affected and that the control for possible extraneous variation, such as macroeconomic factors, is somewhat limited. Looking at the sample size in connection with the fairly skewed data distribution, furthermore induces some constraints upon the interpretations of results.

Lastly, the reliance on subjective evaluations from the respondents is another limitation of this study. This drawback will be further commented upon in the recommendations for further research.
## 8.2 Recommendations for further research

As previously acknowledged, subjective measures collected from managing directors, quality assurance managers and production managers, are employed for each of the Total Quality Management constructs. Using perceptual items, measured on a Likert scale, the TQM constructs are able to capture the perceived extent of quality efforts in an organization. It may thus be argued that the findings of this thesis, based on these subjective measures, only indicate the managerial perceptions. It has in the thesis been argued that the information compiled from these key participants is more suitable, than the employment of a limited collection of incomplete and incomparable data. However, when possible, further analyses should seek to complement these subjective measures by objective data on the constructs, in order to improve the reliability of the findings.

In continuation hereof, when collecting data from managers concerning their own organization and specific managerial issues, there is a potential risk of self-reporting bias, due to the vested interest these respondents may have in the success of the TQM initiatives. Future research could thus seek multiple responses from each firm, in order to reduce this bias. It is however noteworthy that identifying respondents with appropriate functional backgrounds may represent a clear challenge. Furthermore, simply averaging multiple responses from an organization may not represent the true status of quality efforts within the organization. This issue must thus be considered carefully upon inclusion.

It may be recommended for further analyses to take into account possible industry-wide and macroeconomic effects, by tracking a control sample of non-TQM firms. This is advocated, as the research design employed in this study makes it difficult to determine whether the perceived performance gains are solely attributable to TQM, or instead may be influenced by industry or macro-economic forces.

Extending the research design to encompass and examine the effects of TQM between sub-industries would furthermore be recommended in order to increase the external validity. This subdivision however requires a sufficient enhancement of the sample size at hand.

The purpose and associated research questions of this study were stated with the objective of identifying the effects of TQM practices on organizational performance in Danish SMEs, within the manufacturing industry. Having identified the significant relations within the model proposed, it will be recommendable for future research to apply a qualitative approach, e.g. by the use of case study designs, investigating how organizations may exploit the full advantages underlying the adoption of TQM practices.
Bibliography


Bibliography


