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High performance quality management systems and work-related outcomes: Exploring the role of audit readiness and documented procedures effectiveness

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High Performance Quality Management Systems and Work-Related Outcomes:

Exploring the Role of Audit Readiness and Documented Procedures Effectiveness

Dissertation

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Abstract

This study investigates a comprehensive quality management system (QMS) and its influence on multiple work-related outcomes. It examines certified quality systems used in the automotive industry to test whether QMS audit readiness mediates the relationship between quality factors and outcomes. A survey instrument, encompassing quality award criteria and system certification precepts, helped identify factors associated with high-performance. Regression results showed several factors, including leadership and process management, as being critically important in predicting work outcomes. Human resources emerged as being critical to most outcomes. Audit readiness did not emerge as a mediating variable, but rather as a significant process outcome. This research offers an understanding of the factors that are critical to achieving high performance and multidimensional competitive advantage.

Dedication

I dedicate this work to my wife, Angela, and to all my family and friends for their constant support and understanding.

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I would like to extend my sincere thanks and gratitude to my dissertation chair and committee members for their dedication and guidance. Thanks to the American Society for Quality (ASQ) and to their Automotive Division and to Lou Ann for all your support. A special heartfelt thanks to all my friends and colleagues at Eastern Michigan University, especially to the people in cohort 1.0 and cohort 1.5.

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Chapter 1: Introduction

Companies are constantly searching for proven ways to facilitate high performance and further competitive advantage. An evolving line of research indicates that, over the last two decades, quality management has gradually developed into an elaborate business paradigm that can differentiate an organization from its competitors. Quality management can help organizations achieve and maintain high performance and enhance their competitive advantage (Buzzell & Gale, 1987; Lawler, Mohrman, & Ledford, 1995; Mendelowitz, Watson, & Usilaner [GAO], 1991; Naveh & Marcus, 2005; Reed, Lemak, & Mero, 2000; Sila & Ebrahimpour, 2005). However, a question still to be answered is, "What critical factors shape a high-performance quality management system?"

A limited number of studies have tried to identify empirically the critical factors of quality management and evaluate connections to performance. The quality field has made significant progress since the 1980s. The advent of the Malcolm Baldrige National Quality Award (MBNQA), established in 1987 by the U.S. Department of Commerce, has since brought greater attention to the quality field. In 1988, David Garvin, a Harvard Business School professor and quality expert, claimed, "Given its long history, surprisingly little is known about quality management. Academic research on the subject is in its infancy" (p. 222). A decade later, Ahire and O'Shaughnessy (1998) maintained that "only recently has empirical research, focused on developing the theory of quality management, started to appear in scholarly journals…" (p. 8). Now, roughly two decades after Garvin's formative observation, empirical research related to TQM has emerged with noticeable vigor. The current challenge, however, is finding clear patterns in existing research that can help form consensus around empirically proven factors in quality management. The factors critical to quality management are not completely defined or agreed upon (Sila & Ebrahimpour, 2002, 2005). While quality management theory transitions from infancy to early development, the call for more practical (empirical) research in quality continues.

Statement of Purpose & Research Need

The purpose of this study is to investigate how certain quality management factors influence work-related outcomes and whether a particular form of audit readiness mediates the relationship between critical quality factors and multiple work outcomes.

Auto industry professionals, for example, use self-assessments, pre-audits, and readiness evaluations to assess their organizations' readiness for mandatory quality management system (QMS) audits. These assessments determine an organization's level of conformance to the industry-imposed standard, ISO/TS 16949:2002 (TS2). More specifically, registered third-party audits are required to evaluate an organization's new or existing quality system for conformance to the industry standard (Johnson, 2001; AIAG, 2004).

This research is important because it adds to the corpus of knowledge in the fields of contemporary quality management and industrial-organizational psychology by attempting to understand the relation between critical quality factors and work-related outcomes. It examines worker perceptions, attitudes, and behaviors, for example, as part of a comprehensive quality management system. The number of empirical studies that have attempted to identify the critical factors of quality is growing. For example, Sila and Ebrahimpour (2002) conducted a meta-analysis of past literature and found 76 survey studies from 1989 to 2000 that attempted to describe the factors of TQM. This investigation is the first of its kind to examine a comprehensive quality system consisting of multiple factors, including a unique procedures audit readiness variable, and to evaluate the influence of these items on multiple work outcomes. The special audit readiness scale, for example, consists of questions related to the seven mandatory procedures of the TS2 standard.

Other quality system factors explored in this study include leadership, strategic planning, customer and market focus, measurement, analysis and knowledge, workforce focus, and process management. Leadership consists of items related to executive responsibility, ethics, vision, setting objectives, participating in quality, and being accessible to interested parties, namely customers and employees (NIST, 2006, p. 15).

Strategic planning involves creating broad objectives as well as developing and deploying business management plans. The process includes customer involvement and competitive comparisons in establishing broad, yet thorough, business plans. Alignment between short-term and long-term plans is emphasized (NIST, 2006, pp. 18-19).

Customer and market focus consists of identifying and contacting customers within the market. Focus is on understanding customer needs and expectations as well as effectively handling customer relationships and complaints (NIST, 2006, pp. 21-22).

Measurement, analysis, and knowledge management encompass the data and information (e.g. customer feedback, comparative benchmarks) collected, aligned, and integrated into the system. It takes into account how organizations use information in connection with performance and how they evaluate the processes for collecting and analyzing data (NIST, 2006, pp. 24-25).

Workforce focus (HR) covers the people and activities within the work environment. HR concerns employee well-being and includes factors like health, safety, and education. It examines the extent to which these facets align with objectives. The Baldrige suggests employee involvement in improving the business. In addition, the Baldrige recommends measurement of employee views regarding the work environment and training needs (NIST, 2006, pp. 26-28).

Process management encompasses the design, management, and improvement of key work processes and business core competencies. Process management incorporates statistical techniques and functions to reduce and control variation and to improve processes (NIST, 2006, pp. 29-30).

Results (i.e., work outcomes), according to the MBNQA (NIST, 2006), include process effectiveness outcomes, product and service outcomes, customer focus outcomes, financial and market outcomes, leadership outcomes, and workforce focus outcomes.

Process effectiveness outcomes are a diverse set of results that include measures such as productivity, cycle time, and response time for emergency drills. The Baldrige criteria also state that appropriate measures of work system performance may include audits (NIST, 2006, p. 33). This study incorporated the audit readiness variable as a dependent variable representing a specific process effectiveness outcome.

This study combined product and service outcomes and customer focus outcomes into one composite variable referred to as customer performance metrics. Performance measures in these areas cover outcomes that are important to the customer. The MBNQA suggests that organizations assess the selected measures relative to the competitions' performance (NIST, 2006, p. 33). For example, with respect to product and service outcomes, the survey asked respondents to indicate their plants' positions as compared with the competitors' in areas such as defect rates and overall product/service quality. Similarly, for customer focus outcomes, the survey asked respondents to indicate their plants' relative positions to the competitors' in areas such as warranty claims, missed shipments, and overall customer satisfaction.

Financial and market outcomes (i.e., business results), as suggested in the MBNQA criteria, include measures such as return on investment (ROI) and market share (NIST, 2006, p. 32). This research explored measures for ROI, return on sales (ROS), and market share. However, it did not ask specific leadership outcome questions related to governance and fiscal accountability because these type of questions are perhaps more suitable for asking executives at the firm level. Moreover, the research anticipated that the majority of respondents would hold plant-level quality professional positions.

Workforce focus outcomes measured in this study deal with the satisfaction and engagement of the workforce. The survey instrument developed for this study asked to what extent each survey participant liked working for his or her employer. In addition, it asked whether people were satisfied with their jobs. The MBNQA defines engagement as "the extent of workforce commitment, both emotional and intellectual, to accomplishing the work, mission, and vision of the organization. Organizations with high levels of engagement are often characterized by high-performing work environments…" (NIST, 2006, p. 27).

The research measured organizational commitment (i.e., engagement) in terms of one's emotional attachment to an organization. Mowday, Porter, and Steers (1979) described this form of engagement "as the relative strength of an individual's identification with and involvement in a particular organization." And, "it can be characterized by at least three related factors: (1) a strong belief in and acceptance of the organization's goals and values; (2) a willingness to exert considerable effort on behalf of the organization; and (3) a strong desire to maintain membership in the organization" (p. 226).

Research Design & Delimitation

The objective of this study was to define the relationship between some of the main factors of quality management, QMS conformance assessments (audit readiness), and work-related outcomes. First, the study questioned the number of organizational factors that experts, such as Sila and Ebrahimpour, claim are critical to quality management. Second, the study explored mandatory QMS procedures and their relative effectiveness as experienced in the automotive industry. Third, it examined quality factors and QMS audit readiness relative to outcomes via simultaneous and stepwise regression. Existing empirical research that examined the linkages between several of these concepts showed multiple regression and structural equation modeling as being the most frequently used research methods. This investigation was the first of its kind that took into account mandatory QMS procedures and auditing as it incorporated these concepts into a new scale that measured employee perceptions of their organizations' QMS in terms of readiness and effectiveness.

The design of this study followed a quantitative research paradigm. The intent was to generalize from a sample to a specific population (automotive) and to evaluate relationships between observable occurrences. The quantitative study commenced in the spring of 2007. At that time, most auto suppliers had to be registered to ISO/TS 16949:2002 (TS2) by the deadline of December 14, 2006 (QMI, October 2006). The American Society of Quality (ASQ) assisted in the study and helped administer the web-based survey, which ASQ sent out via e-mail to all quality professionals in their automotive division database. This particular database contains a population of approximately 5,000 members (per L. Lathrop, ASQ Automotive Division, personal communications, December 2006). When ASQ elected to send the survey invitation to all automotive division members, they essentially dictated a convenience sample.

The research targeted quality professionals as possible respondents because industry recognizes these professionals as organizational leaders in quality system assurance, planning, registration, implementation, and auditing (Ahire et al., 1996, 1991; Johnson, 2001; Saraph et al., 1989). This author then analyzed the data relative to various work-related outcomes (e.g. workforce engagement, job satisfaction, customer satisfaction, market share) using multiple regression techniques in SPSS version 14 for Windows.

Research Questions

This study of automotive professionals addressed the following questions:

1. What factors, of those just described, define a quality management system and are significant (i.e., critical) in predicting work-related outcomes? Are these factors consistent with factors that have emerged in quality management literature over the last two decades?
2. What is the relationship, if any, among the main factors in a quality management system, audit readiness, and work-related outcomes? Does audit readiness mediate the linkage between quality factors and work-related outcomes, assuming linkages exist, or does readiness essentially act as a process effectiveness outcome?

Hypotheses

H1. Quality factors have a significant positive association with work outcomes.

H2. Quality factors have a significant positive association with audit readiness as a process effectiveness outcome.

H3. Perceived audit readiness (PAR) has a significant positive association with work-related outcomes such that it partially mediates the relationship between quality factors and work-related outcomes. See Figure 1, which illustrates this author's theoretical proposal.

Research tested the hypotheses in three phases in the order H1, H2, and H3. The H1 series of tests, which consists of H1a to H1d, will examine leadership, strategic planning, customer focus, measurement, analysis and knowledge (INFO), workforce focus (HR), and process management in relation to separate outcome variables, specifically business results (H1a), job satisfaction (H1b), organizational commitment (H1c), and customer performance metrics (i.e., product and service quality and customer focus) (H1d).

The second phase examined the second hypothesis (H2), which proposes that critical quality factors will have a significant and positive connection with perceived audit readiness as a process effectiveness outcome.

The third phase looked at another series of hypotheses, H3a through H3d, which propose that QMS perceived audit readiness (QMS) will have a significant and positive connection to work-related outcomes such that, as an added independent variable, QMS will partially mediate the relationship between the QMS factors and work-related outcomes. The H3 series of tests examined the same relationships as in H1, the only difference being the inclusion of QMS as an independent variable. Figure 1 illustrates the theoretical proposal and hypothesis testing sequence.

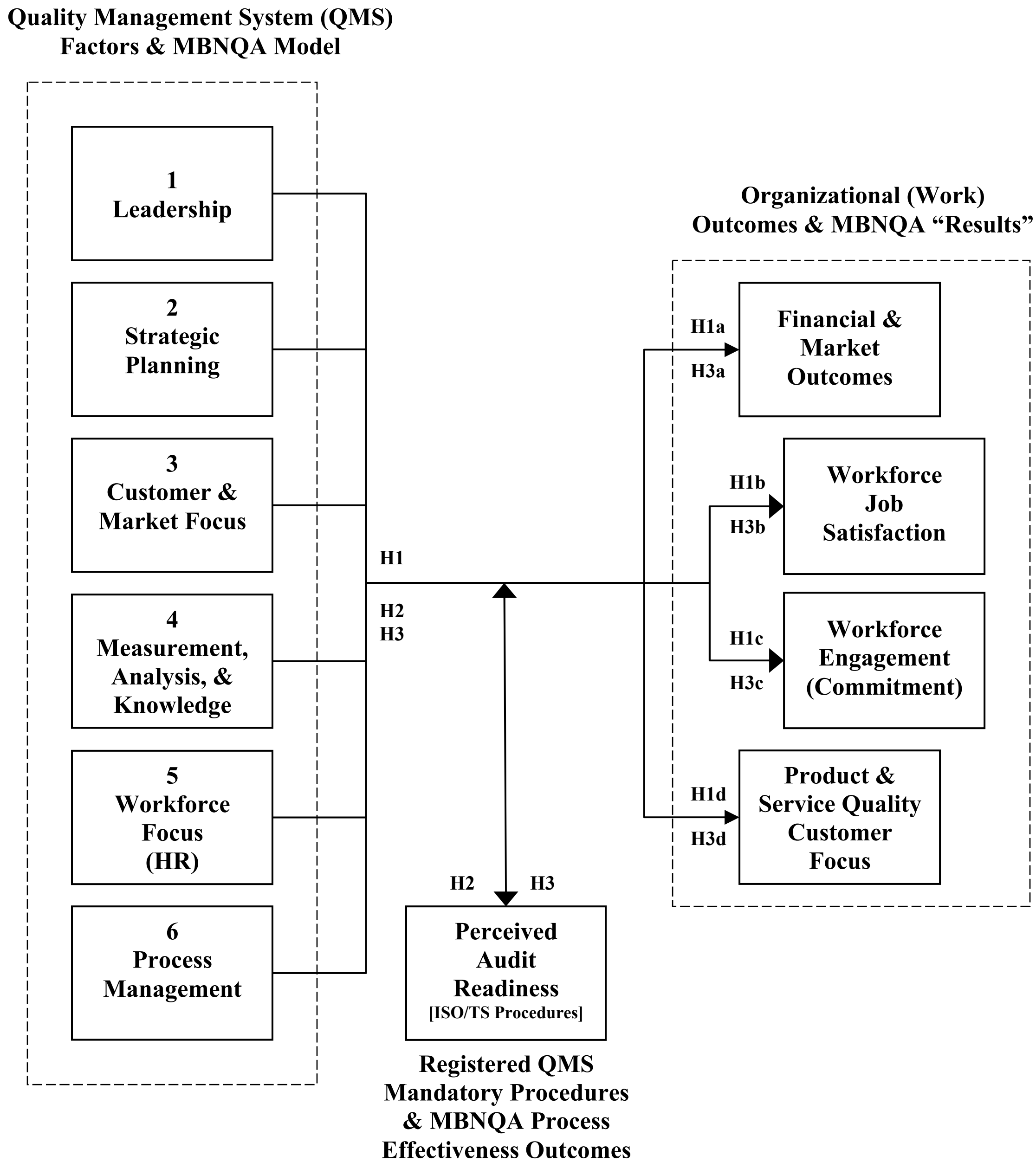

Figure 1. Proposed research model to test relationships among main system factors, mandatory system procedures (audit readiness), and work-related outcomes.

Summary

This study investigates an industry specific quality management system to determine whether critical quality management factors are present that have a significant influence on organizational (work) outcomes. It also examined which factors influence perceived audit readiness (PAR). The study evaluated audit readiness to see whether it mediated the relationship between QMS factors and outcomes. The findings advance the quality field by offering an enhanced understanding of the factors that are critical to quality management and performance. Moreover, the study attempts to demonstrate some of the benefits of conducting pre-audits and assessing employee perceptions.

An audit readiness scale was developed for both research and practical applications. One of the main hypotheses tested in this study of automotive quality professionals was that self-assessed audits that address mandatory system requirements (i.e., PAR) would have a main effect in the relationship between QMS factors and work outcomes. This author also hypothesized that system variables would have main effects on audit readiness as a process outcome and on other work outcomes.

Practical implications include the view that pre-audits can be a relatively accurate method for assessing system performance as to whether an organization is ready to comply with industry standards and whether it is prepared to compete on multiple levels in an aggressive business environment. A positive QMS readiness assessment could potentially save an organization time, money, and perhaps its reputation as a preferred-partnering source. For example, if an organization receives a low audit readiness assessment, they may still have time to strategize, set proper goals, and implement corrective actions that improve their existing processes or procedures. Then, if they take proper action prior to a required third-party audit, an organization could be in a better position to achieve certification and to register as a TS2 compliant system. Researchers and practitioners benefit from this work as they gain an enhanced understating of the major variances and relationships present in a contemporary quality management system. For example, this study helps define the role of mandatory QMS procedures and identifies which quality factors are critical in explaining the variance in work outcomes.

Implementing a high-performance QMS can benefit technology and society by providing consumers with products and services that meet, or exceed, the average consumer's expectations. Various industry sectors have implemented QMS standards (e.g., aerospace's AS9100, telecommunications' TL9000). These sectors have adopted quality standards to aid in their quests to advance new technologies and to meet the changing needs and expectations of society (Daniels, 2000; Stamatis, 2004). Another case in point is the highly competitive automotive industry, which recently instituted a new model QMS standard (i.e., TS2). Automotive products are, in most cases, safer and more reliable than ever before. The University of Michigan's latest American Customer Satisfaction Index (ASCI) survey revealed improved levels of customer satisfaction and reliability over previous years. Moreover, the ASCI showed that, in the automotive industry, customer satisfaction levels were near all-time highs. Industry-wide quality efforts received credit for being the primary driver for the positive results (Fornell, 2007).

Quality management continues to evolve, and more research is needed to define the factors that compose model quality systems and to assess the status of worker perceptions and attitudes relative to quality practices and outcomes. Empirical research that includes requisite items covered in mandatory quality audits does not exist.

Chapter 2: Literature Review

This research explored the possible linkage between quality factors and performance. It examined model quality systems and took a closer look at individual quality factors, such as leadership and process management, that might require greater emphasis in a competitive environment where positive performance outcomes are generally desired across multiple measures. Historical perspectives and philosophies relative to quality management lay the groundwork for model and instrument development. Recent empirical studies have attempted to establish which factors are critical to quality management and performance. The following literature review addresses each of these areas in detail.

Quality Systems: Historical and Theoretical (Non-Empirical) Perspectives

Total quality, as defined by the American Society for Quality (ASQ), is "a strategic integrated system for achieving customer satisfaction that involves all managers and employees and uses quantitative methods to continuously improve an organization's processes" (ASQ, 2007, www.asq.org/glossary). In its description of TQM, the ASQ adds that the comprehensive quality systems of today stem directly from the philosophies and teachings of quality leaders like Philip B. Crosby (1979), W. Edwards Deming (1986), and Joseph M. Juran (1988). Over the last few decades, these authoritative figures have suggested several factors related to quality management (cf., Powell, 1995; Saraph, Benson, & Schroeder, 1989).

Some experts in the quality management field may argue that the quality movement began in the early part of the twentieth century, but there are certain concepts related to quality (e.g., metrology and inspection) that have been traced back several centuries (Gryna, 2001; Juran, 1995). In the twentieth century, quality and many of its characteristics were made popular through efforts of several influential people, namely Walter A. Shewhart, Armand V. Feigenbaum, W. Edwards Deming, Phillip Crosby, Joseph M. Juran, and David Garvin. Each offered society their own quality insights, opinions, and expertise, which, when taken as a whole, create the foundational characteristics of quality as it is known today.

Walter Shewhart, for example, worked for Bell Laboratories in the early part of the twentieth century. In 1924, he introduced the control chart to measure variation and to help identify chance (common) cause and assignable (special) cause within a given process. Shewhart's statistical analysis and special measurement concepts influenced the works of other great quality leaders that followed his example. Accordingly, Shewhart became known as the father of statistical quality control (Montgomery, 2001). Quality measurement soon emerged as a critical process management tool.

In 1943, Armand Feigenbaum put forth the "cost of quality" concept, which had four major cost categories: prevention, appraisal, internal defect, and external defect (Campanella, 1999; Martinez-Lorente, Dewhurst, & Dale, 1998). Feigenbaum described total quality control as "an effective system for integrating the quality-development, quality maintenance, and quality-improvement efforts of the various groups in an organization so as to enable production and service at the most economical levels which allow for full customer satisfaction." He summarized by saying, "Control must start with the design of the product and end only when the product has been placed in the hands of a customer who remains satisfied" (Martinez-Lorente, Dewhurst, & Dale, 1998, p. 378). Quality planning and control are required in order to assure customer satisfaction and to reduce costs of poor quality (Gryna, 2001). Feigenbaum's work suggests that quality management is a system, and organizations can measure its effects in terms of cost.

In 1947, W. Edwards Deming was invited to Japan to help rebuild Japan's war-damaged industry. In 1950, he accepted an invitation to speak at Tokyo's Industry Club (Leitner, 1999; Montgomery, 2001). Deming made clear in his address that "management was the problem, and nothing would improve until they took responsibility" (Leitner, 1999, p. 489). Quality control needed to be put into the hands of the workers and be supported by responsible leaders. Factors like process control, training, planning, and customer awareness are part of the identifying characteristics of a comprehensive quality system (Deming, 1986).

Deming, who would eventually become known as the founding father of total quality management, expressed that "quality has no meaning except as defined by the desires and needs of the customer" (Leitner, 1999, p. 490). This total quality management (TQM) concept was built upon Deming's famous fourteen points. Deming (1986), however, did not approve of TQM slogans. Instead, he strongly urged business leaders to adopt his principles and put into practice respected quality systems:

1. Create a constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.

2. Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership change.
3. Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.
4. End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.
5. Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6. Institute training on the job.
7. Institute leadership. The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.
8. Drive out fear, so that everyone may work effectively for the company.
9. Break down barriers between departments. People in research, design, sales, and production must work together as a team, to foresee problems of production and in use that may be encountered with the product or service.
10. Eliminate slogans, exhortations, and targets for the work force asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as a bulk of the causes of low quality and low

productivity belong to the system and thus lie beyond the power of the work force.

11. a. Eliminate work standards (quotas) on the factory floor. Substitute leadership.

    b. Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.

12. a. Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.

    b. Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, *inter alia*, abolishment of the annual or merit rating and of management by objective.

13. Institute a vigorous program of education and self-improvement
14. Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job. (pp. 23-24)

In the early 1950s, the Union of Japanese Scientists and Engineers (JUSE) developed a total quality control system based on Deming's work and deployed this system throughout Japan, which resulted in some of the most advanced technologies and highest quality products that the world had ever seen (e.g., reliable automobiles, advanced electronic devices) . The JUSE named one of Japan's highest quality awards after the father of total quality as an expression of their sincere appreciation for his work; they called it the Deming Prize. Deming's work helped rouse a quality revolution in

Japan, which made the country a competitive force in the global economy. It would not be until roughly 1980 that Deming's profound knowledge and fourteen points would be heeded in the United States. At that time, companies in the United States started to focus on quality in order to remain competitive and to maintain market share (Benson et al., 1991; Gryna, 2001; Leitner, 1999).

Phillip Crosby started to make his own connection between cost and quality. In 1965, Crosby published a book titled *Cutting the Cost of Quality* that explained how measurements of non-conformance could be used to help prevent poor quality and improve operations. He defined quality as conformance-to-requirements and poor quality as non-conformance-to-requirements. Crosby tried to identify costs associated with not conforming to set specifications and requirements in providing products and services. Crosby published his most notable work, *Quality is Free*, in 1979, and in 1984 he published the popular *Quality without Tears – the Art of Hassle-Free Management*. In his 1979 work, Crosby recommended 14 practical steps to achieve quality. Management commitment, teamwork, training, error cause removal, corrective action, and zero-defects are a few of the more commonly recognized steps and practices that Crosby recommended (Crosby, 1979, pp. 132-139). Crosby felt strongly that zero defects must be the one and only quality performance standard, and all employees must be motivated to pursue this goal (Gryna, 2001). From Crosby's perspective, quality can and should be measured as a non-conformance to some specification and characterized in terms of cost (e.g., cost of scrap, rework, or returns). Furthermore, he makes clear that everybody must be committed to the organizational goal to improve quality and performance (e.g., reduce non-conformances and costs).

In 1957, Joseph M. Juran published his first quality control handbook that in late editions are still popular today. Juran's widely accepted contribution to the advancement of quality is through his suggested combination of statistical analysis techniques and problem-solving methodologies. He recommends as part of his methodology the use of teams to address new or existing quality concerns. Throughout his career, Juran authored numerous articles and texts on the subject of quality. Industry recognized Juran's pioneering contributions and achievements in the field of quality management (Gryna, 2001; Juran, 1988; 1995; Juran & Godfrey, 1999; Montgomery, 2001). The foundational characteristics Juran proposed consist of a three-part framework: 1) quality planning, 2) quality control, and 3) quality improvement (Gryna, 2001; Juran & Godfrey, 1999).

David A. Garvin (1987), a Harvard professor and authority on quality, decision-making, and change, believes that people make quality assessments based on both the tangible and intangible aspects of a product or service. He conceptualized eight dimensions of quality, four tangible and four intangible. The four tangible dimensions were performance, features, conformance, and durability. The four intangible dimensions were reliability, serviceability, aesthetics, and perceived quality. All make reasonable outcome measures.

In his 1988 work, Garvin claimed that organizations with superior quality performance encompassed some of the following practices and characteristics:

- Senior managers support and involvement
- Quantitative measurement of quality performance.
- Reliability engineering
- Statistical sampling

- Monitoring of suppliers
- Narrow product lines

In an earlier study, Garvin (1986) compared Japanese and US manufacturing companies and discovered positive correlations between managers' commitment to quality, subordinates' commitment to quality, and quality performance. Garvin (1986) noted that "…high levels of quality performance are accompanied by organizational commitment to that goal. Attitudes appear to be quite important: without management and a work force dedicated to quality, little is likely to be accomplished" (p. 669). Hence, management must provide a culture that fosters commitment with an emphasis on quality:

> By now it is almost an article of faith among quality experts: Successful quality performance requires a management dedicated to that goal. Without commitment at the highest levels, such objectives as delivery and cost are thought to take precedence. All too often, the result is an 'us versus them' attitude which pits quality control against production.
>
> But if top management embraces quality, these tensions are likely to be reduced. Little work, however, has been done to confirm this view. Nor have the specifics of management direction-setting been studied carefully. Some messages about quality are more effective than others, but little is known how employees distinguish among them. Are policy statements, for example, enough to demonstrate management's seriousness? Will slogans and banners suffice? Or are tangible actions and personal participation required if quality is to improve? (Garvin, 1988, p. 170)

Total quality is credited as the system most responsible for "leading Japan to global economic prominence in the postwar years…and, more recently, with restoring America's economic competitiveness" (Powell, 1995, p. 15). After seeing quality management's influence on Japan and recognizing its potential impact on competitiveness, the U.S. Department of Commerce soon introduced the Malcolm Baldrige National Quality Award (MBNQA). In 1987, President Ronald Regan signed into law The Malcolm Baldrige National Quality Award (MBNQA). The prestigious award has since evolved into a proven set of essential management criteria with the central purpose of establishing core values and best practices to improve organizational performance (NIST, 2006).

The Baldrige model has seven major criteria: 1) leadership, 2) strategic planning, 3) customer and market focus, 4) measurement, analysis and knowledge management, 5) workforce focus, 6) process management, and 7) results (NIST, 2006). Experts consider the MBNQA as the leading quality management model (cf., Ahire & O'Shaguhnessy, 1998; Black & Porter; 1995; Garvin, 1991; Hackman & Wageman, 1995; Johnson, 2001; Prajogo & Sohal, 2006; Mendelowitz, et al., 1991; Sila & Ebrahimpour, 2005; Wilson & Collier, 2000). This research discusses the MBNQA at greater length in later sections.

Table 1.

Popular Quality Management Perspectives (Excerpted from Powell, 1995, p. 18 and updated)

Deming's 14 Points****	Juran's Trilogy***	Crosby's 14 Quality Steps**	Malcolm Baldrige National Quality 2007 Award Criteria*
1. Constancy of purpose	1. Quality Planning	1. Management leadership	1. Leadership
2. Adopt the philosophy	2. Quality control	2. Improvement teams	2. Strategic Planning
3. Don't rely on mass inspection	3. Quality improvement	3. Quality Measurement	3. Customer & Market Focus
4. Don't award business on price		4. Cost of quality evaluation	4. Measurement, Analysis & Knowledge
5. Constant Improvement		5. Quality awareness	5. Workforce Focus
6. Training		6. Corrective action	6. Process Management
7. Leadership		7. Zero-defects committee	7. Results
8. Drive out fear		8. Supervisor training	
9. Break down barriers		9. Zero-defects day	
10. Eliminate slogans		10. Goal-setting	
11. Eliminate quotas		11. Error cause removal	
12. Pride of workmanship		12. Recognition	
13. Education and retraining		13. Quality councils	
14. Plan of action		14. Do it over again	

Note:
**** Deming, 1986, pp. 23-24
*** Juran & Godfrey, 1999, pp. 2.5-2.6
** Crosby, 1979, pp. 132-139
* Baldrige National Quality Program, NIST, 2006, pp. 15-34

Quality Systems: Empirical Perspectives

Sila and Ebrahimpour (2002) showed that, since 1989, empirical studies that attempt to identify critical factors to quality management have grown steadily in number. The Saraph et al. (1989) study, for example, was a first of its kind that developed an instrument mainly from literature and theory (i.e., from the work of Deming, Juran, and Crosby) and analyzed it statistically to operationalize the critical factors of total quality management (TQM). The researchers were able to define TQM such that it could be measured quantitatively. The survey they administered consisted of 81 items, and most of the survey questions used a 5-point scale. One of the output measures, for example, was perceived level of customer satisfaction. The 162 people from manufacturing and service who responded represented 20 companies. Factor analysis of the survey data reduced 81 items and loaded them accordingly into eight specified critical factors: 1) top management commitment, 2) autonomous quality department, 3) training, 4) product/service design, 5) supplier quality, 6) process management, 7) data and reporting, and 8) employee awareness and involvement. Approximately eight to thirteen items, on average, measured and composed each of the scales of the eight independent variables. The term "critical" has been used largely since then to describe the extent of a particular quality practice's presence in an organization. The Saraph et al. (1989) study was the first of its kind that developed a relatively robust instrument utilizing factor analysis to identify critical factors of quality management.

Flynn, Schroeder, and Sakakibara (1994) conducted a similar study with a primary goal of measuring the critical factors of quality management. Flynn et al. surveyed 75 randomly selected manufacturing facilities and asked approximately 60 questions concerning quality. Factor analysis derived seven critical quality factors or constructs: 1) top management support, 2) quality information, 3) process management, 4) product design, 5) workforce management, 6) supplier involvement, and 7) customer involvement. Forty-eight items were used to measure the various factors. Flynn et al. (1994) used Cronbach's alpha to gauge the internal consistency for each scale; alphas ranged from 0.60 to 0.85. The authors claimed that an alpha of 0.60 or above was acceptable for new scales.

Like the Saraph and Flynn studies, Ahire, Gholahar, and Walker (1996) used literature and case studies to produce their own instrument. The final survey was sent to 1000 manufacturing professionals and was completed by 371 respondents. Ahire et al. identified, via confirmatory factor analysis, twelve factors critical to quality management: 1) top management commitment, 2) customer focus, 3) supplier quality, 4) supplier performance, 5) design quality, 6) benchmarking, 7) statistical process control, 8) internal quality information usage, 9) employee involvement, 10) employee training, 11) employee empowerment, and 12) product quality (outcome variable). The Ahire study went a step further than the previously described studies in that it used structural equation modeling to discover a positive and significant relationship between critical factors and product quality.

Black and Porter (1995; 1996) used the work of Saraph and the theory behind the MBNQA to empirically confirm and advance a more robust measure of the critical factors of quality. The European authors recognized "the Baldrige Award framework [as] the most accepted domain for TQM currently available" (1995, p. 154). Principal components analysis was used in an exploratory manner so as to not limit the number of possible resulting constructs. The authors claimed their method was less subjective than the method used by Saraph. It is understood that when factor analysis is supported by sound theory, the degree of subjectivity is lessened. However, allowing statistical methods alone to steer one's research risks departure from sound theory (e.g., separating theory based items and constructs into unusual or impractical interpretations). This type of inaccuracy should not be mistaken as a more robust and objective process. A balance must be found between meaningful correlation and sound interpretation (Tabachnick & Fidell, 2001, pp. 625-626). Black and Porter intended, in a way, to validate Saraph's original instrument. However, the sample consisted of 101 respondents, which hardly warrants the use of factor analysis (Tabachnick & Fidell, 2001, p. 588). In spite of this limitation, the relentless authors continued with factor analysis and managed to identify nine constructs, only one more construct than the number Saraph estimated. The authors then created a second instrument based on the MBNQA, but this time they administered a survey to 204 participants and then subjected the instrument to factor analysis, which resulted in 10 constructs. Of the three models, the 10 factor MBNQA-based instrument was found to be the most complete measure of TQM.

In an interesting part of their discussion, Black and Porter (1995) explained how they characterized each factor as either "soft" or "hard," but went on to say that the distinctions were not easy to make nor were they entirely helpful to their particular study. The soft category included factors like human resources, customer management, and teamwork, whereas the hard category included factors like strategy, information management, and process improvement.

Yusof and Aspinwell (1999) looked for critical quality factors in small and medium enterprises (SMEs). In their approach, they synthesized the works of Saraph et al. and Ahire et al. and then utilized an abbreviated pilot study to finalize the instrument. Most of the factors or constructs they identified were from previous studies that subjected the items to rigorous statistical analyses, namely factor analysis and internal consistency. Yusof and Aspinwell removed certain questions and revised others that were not practical to ask in their original form. Questions concerning "design quality management," for example, were removed because it is understood that not every manufacturer participates in the product design process. The results of their synthesis produced 10 constructs for measuring quality factors in SMEs. What was unique about this study was that the authors formed an instrument based on previous works that had incorporated factor analysis during (instrument) development. This allowed them to move immediately to administering the instrument as part of a pre-test pilot study.

Taking a similar approach to instrument development, Abas and Yaacob (2006) identified 10 critical factors through literature review, which helped validate their instrument's content. Abas and Yaacob went a step further and used structural equation modeling (SEM) to detect a significant relationship between a total quality management (TQM) latent variable and an organizational performance latent variable. The researchers' multidimensional outcomes included measures of financial performance, customer performance, internal process performance, and employee performance. Table 2 lists Abas and Yaacob's observed quality factors (variables). This author, however, was unable to garner anything more from their work because Abas and Yaacob did not provide necessary details, namely item descriptions for their observed variables and statistical evaluations for their SEM analyses. They claim to have found statistically significant relationships between TQM and performance. However, the transparency and reliability of their results is questionable.

Other researchers have tested and revealed similar critical factors using similar methods as mentioned above (cf., Antony et al., 2002; Singh & Smith, 2006; Sila & Ebrahimpour, 2005; Wilson & Collier, 2000). Table 2 summarizes most of the instruments, factor models, and empirical perspectives discussed. Studies that went a step beyond model development and proceeded to analyze and thoroughly describe connections between quality factors and performance are discussed in the next section.

Table 2.

Summary Comparison of Quality Management Instruments, Factor Models, & Empirical Perspectives

Saraph et al. (1989)	Flynn et al. (1994)	Ahire et al. (1996)	Black et al. (1996)	Samson et al. (1999)	Yusof et al. (1999)	Sila et al. (2005)	Abas et al. (2006)	Author's Instrument
Top management commitment	Top management support	Top management commitment	Corporate quality culture	Leadership	Management leadership	Leadership	Top Management Commitment	Leadership
Product / service design	Product design	Design quality	Strategic quality management	Strategic Planning	Work Environment	Strategic planning	Service Design	Strategic planning
Autonomous quality department	Customer involvement	Product quality	Operational quality planning	Customer Focus	Resources	Customer Focus	Strategic planning	Customer & market focus
Data and reporting	Quality information	Benchmarking	External interface management	Information & Analysis	Measurement & feedback	Information & analysis	Benchmarking	Measurement, analysis & knowledge (Info)
Training	Workforce management	Customer focus	Quality improvement	People Management	Improvement techniques	HR management	Customer focus	Workforce focus (HR)
Employee awareness & involvement	Process management	Internal quality information usage	Communication of information	Process Management	Human resource management	Process management	Quality Information Systems	Process management
Process management	Supplier involvement	Statistical process control	Customer satisfaction orientation		Education & training	Supplier management	Human resource management	QMS audit readiness
Supplier quality		Employee involvement	People & customer management		Continuous improvement	Business results	Continuous improvement	Financial & market outcomes
		Employee training	Teamwork		Systems & processes		Supplier Relationships	Workforce focus – job satisfaction
		Employee empowerment	Supplier partnerships		Supplier quality Management		Social Responsibility	Workforce focus – organizational commitment
		Supplier quality						Product / service quality & customer satisfaction
		Supplier Performance						

Note: Wilson et al. (2000) instrument is described in text and in Table 5. Factors for this research are similar to Wilson's except Wilson combined customer focus and satisfaction.

Quality Systems: Relationships to Performance

Quality management, as a comprehensive business system, can affect different areas of performance. In an federal report drafted by Mendelowitz et al. (1991), the authors described how a research team from the U.S. General Accounting Office (GAO) surveyed roughly 20 companies and observed common quality practices that appeared to comprise a larger total quality system (e.g., SPC, training, involvement). These practices were said to be associated with better employee relations, enhanced product quality, lower costs, greater customer satisfaction, and improved market share and profitability. The study, however, did not use any statistical analyses to support any of their findings. The informative observational report was based on what could be construed as anecdotal evidence. The twenty companies that took part in the study, however, were high-scoring Malcolm Baldrige Award applicants, which adds validity to their findings because high assessment scores can imply that an organization has an exceptional, yet less than perfect, total quality management system in place. The companies that participated in the GAO study came from various industries representing manufacturing and service.

Mendelowitz et al. (1991) also emphasized the importance of human aspects in quality management. The GAO claimed that it was essential that organizations focus on their employees because “this focus should strengthen employee commitment to continuous quality improvement” (p. 36). An interesting observation is that human resources and people systems are the most frequently mentioned factor necessary for successful system implementation (See Table 2). Quality management can produce competitive advantage when systems strategically emphasize and align involvement, commitment, and satisfaction (Mendelowitz et al., 1991; Powell, 1995; Samson et al., 1999). Again, the GAO study was limited by the fact that it was mostly observational and not of a statistically rigorous or empirical sort.

Adams (1994), on the other hand, took an empirical approach as he employed backward stepwise regression to investigate the relationships between "quality improvement approaches" (p. 27) and operating and financial performance. Adams conducted his analysis using a sample of 187 operations managers. Twenty questions regarding quality management practices reduced to five variables via factor analysis. However, the practicality behind some of the author's accepted factor loadings were questionable. The author, for example, accepted the combination of financial reward (i.e., pay for performance) and statistical process control as one factor simply because factor analysis suggested it. The author could have kept the items separate, he could have eliminated items, or he could have added questions for practical reasons and then reanalyzed the data using factor analysis and regression. Despite the difficulties the author had with explaining factor loadings, he proceeded to regress various operating and financial performance measures onto the five independent variables (i.e., the factors). He found that behavioral factors (e.g., management responsible for quality, employee involvement) influenced the most outcomes in terms of quality (e.g., returns, percent defective) and financial performance (e.g., ROA). Other factors, such as conformance and design and knowledge, also affected quality performance. Adams (1994) concluded that "factors – which are groupings of quality improvement approaches (items) – are required to explain quality, productivity, and financial performance," and because quality management is such a complex system, Adams went on to say that, "an individual item, expressed as one approach to quality…is not sufficient to explain performance significantly (statistically)" (p. 39). An array of factors can influence work-related outcomes (Adams, 1994).

Powell (1995) analyzed partial correlations and tested for possible associations between quality management practices and performance. One clear limitation to this study was that he used a small sample of 39 chief executive officers. Some of the independent variables Powell examined were TQM factors such as executive communication, closeness to the customer, closeness to the supplier, training, employee empowerment, and process management in relation to performance (e.g., productivity, growth in sales, revenues, profitability). Powell found that the harder (more explicit and defined) practices, which are generally associated with TQM, like benchmarking and process improvement, were not linked to advantages in performance. Powell, however, did find that "certain tacit, behavioral, and imperfectly imitable features – such as open culture, employee empowerment, and executive commitment – can produce advantage" (p. 15). The author also acknowledged the study's limitations and urged other researchers "to test their findings using larger samples and alternative methodologies" (p. 32). Multiple regression and structural equation modeling are frequently used in studies such as this (Kaynak, 2003, Sila & Ebrahimpour, 2002).

A study by Hendricks and Singhal (1997) examined the performance of nearly 400 quality award-winning organizations over a ten-year period, from 1983 to 1993, and discovered that award-winning total quality organizations experienced higher performance levels than non-award-winning organizations. Quality awards were granted from independent organizations like Baldrige or Philip Crosby, but differences between awards were downplayed. The authors used a single construct, winning a quality award, as a proxy for having a total quality management system in place. A highlight of their research is that it was one of only a few cases where objective performance measures were used in lieu of perceptual or subjective ones. Hendricks and Singhal (1997) found evidence that award-winning (TQM) firms outperformed non-awarding winning firms in outcome areas such as percentage changes in assets, in operating income, in sales, and in total costs to sales.

Morrow (1997) surveyed 2249 employees, all from the same organization, and measured only a few quality practices, specifically customer focus, continuous improvement, and teamwork. Morrow looked at the impact each measure had on specific work-related outcomes. Job satisfaction, communication, and perceptions of the work environment served as outcome measures. Morrow utilized stepwise regression to test her hypotheses. The researcher claimed that “while empirical research is not yet available to substantiate an explicit connection between each TQM dimension and these three outcomes, TQM embodies a number of well-established management precepts which suggest that TQM should have a desirable impact on these outcomes” (p. 366). The Malcolm Baldrige National Quality Award (NIST 2007, p. 32), for example, is a current guideline and “precept” which demands that certain considerations be made for employees’ satisfaction and commitment (engagement) and that current levels and trends be monitored in these vital areas. Morrow might have been the first quality management researcher to emphasize, through an empirical study, the relationships between critical quality factors and softer work-related *outcomes*. Outcome measures included communication (information quality [i.e., accuracy] and quantity) and perceptions of the work environment (warmth, support, valued employees). Morrow notes a number of studies that link single factors with outcomes; one study mentioned was by Cordery, Mueller, and Smith (1991), which showed a connection between teamwork and organizational commitment. The Cordery study focused on organizational commitment as an outcome variable, but it was interesting to find that Morrow did not include it as one of the outcomes in her study. She did, however, maintain that future research should "expand the work-related outcomes considered (e.g., job satisfaction, organizational commitment, turnover), and…[evaluate] the impact of TQM on so called 'harder' measures of organization success" (p. 371). In view of Morrow's recommendation for further empirical validation of quality factors and outcomes, and given that organizational commitment (i.e., engagement) is strongly emphasized by the MBNQA, an organizational commitment variable was incorporated into this study as a work-related outcome measure. This research will discuss organizational commitment in more detail later.

Morrow (1997) concluded that customer focus, continuous improvement, and teamwork are all significant predictors of job satisfaction, communication, and work environment perceptions, with the exception of customer focus not reaching a significant association with supervisor job satisfaction and support perception, and, interestingly, teamwork was not associated with positive perceptions of goal and performance standards.

Samson and Terziovski (1999) examined 1024 Australian and New Zealand manufacturing organizations who responded to a lengthy 17-page 246-question survey. The authors employed factor analysis to explore and reduce the data, then utilized simultaneous regression analysis (i.e., forced into model all variables at once) to determine if their factors, which were similar in notion and name to factors established in the Baldrige criteria, could explain any of the variance in operational performance. Samson and Terziovski labeled their factors leadership, people management, customer focus, planning, information and analysis, and process management. They found that "the strong predictors of performance were the so-called 'soft' factors of leadership, human resources management, and customer focus, and the more systems and analytic oriented criteria (information and analysis, strategic planning, process analysis) were not strongly and positively related to performance in the regression" (p. 403). Samson and Terziovski's regression model was significant ($F = 46.2$, $p < .001$) and it produced an R^2 of .214, meaning that it explained more than 20% of the variance in performance. Performance was measured by a single composite derived from measures of productivity, employee morale, customer satisfaction, and delivery performance, to name a few (Samson & Terziovski, 1999, pp. 401-402).

Dow, Samson, and Ford (1999) used the same dataset as Samson and Terziovski (1999), but Dow et al. focused on large firms ($n = 698$) and assessed specific performance outcomes. The outcomes include percent defective at final assembly, cost of warranty claims, total cost of quality, and assessment of defects relative to competitors. The Dow study also employed structural equation modeling (SEM) techniques instead of multiple regression methods. However, the results were similar to Samson and Terziovski (1999) and to Powell (1995). Dow et al. (1999) stated, "Only a handful of the soft aspect of quality management practices can claim a relationship with quality outcomes…" (p. 23). This is a somewhat bold statement considering previous research had identified some harder processes as critical to quality and performance.

Interestingly, Dow's findings via SEM did not support an interdependence assumption that they tested, which basically contends that systems, like a registered QMS, most likely function as a fully integrated system to the extent that complete interactions between independent variables can be expected to influence not only each other but outcomes as well. However, evidence has shown that "only a handful" of variables within a system generally emerge as significant influences on performance (Dow et al., 1999, p. 23). This suggests that a comprehensive quality management system can – and perhaps should – be explored as a partially integrated system. In other words, as long as the majority of the system is represented by independent variables, main effects analysis via multiple regression, for example, can produce valid results. This research focuses on main effects analysis as it attempts to build on existing theory and to lead the field closer to a consensus on what QMS factors are critical.

Kaynak (2003) surveyed 382 people randomly selected respondents from databases made available by the American Society of Quality (ASQ) and the Institute of Supply Management (ISM). The databases included organizations from manufacturing and service sectors with manufacturing presenting the greatest proportion (85%). Since the author did not make any accommodations for missing values, the sample was reduced to 214 usable responses. Kaynak concluded that process management, supplier management, and product/service design have direct effects on operational performance, while leadership, training, employee relations, and quality data (information) have indirect effects through the three variables that had direct effects on performance.

Kaynak (2003) mentioned the importance of validating past research and how using different research methodologies can be used to confirm previous findings as well as add consistency and confidence to one's own conclusions. Kaynak (2003), however, disagreed with Dow et al. (1999) and considers structural equation modeling (SEM) a superior method over correlation (see Powell, 1995) and multiple regression (see Adams, 1994; Morrow, 1997; Samson & Terziovski, 1999) because SEM, he claimed, is less likely to "fall short" (p. 406) in identifying critical factors that have either direct or indirect effects on performance outcomes.

Shah and Goldstein (2006, p. 148), on the other hand, reveal that, with SEM, there are few standards that researchers are expected to follow in terms of conducting analyses and interpreting and presenting results. Shah and Goldstein assert that the objectives for SEM are somewhat different from the objectives commonly set for regression. Regression is more about modeling predictive relationships and explaining variance in dependent variables, whereas SEM is more about developing theory and testing structural form (p. 151). Moreover, SEM requires that any relationships used in this type of analysis be "well established and amenable to accurate measurement in the population" (Shah & Goldstein, 2006, p 156). Researchers are still in the process of verifying the relationships between quality management factors and work-related outcomes. Moreover, theory is not firmly established and measures of quality management are not completely accurate or consistent.

Investigating specific factors, like information quality, could help further define quality management theory and underlying quality system components. Information quality has to do with the correctness of information, the amount of rechecking, and the uncertainty of its content. Information may indeed have a natural influence on performance, yet it has received little attention in the area of research. Gil Preuss (2003) found, via hierarchical stepwise regression, that information quality mediated a linkage between work design and employee involvement and performance in service quality (i.e., patient care). This one element, information quality, which did not surface as being significant in earlier studies (e.g., Kaldenberg & Goblei, 1995; Samson & Terziovski, 1999), turned out to be significant to quality and perhaps worth considering as being part of a larger QMS. The MBNQA emphasizes information quality (NIST, 2006).

Sila and Ebrahimpour (2005) surveyed 1500 manufacturing companies drawn from ASQ's database of manufacturers to look for linkages between critical factors and business outcomes. The study generated a sample of 220 respondents. Leadership and process management are the only two variables that had direct effects on business results. Leadership and information, in terms of data management and use, had the most direct effects on all other variables. Human resources had an indirect effect on business results mediated through a significant relationship with process management. Information then had indirect effects through HR and process management. Sila and Ebrahimpour concluded that leadership and information do the most in terms of shaping a complete quality management system. Leadership, however, did more than simply relate to other variables in the system. Leadership produced a significant and direct impact on results and, thus, surfaced as a main effect (i.e., critical factor). An empirically driven consensus is building for the critical role of leadership. However, Sila and Ebrahimpour were unable to confirm some of the findings from previous studies where information (see Wilson et al., 2000) and HR items (see Powell, 1995) had direct effects on results.

Prajogo and Sohal (2006) used SEM to study Australian organizations, which were ISO 9000 certified, and discovered that people and information are important factors in a quality management system. Similar to Preuss's (2003) findings in service environments, these researchers found a significant relationship between information and performance in an ISO environment. Prajogo and Sohal used the phrase "multidimensional competitive advantage" (p. 915) to describe multiple outcome measures that are important in describing the overall performance of a given organization or business. Researchers and practitioners can, and perhaps should, strategically target and study multiple measures concurrently rather than one isolated outcome at a time, particularly if the organizations desires, or if a market or industry requires, multidimensional high-performance. Prajogo and Sohal's research suggests that people management and information analysis partially mediate the relationship between strategy and specific outcomes, namely product quality and innovation. Their findings also suggest that a total quality management strategy may be connected to enhanced performance and competitive advantage through critical quality practices. The research community, however, has not reached consensus regarding every factor that may be present in a particular system and that might, in some manner, influence performance.

Overall, the literature has not conclusively demonstrated that individual system variables consistently influence performance. No distinct patterns have emerged in terms of which factors directly influence performance (Sila & Ebrahimpour, 2002, p. 940). Furthermore, researchers have not reached consensus in terms of understanding which factors are critical to quality management and performance. This is due in part to the various inconsistencies in research results (Abas et al., 2006; Sila et al., 2002). It is important for research to continue testing new theories and models until a consensus can be reached in terms of identifying the factors that consistently influence performance.

The studies described in the above section provide evidence that quality management systems can have a positive influence on work performance outcomes. However, patterns identifying critical factor are inconsistent and are still evolving, so consensus regarding which factors are most critical to performance has yet to be reached. The variety of methods and results presented in this literature review demonstrate the need for further identification and validation of critical quality factors. Validation can happen through using different methods and/or using similar and consistent methods. Despite the growing popularity and use of SEM, correlation and regression methods are shown to be adequate for the intent of this study. Claiming that SEM is more suitable in cases such as this might be premature because "when the underlying theory is not well developed, simpler data techniques such as EFA and regression analysis may be more appropriate" (Hurley et al., 1997; Shah & Goldstein, 2006, p. 154). The review also stresses the importance of attempting to understand further the true nature of a high-performance quality management system.

Industry Challenges: Quality and Competitiveness

Organizations have used total quality as part of a differentiation strategy to help them stand out in their respective markets. Strategies such as total quality are typically implemented to maintain, if not increase, market share and prevent decline (Goetsch and Davis, 2005). An evolving line of research indicates that, over the last two decades, quality management has gradually developed into an elaborate business paradigm that can differentiate an organization from its competitors. Quality management can help organizations facilitate high-performance and enhance their competitive advantage

(Buzzell & Gale, 1987; Lawler, Mohrman, & Ledford, 1995; Mendelowitz, Watson, & Usilaner [GAO], 1991; Naveh & Marcus, 2005; Reed, Lemak, & Mero, 2000; Sila & Ebrahimpour, 2005).

Some authors, on the other hand, believe that quality systems are a useless fad and any organization that tries to implement one is doomed to fail (Bleakly, 1993; Economist, 1992; Spector & Beer, 1994). Choi and Behling (1997) (as cited in Dooley & Flor, 1998, p. 158) blamed failure on the QMS's inability to produce positive results that affect the bottom line. In addition, the authors argued that system failure is partially a function of how managers strategically structure and support the system. In other words, leaders must construct the quality management system and support the critical factors they choose to include or risk suffering the consequences. According to Van De Wiele, Williams, and Dale (2000), organizations must clearly define and support a quality system and tie it to success in order for it to progress from a business "fad" to an organizational "fit."

Quality systems can fail from not having the appropriate factors in place at time of implementation. For example, "companies that have registered to QS-9000 before they were actually ready implemented a system that deteriorated over time. This is why it's so important to set the foundation for your [QMS]…" (Brown, 1997, p. 38). An organizational risk remains where if one critical factor in a quality system is not properly identified and supported, then failure can result.

It has long been held that quality management does in fact represent a significant business system, yet its acceptance continues to be challenged, especially by those who view it as nothing new. However, the advent of standardized quality management systems and comprehensive models, like TS2 and the MBNQA, respectively, are progressive organizational undertakings as well as powerful catalysts for developing research. The model concept is arguably a new strategic approach. However, the question then becomes, “Is the proposed model for quality management consistent with theoretically supported and empirically tested definitions?”

Advanced Quality Management Model/System: MBNQA

The MBNQA, created by Congress and signed into law by President Reagan in 1987, is the benchmark quality management model (cf., Ahire & O’Shaguhnessy, 1998; Black & Porter; 1995; Garvin, 1991; Hackman & Wageman, 1995; Johnson, 2001; Prajogo & Sohal, 2006; Mendelowitz, et al., 1991; Wilson & Collier, 2000). Flynn et al. (1994, p. 334) claimed that the MBNQA is one way to assess the validity of any intended quality management system. More recently, C. P. Kartha (2004), from the University of Michigan, described the MBNQA as the “*de facto* definition of TQM” (p. 331). More companies have started to take note of quality management’s potential. In fact, five years after the formation of the MBNQA, nearly 90% of America’s 500 largest companies had implemented some type of total quality management program (Powell, 1995).

Self-assessments relative to the Baldrige criteria are the key drivers toward improvement (NIST, 2006). The Baldrige model, as shown in Table 1 and Figure 2, has seven major criteria: 1) leadership, 2) strategic planning, 3) customer and market focus, 4) measurement, analysis, and knowledge management, 5) workforce focus, 6) process management, and 7) results, which are critical to quality management and performance (NIST, 2006, p. 5).

Wilson and Collier (2000) evaluated the implicit relationships portrayed in the MBNQA model (See Figure 2), such as whether process management is a predictor of results, and they found that a small array of MBNQA factors did in fact predict certain results. Process management, for example, had a positive association with both business results and customer satisfaction. Information analysis shared the same relationships as process management did with business results and customer satisfaction. Wilson and Collier adopted measures from existing literature, namely Flynn, Schroeder, & Sakakibara, 1994. Their instrument also included several new items drawn directly from the MBNQA criteria to give a more comprehensive and valid measure of what constitutes a high-performance quality management system. Wilson and Collier's work served as a benchmark for this study (See Table 5 below variable descriptions). The researchers posed more than 100 questions that were reduced using factor analysis to help them define several critical factors of quality management or, as it turns out, the seven Baldrige criteria. Chapter 3 discusses the Baldrige criteria in more detail.

Sila and Ebrahimpour (2002) examined 76 survey studies from 1989 to 2000 to determine the range of categories that have been used to describe the factors of TQM and to determine which categories are the most frequently researched. The Saraph et al. (1989) study and the Wilson et al. (2000) study were part of the 76 survey studies included in their analysis, and this research reviewed both studies. Sila and Ebrahimpour grouped *ex post facto* Saraph's 81 questions into 14 of the 25 categories. Sila and Ebrahimpour defined the 25 categories using keywords from the 76 studies they analyzed. Saraph, however, used factor analysis and reliability (internal consistency) to confirm and validate the eight critical factors and scales they derived from literature.

Similarly, Wilson meticulously developed 101 questions and nearly 20 items and used factor analysis to confirm the fit of the data with the seven major criteria defined by Baldrige. Sila and Ebrahimpour's research suggested that one could describe an advanced quality management system by as many as 25 categories or subcategories. Baldrige refers to these subcategories as "criteria items," "performance-oriented requirements," and as "assessment dimensions," (NIST, 2006, pp. 6-7). The researchers also discovered that customer focus, human resources, leadership, process management, information, and strategy were the most frequently used categories for assessing a quality management system. The same authors put forth similar conclusion in a later study (Sila et al., 2005). Their findings reflect the increasing use of award models, like the MBNQA, as accepted frameworks for advanced quality management systems.

Advanced Quality Management System: ISO/TS 16949

Not only is there the challenge to discover the factors that define a high-performance QMS, but some organizations are faced with the challenge of having to be certified to an industry-mandated quality standard that is not convincingly (i.e., empirically) linked to enhancements in multidimensional outcomes. This study questions the nature of several mandatory requirements in the ISO/TS standard and examines their connection to multidimensional outcomes.

Some experts have argued that certified systems, like ISO9000 and QS9000, are of high-performance, total-quality caliber given that part of the intent is to systematically manage, if not improve, processes, product quality, and customer satisfaction (Brown, 1997; Corrigan, 1994; Johnson, 2001). Certified (registered) quality management systems that are similar in content to the MBNQA have served as proxies for TQM because having an actual quality system focuses efforts on quality, which is a main emphasis of the MBNQA (Johnson, 2001; Brown, 1997). However, despite the many inherent similarities between the MBNQA and quality standards like ISO, some researchers assert that having a certified system is merely a first step toward total quality (Curkovic & Handfield, 1996). The MBNQA, on the other hand, states that systems registered to a quality standard, like ISO, demonstrate a level of maturity in deployment and approach to quality and performance management (NIST, 2006, p.14). The relationship between the auto industry's quality standard and performance outcomes is still unclear (Johnson, 2001). Johnson (p. 167) recommends that future research utilize the MBNQA criteria as a comprehensive assessment of whether an organization has a high-performance QMS in place.

Auditing is a major rule and mandate in the automotive industry that practically every supplier must endure. Organizations that conduct business in the automotive industry and who are directly involved in value-added manufacturing (e.g., materials, assembly, service parts) must have their QMS successfully certified and routinely audited by internal and external sources in order to be awarded future business (AIAG, 2003; Johnson, 2001; Stamatis, 2004).

A major implication for having a third-party certified QMS is that customers, namely automotive Original Equipment Manufacturers (OEMs), look to this as evidence to base key sourcing decisions. Consequently, suppliers must comply with the given standard in order to sustain and/or quote new business with OEMs. Suppliers have to measure up because failure to maintain certification can result in a loss of new or existing business (Johnson, 2001). Kulp and Narayanan (2004) created a Harvard Business Case that describes the multiple dimensions and customer performance measures typically tracked in the auto industry. Their case shows how QMS certification brings with it a series of required performance measures, referred to as customer scorecards, where OEMs, for example, ask suppliers to report product quality, customer satisfaction, and delivery data. The case illustrates the importance of achieving multidimensional competitive advantage because organizations that achieve this milestone are recognized leaders in excellence and targeted as key sources for future business.

ISO/TS 16949 (TS2) is the newly revised global automotive industry quality management standard (AIAG, 2003; 2004). The new standard is based on ISO 9001:2000 and mirrors the MBNQA in core values and quality management principles (e.g., customer focus, leadership, employee involvement, and process approach). The TS2 quality standard, published in March of 2002, “aligns existing American (QS9000), German (VDA6.1), French (EAQF), and Italian (AVSQ) automotive quality system standards…and eliminates the need for multiple certifications” (Kartha, 2004, p. 336). QS9000, which was the former automotive QMS standard in the U.S., has transitioned to TS2. A full-compliance deadline was set for December 14, 2006, for all Tier 1 suppliers. Conformance audits, per requirements of the standard, look for positive results in product quality, customer satisfaction, and delivery (AIAG, 2004; QMI, October 2006).

The new TS2 standard is an extension of the ISO 9001:2000, and it includes seven mandatory procedures that organizations must have documented: 1) control of documents, 2) control of records, 3) training, 4) internal audit, 5) control of nonconforming product, 6) corrective action, and 7) preventive action (QMI, October

2006; Stamatis, 2004). The term “documented procedure,” as it appears in the International Standard, “means that the procedure is established, documented, implemented and maintained” (AIAG, 2003, p. 5). For example, according to TS2, internal auditing of records, processes, and operations is a mandatory procedure, so there must be evidence of this practice at work in the system at time of official audit. Auditing is critical enough that the automotive industry made it mandatory event. Third-party audits will check to see that organizations regularly conduct internal audits and that organizations comply with the TS2 standard (AIAG, 2004; QMI, October 2006).

Organizations might use audit readiness checks and effectiveness assessments to measure the perceived level of conformance with respect to the implementation and application of the seven mandatory procedures. Organizations might consider making audit readiness assessments routine if perceived as having some benefit. At the present, complete system pre-audits are an option recommended, but not mandated, by the standard. However, a pre-audit readiness check that focuses on key areas, namely the mandatory procedures and frequently reported items on scorecards (i.e., outcomes), could perhaps benefit the organization by giving it a rapid systems assessment.

Human Aspects of Quality Models and Systems: Inputs and Outputs

Saraph et al. (1989) claimed that it was important that “decision makers…know the status of the organizational controllables (in this case, the levers of quality management) that they can manipulate to make organization-wide improvements in quality performance” (p. 811). Similarly, Welsch and LaVan (1981) suggested that “management [be] concerned with identifying those variables that are related to organizational commitment in order that they may design organizational strategies to maximize commitment levels" (p. 1079). Organizations need to pay close attention to the audit "lever" because it is a mandatory procedure per the standard. Another lever needing attention is employee attitudes because employees are a common denominator within all quality systems, and a greater understanding of this link is needed.

Organizations have concerned themselves with employee attitudes and behaviors for some time and for obvious reasons. It is apparent and understood that employees have some degree of influence on performance. Organizations that take employee matters seriously and believe attitudes, like job satisfaction and commitment, are important are encouraged to measure attitude levels on a regular basis. Organizations that confirm levels of commitment and satisfaction can then address the matters in corporate strategy and managerial action plans. It is well known that attitudes and behaviors in need of improvement can be modified by rewards, goal setting, training, or improved work design, for example, in order to achieve a more desirable arrangement that enhances performance (Hackman & Oldham, 1976; Herzberg, 1994). Moreover, the MBNQA recognizes this idea, that people influence performance, as it suggests that certain attitudes be measured regularly. The MBNQA suggests multiple metrics be used that offer broad, multidimensional assessment of the organization and of the overall management system (NIST, 2006). However, in most of the research contained in this literature review, the performance measures were mainly financial or operational. Several studies included "soft" inputs (e.g., employee involvement, teamwork) but only a few investigated more than one soft output. Few studies looked at multiple metrics and included attitudinal measures (e.g., Adams, 1994, Powell, 1995). This study incorporates a multidimensional competitive advantage perspective as it investigates multiple outcome measures and quality factors characterized as soft and hard.

Summary

The literature review has established the scope and context for this investigative study. This author has argued several key points. First, quality experts like Deming and Juran have proposed various factors and models of quality management. Some expert theories have been tested and empirically supported. Second, researchers have linked some critical factors to positive work-related outcomes and performance. However, no distinct patterns between studies have emerged in terms of which factors directly influence performance. Third, a quality management system can lead to enhanced performance and competitive advantage, but agreement of what constitutes a model system is still up for debate. Fourth, the MBNQA is the benchmark quality management system. Future research, via multiple regression or SEM, for example, can utilize the MBNQA criteria as a comprehensive assessment to determine which factors are critical to performance. Fifth, the auto industry's ISO/TS 16949 quality standard is mandatory for a majority of suppliers. ISO/TS registered organizations must continue to meet the standard or risk being noncompliant, which could ultimately translate into loss of business. Sixth, organizational assessments are necessary in most advanced quality management systems. The MBNQA recommends self-assessments. The auto industry mandates internal and external audits. However, research on the subject is nonexistent. Seventh, understanding human attitudes and perceptions of quality and work are essential to any business. An interesting observation is that existing research frequently mentioned people as a common denominator in most quality systems. Researchers need to investigate the “softer” human aspects of quality as well as the “harder” and more technical system characteristics. Researchers should not ignore or be quick to dismiss the softer aspects of quality management. Last, relationships between quality factors and multidimensional outcomes need more explanation through empirical research.

Chapter 3: Methodology

Chapter 3 outlines the methods utilized to test the research questions and hypotheses described in Chapter 1. The chapter discusses the overall design and research procedures used in the study, and it describes the participants and sample population. Chapter 3 includes considerations regarding statistical power and sample size. It describes the operationalized measures and critical factors, which served as the independent and dependent variables in regression, and it details the tests of validity and reliability employed in the study.

Procedures

This research examined mandated quality management systems present in the automotive industry. The investigation used a survey instrument consisting of several factors associated with high-performance quality management. The instrument incorporates criteria from the MBNQA and the ISO/TS 16949 standard. Theory and existing research in the area of quality management assisted in validating the instrument. Experts helped validate the instrument as well. Internal consistency (i.e., reliability) of the survey instrument scales (i.e., composite variables) were assessed using Cronbach's alpha. The instruments section (below) and Appendix C offer a complete description of the survey.

The purpose of the instrument and this research was to identify critical factors of quality within a model quality system (i.e., ISO/TS 16969), which parallels the MBNQA, and then compare (confirm) these findings with factors that are emerging in contemporary quality management literature. The study employed correlation and simultaneous and stepwise regression methods to empirically test whether certain variables found within the registered quality management system had an impact on work-related outcomes (e.g., product and service quality and customer focus) and whether audit readiness, with respect to mandated procedures, mediated the relationship between critical quality practices and work outcomes. Data were analyzed using regression in SPSS version 14 for Windows.

Participants and Sample Population

The principal sample had a targeted response of approximately 250 quality professionals from the automotive industry. Controlling for industry would help assure that critical quality practices were present in each organization and that mandatory QMS registration and third-party audits took place. Consequently, generalizability will be limited to this group. A targeted range of approximately 150 to 250 participants is a conservative sample that is similar to the numbers in related research (cf., Adams, 1994 [187 usable responses]; Black & Porter, 1996 [204]; Silas & Ebrahimpour, 2005 [220]; Wilson & Collier; 2000 [160]).

The American Society of Quality (ASQ) Automotive Division council granted the author indirect access to its industry-specific database for use as the sampling universe or population. The research obtained its principal sample by having the ASQ send out an invitation to participate in one ASQ's regular mass electronic mailings to its Automotive Division members. When ASQ elected to send the survey invitation to all automotive division members, they essentially dictated a convenience sample.

Quality professionals in ISO/TS registered organizations were the unit of analysis. These individuals were considered key respondents because they were likely to have the most knowledge of the organization's quality systems and strategies. ASQ members have served as the population for related studies (cf., Black & Porter, 1996; Johnson, 2001; Saraph et al., 1989; Wilson et al., 2000; Yusof & Aspinwall, 1999).

ASQ, however, mandated that questionnaires be accessible on the web and should be mailed out only as a follow-up measure to improve response rate. This study did not employ a paper version of the survey nor did it offer any special incentives to increase response rate. A self-report web-based survey routine collected data from the surveys completed on-line (www.surveymonkey.com, 2007). This author exported the data accordingly to Microsoft Excel and to SPSS for more in-depth analyses. All data were kept secure using means such as locking records in cabinets and drawers and password protecting electronic files.

Respondents were asked to provide demographic data such as age, educational level, position, and years in automotive. Two hundred and eighteen (218) automotive division members submitted surveys of which the study deemed 172 usable for its sample and analysis. Consultants, registrars, and academics were removed from the sample to stay in line with the original intent of focusing on manufacturers with registered quality systems. Missing data values on more than 10% of all cases concerning independent and dependent variables were declared unusable and subsequently removed from the data set.

Power and Sample Size Estimation

Green (1991) claims that, as a rule, one can use the following equations, $N \geq 50 + 8k$ and $N \geq 104 + k$, to calculate a reasonable sample size. The letter k represents the number of independent variables used in the study, which in this case were seven. The estimate also assumes a medium size relationship between independent and dependent variables with $\alpha = .05$ and $\beta = .20$. Sample size was calculated using both equations, and the larger of the two was considered. The larger estimate, derived from the latter equation, resulted in a target sample of 111. Doubling the number of predictors to fourteen produced a required sample size of 162 per the equation, $N \geq 50 + 8k$. This equation produced the larger estimate. This estimation process gave some indication as to what more power and/or more predictors would require in terms of sample size.

Miles and Shevlin (2001, pp 119-125) provide sample size charts that are very useful. An alpha of .05, a power of .80, a medium effect size (.10 to .30), and the chart for six predictors derived a reasonably powerful sample size. The corresponding chart indicated that a sample of 120 or more would suffice. A seven-predictor chart, however, was not available; the next level up was 10 predictors. Consequently, the study targeted a sample larger than the estimated sample of 120.

The study utilized G-Power 3.0 Software, which allows inputs to take into account the actual number of predictors, to help determine what an appropriate sample size should be. Inputs included a medium effect size, an alpha of .05, and power of .80, and seven predictors were used to estimate the sample size. The software showed that 153 respondents would be a large enough sample to show significant effects. Increasing power to .90 increased this figure to 193. Returning the power level to .80, then adjusting the number of predictors to ten and holding all other inputs constant resulted in an estimated sample size of 174. Fourteen predictors under the given conditions required 198 responses. A larger sample or one in excess of 200 would obviously add more predictive power to a study such as this. An interesting note is that more responses are needed to demonstrate small to medium effects versus medium to large ones. A target of 150 to 250 respondents was adequate. This study included 172 usable responses.

Instrument and Measures

This author used a collection of existing scales to develop an instrument that assessed the various factors commonly found in a quality management system. Scales incorporated into the survey included a new audit readiness composite variable and multiple work-related outcome measures. The next section describes each composite variable (scale). Using existing scales adds a greater level of understanding to the field of quality management and adds value to the current body of empirical research as this study served, in part, to validate existing scales through further application using different methods of analysis (i.e., regression versus SEM). Demographic and company information was collected. The final survey is located in Appendix C.

For this study, the main quality system factors served as independent variables. The study used composites that aimed to measure six of the seven major categories of the MBNQA (Leadership, Strategic Planning, Customer & Market Focus, Measurement, Analysis & Knowledge Management, Workforce Focus, and Process Mgmt), which are part of the system's foundation and operation (see Figure 1). The experts behind the NIST and the Baldrige National Quality Program claim that the MBNQA categories, like

"Measurement, Analysis, and Knowledge Management (Category 4) are *critical* [emphasis added] to the effective management of your organization" (NIST, 2006, p. 6).

Dependent variables consist of items that fall under the seventh category of the MBNQA (i.e., Results) and include product/service quality, innovation, customer satisfaction, defects, job satisfaction, and market share. Each variable is described at greater length in the next section and in Appendix C.

A comprehensive quality system survey instrument developed by Wilson and Collier (2000) was selected for use in this study as a benchmark. It was chosen mainly because of its detail in depicting a model quality management system that parallels the MBNQA and because the instrument shares many similarities with the Samson and Terziovski's (1999) instrument, which used the MBNQA as a guide for question development. Wilson and Collier's instrument also used several questions from Flynn et al. (1994). Wilson subjected their instrument to a rigorous development process, which swayed this author's decision to select it as a benchmark instrument.

Wilson used robust methods (e.g., pre-tests, pilot study, internal consistency, factor analysis) to assure the validity and reliability of their instrument as a measure of MBNQA criteria. It is likely that each scale or composite does not completely measure its respective construct. However, Wilson's original instrument, relative to other instruments in its class, captures a majority of the most critical categories of TQM and measures categories, like strategic planning, that most others do not capture (Sila and Ebrahimpour, 2002, p. 945). Literature suggests measuring quality systems using the MBNQA format even when assessing registered quality management systems (Johnson, 2001; Sila & Ebrahimpour, 2002). This is most likely due to the fact that many of the same factors that are present in the MBNQA are also stressed in the ISO family of standards (e.g., ISO/TS 16949:2002) (QMI, October 2006). See Figure 2 and Table 3 for more detail. The ISO/TS quality system standard, for example, is the entire ISO 9001:2000 standard with interpretations of ISO language and added technical specifications (TS) by the International Automotive Task Force and Japan Automobile Manufacturers Association (AIAG, 2003, Technical Specification, p. vii).

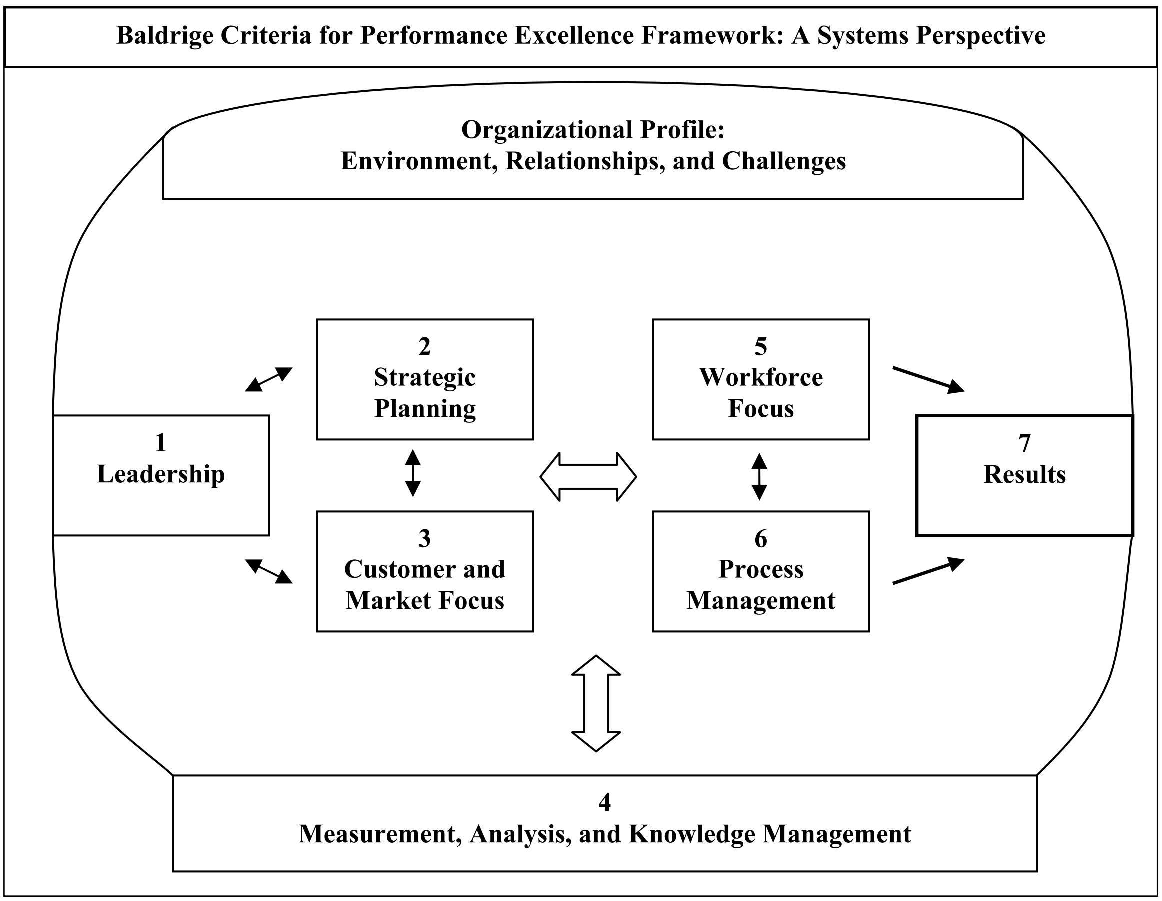

Figure 2. Critical Factors of the MBNQA (Excerpted from the Baldrige National Quality Program, (NIST, 2006), *Criteria for Performance Excellence*, p. 5)

Table 3.

Quality Factors and Mandatory Procedures in ISO Standards

Eight Quality Management Principles*	Parallel Quality Factor** used in this study	Seven Mandatory Procedures*	Parallel QMS Perceived Audit Readiness Items used in this study
1. Customer Focus	Customer & Market Focus	4.2.3 Control of Documents	Document Control (QQ1)***
2. Leadership	Leadership	4.2.4 Control of Records	Records Maintenance (QQ2)
3. Involvement of People	Workforce Focus	6.2.2.2 Training	Training Procedures (QQ3)
4. Process Approach	Process Management	8.2.2 Internal Audit	Internal Audits (QQ4)
5. System Approach to Management	Strategic Planning	8.3 Control of Nonconforming Product	Control Nonconformance (QQ5)
6. Continual Improvement	Process Management	8.5.2 Corrective Action	Corrective Action (QQ6)
7. Factual Approach to Decision Making	Measurement, Analysis, & Knowledge Management	8.5.3 Preventive Action	Preventive Action (QQ7)
8. Mutually Beneficial Supplier Relations	Process Management		

Note:
*Eight Quality Management Principles and Seven Mandatory Procedures were excerpted from *ISO/TS 16949:2002 Automotive Quality Standard*, retrieved 10/26/07 from QMI's information center at www.qmi.com/information_center/standards/iso16949/. Eight principles are also referred to in Sila & Ebrahimpour, 2002, p. 944
**MBNQA criteria (factor) that had the most apparent (direct or indirect) relationship with the ISO management principle was listed
***QQ1, for example, represents question 1 in the QMS audit readiness and process effectiveness scale

Wilson and Collier (2000), Samson and Terziovski (1999), Saraph et al. (1989), and Flynn et al. (1994) all used factor analysis to develop their instrument. Wilson and Collier tested their instrument for content and construct validity. The instrument, as shown in Table 5, contains several measures for independent and dependent variables. The internal consistency of the various scales within Wilson and Collier's instrument had significant Cronbach alphas of greater than 0.80.

Baldrige criteria ask "how" something usually happens. Auditors must look for evidence that demonstrates that an item is present or occurs at positive or reasonably high levels. This particular survey measures the extent to which things like leadership and other Baldrige criteria take place. Each composite captures most of the items within a given criteria. As mentioned, internal consistency was used to test the reliability of each scale. A limitation of the instrument might be that it does not capture every single item and/or nuance of the MBNQA. However, a balance had to be reached between actual content and the anticipated response rate. This study uses a pre-existing instrument, and, since extreme modifications would most likely diminish its reliability, the research allowed only slight modification to the contents of the instrument. Expert input and literature review validated the resulting instrument. Following is a brief description for each variable, including those derived from the Baldrige award.

Variables: Quality Factors and Work-Related Outcomes

Independent variables (IV).

Leadership or LEAD, which is the variable code used in SPSS, is considered a major "driver" in quality management (Samson and Terziovski, 1999). This concept is operationalized via a composite scale that consists of seven items. As described in the MBNQA (NIST, 2006, p. 15) and as illustrated in Appendices C and E, the leadership composite consists of items related to executive responsibility, ethics, vision, setting objectives, participating in quality management, and being accessible to interested parties, namely customers and employees. The leadership scale asked respondents to indicate their level of agreement or disagreement with statements such as "There is a high degree of senior management participation in quality management activities." Questions for all major variables were presented on a scale of one to seven. For most questions, a score of one reflected a negative response, as in strongly disagree or no emphasis, and a score of seven reflected a positive response, such as strongly agree or extreme emphasis.

Strategic planning (STRA) involves creating broad objectives as well as developing and deploying business management plans. Respondents were asked to rate five items that describe strategic planning on a scale of one (strongly disagree) to seven (strongly agree). The scale includes items related to customer involvement and competitive comparisons in establishing broad, yet thorough, business plans. Alignment between short-term and long-term plans is emphasized. Translating important goals into business drivers and performance measureables is an integral part of strategic planning (NIST, 2006, pp. 18-19). Extent of deployment is a final item used to capture the essences of strategic planning and, thus, completes the composite.

Customer and market focus (CUST) consists of contacting and identifying customers within the market. The composite (criteria) highlights the importance of understanding customer needs and expectations as well as effectively handling customer relationships and complaints. It factors in close relationships that facilitate return business (NIST, 2006, pp. 21-22). Close contact, understanding needs and expectations, and complaint management are part of this relative scale used to measure customer and market focus. Respondents answered four questions that described their organizations' customer and market focus. Response options ranged from one (strongly disagree) to seven (strongly agree).

Measurement, analysis, and knowledge management (INFO) encompasses the data and information (e.g. customer feedback, comparative benchmarks) collected, aligned, and integrated into the system. It takes into account how organizations use information in connection with performance and how they evaluate the processes for collecting and analyzing data (NIST, 2006, pp. 24-25). The survey measured this concept using four questions. Response options ranged from one (no emphasis) to seven (extreme emphasis).

Workforce focus (HR) is the largest composite, consisting of 12 items, which covers the people and activities within the work environment. It examines the extent to which these facets are aligned with objectives. HR is concerned with employee well-being and includes factors like health, safety, and education. The Baldrige suggests employee involvement in improving the business. Measurement of employee views regarding the work environment and their training needs are advised. Employees are expected to be trained in quality and to share in the responsibility for high performance (NIST, 2006, pp. 26-28). Responses ranged from one (strongly disagree or no emphasis) to seven (strongly agree or extreme emphasis).

Process management (PROC) encompasses the design, management, and improvement of key work processes and core competencies. Process management incorporates statistical techniques and functions to reduce and control variation and to improve processes (NIST, 2006, pp. 29-30). Respondents answered seven questions that described the extent of process management at their organization. For example, the survey asked respondents to indicate their level of agreement or disagreement with statements such as "A large percent of the key processes and equipment in our facility are currently under statistical quality control." Response options ranged from one (strongly disagree) to seven (strongly agree).

For more in-depth descriptions of each variable, read the MBNQA criteria and Wilson and Collier (2000). Some key factors that have potential for being critical to quality in relation to the automotive industry, and are not directly addressed by the MBNQA, are the concepts of internal auditing and audit readiness and effectiveness.

Mediator variable.

Research defined a QMS perceived audit readiness scale using mandatory procedures from ISO9001:2000 and TS2 standards. Table 3 above illustrates the standards' multiple mandatory items. The scale consists of eight closed-ended questions that range in response from one (strongly disagree) to seven (strongly agree). The survey asked respondents to express their level of agreement or disagreement with statements such as "Our documented records maintenance procedure is proven to be effective in practice." Research tested this particular variable as a potential mediating independent variable within the system, and it tested it separately as a process effectiveness outcome (dependent) variable. The section following the descriptions of the dependent variables describes the results of the checks for instrument validity and reliability.

Dependent variables (DV).

Work-related results, according to the MBNQA (NIST, 2006), include process effectiveness outcomes, product and service outcomes, customer focus outcomes, financial and market outcomes, leadership outcomes, and workforce focus outcomes.

Process effectiveness outcomes are a diverse set of results that includes measures such as productivity, cycle time, and response time for emergency drills. The Baldrige criteria also states that appropriate measures of work system performance may include audits (NIST, 2006, p. 33). This study incorporated the audit readiness variable also as a dependent variable representing a specific process effectiveness outcome.

This study combined product and service outcomes and customer focus outcomes into one composite variable sometimes referred to as customer performance metrics. Performance measures in these areas should cover outcomes that are important to the customer, and the selected measures should be assessed relative to the competition's performance (NIST, 2006, p. 33). For example, with respect to product and service outcomes, the survey asked respondents to indicate their plants' position as compared with the competitor's in areas such as defect rates and overall product/service quality. Similarly, for customer focus outcomes, the survey study asked respondents to indicate their plants' relative position to the competitor's in areas such as warranty claims, missed shipments, and overall customer satisfaction. Respondents answered six questions that described product and service outcomes and customer focus outcomes as one composite.

Financial and market outcomes, also referred to as business results, include measures such as return on investment (ROI) and market share (NIST, 2006, p. 32). This study presented a composite scale that encompassed three questions measuring ROI, return on sales (ROS), and market share. This study did not ask leadership outcome questions related to governance and fiscal accountability, for example, because these types of questions are perhaps more suitable for executives positioned at the firm level.

Workforce focus outcomes measured in this study deal with the satisfaction and engagement of the workforce. Engagement is defined by the MBNQA (NIST, 2006) as "the extent of workforce commitment, both emotional and intellectual, to accomplishing the work, mission, and vision of the organization. Organizations with high levels of engagement [i.e., commitment] are often characterized by high-performing work environments in which people are motivated to do their utmost for the benefit of their customers and for the success of the organization" (p. 27).

Organizational (affective) commitment is a work-related outcome and is a measure of one's emotional attachment to an organization. A commitment scale developed by Meyer and Allen (1997) was used. Mowday, Porter, and Steers (1979), who are pioneers in the behavioral science field, described commitment "as the relative strength of an individual's identification with and involvement in a particular organization." They stated, "it can be characterized by at least three related factors: (1) a strong belief in and acceptance of the organization's goals and values; (2) a willingness to exert considerable effort on behalf of the organization; and (3) a strong desire to maintain membership in the organization" (p. 226). Mowday et al. continued by saying that organizational commitment "represents something beyond mere loyalty to an organization. It involves an active relationship such that individuals are willing to give something of themselves to contribute to the organizations well being" (p. 226). Meyer and Allen's (1997) scale is specific in that it consists of six close-ended questions based on a one-to-seven Likert-type scale that ranges from strongly disagree to strongly agree. Mowday et al. (1979), on the other hand, produced a scale that consisted of nine questions. Meyer's original coefficient alphas ranged from 0.77 to 0.88.

The scale used in this study to measure job satisfaction was one created by Cammann, Fichman, Jenkins, and Klesh (1983) for use in the Michigan Organizational Assessment Questionnaire. The three closed-ended questions used a Likert scale with response options that ranged from one (strongly disagree) to seven (strongly agree). Previous work that utilized this instrument is an indication of the instrument's validity.

The internal consistency of the original instrument produced a coefficient alpha value of 0.95. Table 4 provides a summary with keyword descriptions relating to each question.

Table 4.

Variable (Scale) List and Keyword Descriptions

Variables	SPSS Code	Scale Coverage & Item Keywords
Quality System Factors *Independent Variables:*		
Leadership	LEAD	Responsible for Quality (LQ1)*, Encourages Employee Involvement (LQ2), Participate in Quality (LQ3), Accessible (LQ4), Vision (LQ5), Performance Objectives (LQ6), Legal & Ethical Behavior (LQ7)
Strategic Planning	STRA	Customer, Supplier, Employee Involved (SQ1), Competitive Comparisons & Benchmarks (SQ2), Short Term & Long Term Aligned (SQ3), Translated into Business Drivers & Performance Measures (SQ4), Level of Deployment (SQ5)
Customer & Market Focus	CUST	Frequent & Close Contact (CQ1), Understand Needs & Expectations (CQ2), Complaint Cause Management (CQ3), Return Business (CQ4)
Measurement, Analysis, & Knowledge (Information)	INFO	Access to Reliable Data (IQ1), Collect Feedback (IQ2), Integrate Knowledge & Data into Plans (IQ3), Evaluate Data Collection & Analysis Processes (IQ4)
Workforce Focus (Human Resources)	HR	Aligned Plans (HRQ1), Employee Development Objectives (HRQ2), Recognition & Reward (HRQ3), Improvement Activities (HRQ4), Conducive Work Environment (HRQ5), Measure Employee Views (HRQ6), Range of Tasks (HRQ7), Responsible for Quality (HRQ8), Motivation (HRQ9), Training in Quality (HRQ10), Employees Involved in Training Development (HRQ11), Evaluate Training Benefits (HRQ12)
Process Management	PROC	Mistake Proofed Processes (PQ1), Statistical Process Control (PQ2), Reduce Variation & Improvement (PQ3), Monitor Performance, Charts & Diagrams (PQ4), Long Term Relationships with Suppliers (PQ5), Select Quality Supplier (PQ6), Small Number of High Quality Suppliers (PQ7)
Organizational Outcomes *Dependent Variables & Tested Mediator Variable:*		
Process Effectiveness Outcomes – QMS Perceived Audit Readiness (Standard Mandatory Outcomes)	QMS	Effective Documented Procedures regarding: Document Control (QQ1), Records Maintenance (QQ2), Training Procedures (QQ3), Internal Audits (QQ4), Control Non-Conformance (QQ5), Corrective Action (QQ6), Preventive Action (QQ7), Customer Oriented Processes (QQ8)
Financial & Market Outcomes (Business Results)	OUTbusiness	Market Share (BRQ1), Return on Investment (BRQ2), Return on Sales (BRQ3)
Workforce Focused Outcomes – Satisfaction (Job Satisfaction)	OUTjobsat	Satisfied with Job (JSQ1), Don't Like Job (JSQ2), Like Working Here (JSQ3)
Workforce Focused Outcomes – Engagement (Organizational Commitment)	OUTorgcom	Spend Career Here (OCQ1), Organization Problems are My Own (OCQ2), Part of the Family (OCQ3), Emotionally Attached (OCQ4), Organization has Personal Meaning (OCQ5), Sense of Belonging (OCQ6)
Product & Service Quality / Customer Focused Performance Metrics Outcomes (Customer Satisfaction)	OUTcustomer	Incomplete Orders, Missed Shipments or Deliveries (CSQ1), Returns and Warranty Claims (CSQ2), Defect Rates (CSQ3), Product/Service Quality (CSQ4), Innovation (CSQ5), Customer Satisfaction (CSQ6)

Note: LQ1, for example, represents Leadership Question 1 as found in the survey instrument

Table 5.

Benchmark Study and Comparison: Wilson and Collier, 2000

Wilson & Collier (2000)	Author's Study
Sample Population: ASQ Automotive Division	Sample Population: ASQ Automotive Division
Survey Instrument: 101 Questions	Survey Instrument: 90 Questions*
Response: 226 (160 useable)	Response: 218 (172 useable)
Research Method: Structural Equation Modeling	Research Method: Multiple Regression
Independent Variables: -Leadership -Strategic Planning -Information & Data Analysis -Human Resources Management -Process Management	Independent Variables [SPSS Code]: -Leadership [LEAD] -Strategic Planning [STRA] -Customer & Market Focus [CUST] -Measurement, Analysis, & Knowledge (Information) [INFO] -Workforce Focus (Human Resources) [HR] -Process Management [PROC]
Dependent Variables: -Business Results -Customer Focus & Satisfaction	Dependent Variables: -QMS Audit Readiness (Performance Effectiveness) [QMS] -Financial & Market Results (Business Results) [OUTbusiness] -Workforce Focus – Job Satisfaction [OUTjobsat] -Workforce Focus – Organizational Commitment [OUTorgcom] -Product/Service Quality & Customer Metrics [OUTcustomer]

Note: *Most questions used in this study were excerpted from benchmark study, i.e., from Wilson & Collier (2000), with permission.

Validity

Review of related studies and content analysis of quality management literature assisted in the development of survey instrument questions. The author used existing scales in constructing most of the survey instrument as described above and as shown in Appendix C. The perceived QMS audit readiness scale, however, was developed by this author based on the mandatory requirements of the current automotive industry standard, TS2, and as suggested by the Baldrige criteria, which suggests that audit activities are possible process effectiveness outcome measures.

EMU's quality management faculty, graduate students, and experts from their Center for Quality along with AQSR lead auditors, and quality professionals from the automotive industry were involved in evaluating and pre-testing the instrument. Pre-tests included a group of more than 20 quality professionals to check the instrument's face validity and to analyze the instrument for substance, format, fit, and readability. Content validity was also based on a review of related literature.

ASQ required the author to convert the full instrument to a web-based format and then conduct a second pre-test and on-line pilot run of the survey with a separate group of industry experts, namely ASQ automotive division members. This author provided a general invitation to the Auto division chair so she could email it to a select group of experts who were willing to take part in the pre-test. The communications are provided in Appendix B. The invitation included a direct link to the web-based pilot instrument. Most of the changes stemming from the pre-tests were related to wording and to the actual number of questions that were being asked. A small minority of pre-test participants expressed concern about possible respondent fatigue and about question overlap and redundancy. No one claimed to have difficulty responding to any of the questions in the instrument.

All concerns that emerged during the pre-test phase were taken seriously to the extent that the author made appropriate wording adjustments and reduced the total number of questions to avoid any issues such as bias. The investment in time and cost per respondent to complete the survey was a consideration. The instrument started out with more than 110 questions, at which point most of Wilson and Collier's questions were used, along with the QMS perceived audit readiness questions. The final instrument, however, was narrowed to 90 questions total. Questions that were deemed potentially redundant or tangential were removed. As an example, three questions in the original instrument related to information systems and were subsequently removed because the questions were perceived as being peripheral to the study and not as essential as the items retained. ASQ experts confirmed that the reduction in questions and overall revisions did not take away from the validity of each scale or from the validity of the instrument as a whole. Internal consistency reliability was tested for each scale.

Reliability

Internal consistency of each scale was tested via Cronbach's alpha. Item correlations were assessed to assure proper inclusions. Scales with resulting alpha values of .70 or higher are consistent (Cohen, Cohen, Aiken, & West, 2003), which was the case for all scales used in this study. See internal consistency graphics in Appendix I. Research then created composite measures by taking the average response to the set of related questions. According to Hair et al. (1998), "the guiding premise [with respect to composite measures] is that multiple responses reflect the "true" response more accurately than does a single response" (p. 10). The methods used to check the validity and reliability are in line with other empirical studies in the quality management field (e.g., Saraph et al. 1989; Sila et al., 2005).

Human Subjects Approval

This study obtained human subjects approval because human measures (i.e., employee surveys of attitudes and behaviors) were part of its focus. Approval by the University Human Subjects Review Committee was granted in late September 2006 (See Appendix A). A consent agreement was developed based on the guidelines provided by EMU's Graduate School, and informed consent agreement terms were provided to all prospective participants. Participants expressing their consent were given an opportunity to decide whether to participate in the study. Participation was completely confidential and voluntary.

Statistical Analysis

This study employed simultaneous and stepwise regression methods. It examined the correlation between all variables and assessed descriptive statistics as well. To build the regression models, this author placed quality management items, as found in related literature and in benchmark instruments, into composite scales and used them as independent variables. Composites for work-related outcomes and performance served as dependent variables. Regression was the method of choice because it is commonly used to reveal the most important factors or predictors related to a particular output (Tabachnick & Fidell, 2001) and is arguably more applicable to this research than methods like SEM (Shah & Goldstein, 2006). This case used regression to test the relationship between quality management factors and performance, and it was used to indicate whether perceived audit readiness had a significant role in predicting work outcomes, or whether readiness was a process effectiveness outcome in and of itself.

Research checked regression inputs (i.e., data and assumptions) for possible irregularities and non-compliances that could bias the results. Corrective actions were considered where needed. Various regression outputs were examined to test the stated hypotheses. The research examined regression models for overall significance using F-tests. Amount of variance explained by a given model and its goodness of fit were evaluated based on a percentage derived from the coefficient of determination (R^2). Sequential changes in the amount of variance explained with each added step in regression (i.e., ΔR^2), which in this case was one added step, were assessed using F-tests. In addition, significance of individual beta (β) weights, based on t-tests, was examined to identify the relationship between the independent variables and dependent variable. Beta weights also indicated the critical nature and predictive importance of each independent variable relative to the dependent variable (Hair et al., 1998; Tabachnick & Fidell, 2001).

The study conducted mediation analysis using a hierarchical stepwise regression process established by Baron and Kenny (1986). The process is as follows:

1. Show that the initial independent variable (IV) correlates with the dependent variable(s) (DV)
2. Show that IV correlates with potential mediator (M)
3. Show that M affects DV (i.e., the outcome)
4. Examine effect of IV on DV controlling for M (Baron & Kenny, 1986)

This research examined the relationships among quality management factors (IV), work outcomes (DV), and what this author calls the QMS perceived audit readiness variable (M). More specifically, this work examined whether certain quality factors can predict various work outcomes (e.g., customer satisfaction, organizational commitment). It examined whether quality factors and an added audit composite variable can predict multiple work outcomes. Last, the study investigated whether QMS perceived audit readiness mediates the relationship between the various quality factors and work outcomes. The data were analyzed for significance of individual factors in the system and possible mediating effects on the dependent variable with the addition of the new variable. Significant decrease in the estimated effect on the dependent variables, exhibited by a decline in original coefficient values of the independent variables due to the added mediator variable, is an indication of partial mediation (Baron & Kenny, 1986).

Summary

Chapter 3 outlined the methods utilized to test the research questions and hypotheses described in Chapter 1. Chapter 3 discussed the design and research procedures employed. This study used a survey instrument in combination with correlation and simultaneous and stepwise regression research methods. The survey instrument was pretested and its contents were validated and tested for internal consistency. The principal sample had a targeted response of approximately 250 quality professionals from the automotive industry. The study was granted human subjects approval by Eastern Michigan University's Human Subject's Institutional Review Board. This author used a collection of existing scales to develop an instrument that could assess the various factors that can be found in a model quality system. Scales incorporated into the survey also measured a new audit readiness variable and multidimensional work-related outcomes. Table 4 summarizes the variables used in this research.

Chapter 4: Analyses & Results

This study commenced in the spring of 2007. Most auto suppliers were supposed to register to ISO/TS 16949 (TS2) by the announced deadline of December 14, 2006. Some original equipment manufacturers (OEMs) requested supplier conformance to the TS2 standard by 2004. The research administered a web-based survey to measure the quality management variables. The author sent e-mail invitations to the ASQ's automotive division chair to have distributed to all division members (see Appendix B). The web-based survey was directed toward quality professionals in the organization because they are recognized as the leaders in quality system assurance, planning, registration, implementation, and auditing. Furthermore, controlling for industry helped assure that critical quality practices were present in each organization and that QMS registration and third-party audits took place. Consequently, generalizability will be limited to this group. These data were then compared to organizational outcomes, and results are described below. Means, standard deviations, correlations, and other descriptive statistics are reported in the results.

Demographics and Sample Characteristics

Respondents were asked to provide demographic data such as age, educational level, position, and years in automotive. Two hundred and eighteen (218) automotive division members submitted surveys, 172 of which were deemed usable for this sample study. Consultants, registrars, and academics were removed from the sample to stay in line with the original intent of focusing on manufacturers with registered quality systems.

Missing data values on more than 10% of all cases concerning independent and dependent variables were declared unusable and subsequently removed from the data set.

An overall response rate was not calculated because the exact number of automotive division members who were sent an email invitation and those who actually received an e-mail invitation to take part in the study was not determined. ASQ claimed to have sent the email invitation to its entire division membership of 5,000 professionals. However, ASQ could not provide the actual number of email receipts nor could they provided the number of emails that were undelivered due to firewalls, spam filters, pop-up blockers, and so forth. It is perhaps highly unlikely that all members subscribe to receiving mass emails from ASQ. This sample of 172, however, has enough statistical power to identify significant moderate effects, assuming they exist, which minimizes the risk of experiencing a Type II error (Green, 1991; Miles et al., 2001).

The majority of respondents were either quality managers (54) or quality engineers (48). More than 50 percent of the respondents had worked in the automotive industry for 16 years or more, and nearly 90 percent had worked in the industry for at least 6 years. Ninety-five percent had college experience. Thirty-five percent of respondents worked for large companies that employed more than 500 people at the respective location. Most people were reasonably knowledgeable in ISO/TS; less than 10% responded as having low to very low knowledge in this area. One rather interesting observation was that 76 percent of the quality professionals were also part of their organization's audit team or committee. A respondent group profile is provided in Table 6. Refer to Appendices F through H for more demographics and sample characteristics.

Table 6.

Respondent Group Profile Characteristics

Group Characteristics	Frequencies
Job Titles	Quality Managers (54), Quality Engineers (48), Directors (12), Quality Continuous Improvement Specialists (10), Quality Auditors (9), All Others
Years in Auto Industry	Less than 1 year (1), 1 to 5 years (12), 6 to 10 years (32), 11 to 15 years (30), 16 or more years (92)
Education	High School (6), Some College (29), Associates Degree (18), Bachelors Degree (48), Some Graduate Work (13), Master's Degree (50), Doctorate (5), Other (3)
Number of Employees*	1 to 50 employees (18), 51 to 100 (23), 101 to 250 (34), 251 to 500 (36), 501 or more (60)
Knowledge of ISO/TS	Very low to low (15), Medium to high (109), Very high (47)
Knowledge of MBNQA	Very low to low (68), Medium to high (93), Very high (8)
Audit Team Member	Yes (132), No (40)

Note: *This refers to the number of employees at the respondents respective location

Descriptive Statistics and Intercorrelations

Descriptive statistics (e.g., mean, standard deviations) taken from the data were screened for irregularities and possible measurement errors (e.g., extreme cases, missing data). The data range for each variable, for example, was expected to fall between 1 and 8 such that any value outside of this range would surface as irregular and require further investigation. Some missing data were discovered and either removed or accommodated. Methods used to handle data issues are discussed later in the data preparation section. Descriptive statistics for each variable are available in Table 7 and Appendices G and H.

Examination of the intercorrelation table offered some initial insight into the potential presence of the theorized relationships. See Table 7 for more information. For instance, leadership is positively correlated with both organizational commitment ($r = .604$, $p < .01$) and job satisfaction ($r = .604$, $p < .01$), and research hypothesized that leadership is a significant predictor of the two attitudinal outcomes. The highest correlation was between organizational commitment and job satisfaction ($r = .837$, $p < .01$), which is consistent with the fact that they are both attitudinal measures that can be stimulated by similar situations and emotions. However, the two variables actually measure different aspects of work. Commitment deals with one's perceived engagement or connection to the organization, while job satisfaction is more of a response and connection to specific tasks and duties of the job (Mowday et al., 1982). Mowday et al. claim that "although day-to-day events in the work place may affect an employee's level of job satisfaction, such transitory events should not cause an employee to reevaluate seriously his or her attachment to the overall organization" (p. 28).

Some of the lowest correlations discovered were between a few independent variables and the customer performance dependent variable. Information, for example, has a relatively low but significant positive correlation with customer performance metrics ($r = .197$, $p < 0.05$). HR had a low but significant positive correlation with customer performance ($r = .218$, $p < 0.01$). Several weak correlations can indicate limited multivariate relationships, which, in turn, could lead to insignificant regression betas and/or models. Intercorrelations between independent variables ranged from $r = .556$ to $r = .794$, which demonstrates a moderate degree of correlation and warns of multicollinearity. Multicollinearity is addressed in evaluating regression assumptions.

Table 7.

Means, Standard Deviations, and Correlations Between Variables

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Leadership	4.912	1.351	1.000										
2. Strategic Planning	4.617	1.400	.730**	1.000									
3. Customer Focus	5.543	1.148	.596**	.631**	1.000								
4. Information	4.805	1.239	.783**	.742**	.623**	1.000							
5. HR	4.277	1.335	.761**	.794**	.556**	.705**	1.000						
6. Process Management	4.175	1.251	.588**	.586**	.633**	.587**	.609**	1.000					
7. QMS Audit Readiness	5.258	1.106	.621**	.611**	.698**	.612**	.621**	.636**	1.000				
8. Business Outcomes	4.291	1.203	.288**	.344**	.341**	.296**	.396**	.369**	.291**	1.000			
9. Job Satisfaction	5.133	1.621	.647**	.559**	.489**	.554**	.650**	.474**	.445**	.299**	1.000		
10. Organizational Commitment	4.665	1.637	.604**	.550**	.469**	.538**	.671**	.405**	.444**	.266**	.837**	1.000	
11. Customer Metrics	4.786	1.012	.260**	.243**	.252**	.197**	.218**	.267**	.198**	.093	.141*	.125†	1.000

Note: Means, medians, and standard deviations are based on a 7 point scale. (n = 172) ** $p < .01$ * $p < .05$ † $p < .10$ (one tailed)

Data Preparation

After being screened for outliers and missing data, the data were prepared for multiple regression testing. As mentioned above, questionnaires that had missing data values on more than 10% of all cases were considered unusable and were subsequently removed from the data set. An option for handling missing data and no response items is to impute a value in its place (Hair et al., 1998; Tabachnick & Fidell, 2001). This author imputed the series mean for all remaining items with no response or missing data.

Participants were given the option to select "no opinion" as a response to most questions. In this instance, the "no opinion" response was treated the same as if the participant had selected an impartial position on the scale. Most scales ranged from one to seven, with four presumed to be neutral or a reasonably unbiased middle ground. In SPSS, all "no opinion" scores (i.e., 8) were recoded as neutral (i.e., 4).

Each question belonged to a multi-item scale. According to Hair et al. (1998), "the use of multiple indicators allows the researcher to more precisely specify the desired response" and, in other words, "…multiple responses reflect the 'true' response more accurately than does a single response" (p. 10). Thus, instead of using a single response to measure a particular concept, like leadership, several interrelated questions were formed into a scale, and the average composite score was used to capture a more descriptive measure of the concept (Hair et al., 1998). Refer to Appendix E for more information. Most of the questions and corresponding scales were drawn from previous works where items had already been reduced via factor analysis and checked for internal consistency.

Since a number of questions were removed from the instrument, per expert recommendations, internal consistency reliability was tested for each resulting scale (i.e., each critical factor composite), and consistency was determined using Cronbach's alpha coefficient, which is the most commonly used measure of reliability (Cohen et al., 2003). All but one composite, the customer outcome measure ($\alpha = .707$), resulted in a Cronbach's alpha greater than .80. Alphas greater than .70, however, demonstrate a strong intercorrelation between items and serve as a reliable indication that the items within each composite measure the same construct (Hair et al., 1998, p. 118). The internal consistency coefficients were also in agreement with comparable coefficients established in previous research (cf. Saraph et al., 1989; Wilson et al., 2000). As a simple test to see if the independent variables could be viewed as a consistent system, internal reliability of the composite variables was tested and resulted in an alpha coefficient of 0.922. Internal consistency results are located in Appendix I.

Univariate Assessment

Individual composite variables were checked for outliers and normality. Univariate analysis used standardized variable scores (z-scores) to locate potential outliers. Any score greater than 3 standard deviations or less than -3 standard deviations was investigated and considered for possible removal. Only two variables had potential outliers. The customer performance independent variable had one case, out of 172, that fell beyond -3 standard deviations, and the QMS variable had two cases below -3 standard deviations. The outliers represented approximately 1% of all cases, which coincides with the expected probability of obtaining values at such extremes. Upon further investigation of the original data set, this author could not find any justifiable or practical reasons to remove the items. Thus, after investigating the data for univariate outliers, all items were retained.

Research checked univariate normality visually using histograms and box plots and also by evaluating skewness and kurtosis scores and using significance tests (e.g. Kolmogorov-Smirnov [K-S] Lilliefors test). Several composite variable distributions exhibited signs of non-normal behavior. Nearly all variables, namely the independent variables, had a visible negative skew. To remedy negative skew, Tabachnick and Fidell (2001, pp. 81-83) suggested that the variable be reflected and then subjected to either a square root or log transformation. The authors also claimed that tests of normality, like the K-S Lilliefors test, are overly sensitive (p. 73). The transformations that had the most normalizing affect on each variable are ranked in Table 8.

Table 8.

Data Transformation Assessment Results & Summary

Variables*	**Tested Transformations & Rankings**		
	None	**Log(k-x)**	**Square Root(k-x)**
Leadership	3	1	2
Strategic Planning	3	2	1
Customer & Market Focus	3	1	2
Measurement, Analysis, & Knowledge (Information)	2	3	1
Workforce Focus (HR)	2	3	1
Process Management	2	3	1
QMS Audit Readiness	3	1	2

Note: Ranked in ascending order as to which transformation had the most normalizing affect (1 being best, 3 being worst)

The individual variables were evaluated for normality and possible transformation but were not transformed prior to regression because regression does not require that the distributions of independent variables be normal. The assumption for normality in regression analysis requires only that the residuals be normally distributed about the dependent variable. Moreover, “multivariate normality is the assumption that each variable and all linear combinations of the variables are normally distributed. When the assumption is met, the residuals of analysis are also normally distributed and independent” (Tabachnick and Fidell, 2001, p. 72 and p. 119).

Multivariate Assessment & Assumptions

Research inspected multiple regression assumptions for apparent violations and abnormalities. The examination checked for the absence of multicollinearity and the absence of influential outliers in both the independent and dependent variables. Residuals were assessed for normality, linearity, homoscedasticity, and independence. For example, Durbin-Watson test statistics were near 2.0 for all regression analyses. The estimates ranged from 1.910 to 2.123. This assessment suggests independence of residuals to the extent that there are no patterns or carryover effects seen from one observation to the next in the data (Hair et al., 1998; Tabachnick & Fidell, 2001).

Multicollinearity among independent variables, which was thought to be a concern based on bivariate correlations, turned out to be a nonissue. Variance inflation factors (VIF), which measure the degree of collinearity, were calculated using the equation $1 / (1 - R^2)$, and the results are displayed in Table 9. To calculate VIF scores, each factor, or independent variable, was regressed against all others to generate a respective R^2 value, which measured the proportion of explained variance about the dependent variable mean, by the other factors or independent variables (Hair et al., 1998,

p. 193). The R^2 value was then used to calculate the VIF score. For example, LEAD was regressed onto STRA, CUST, INFO, HR, PROC, and QMS, which resulted in an R^2 value of 0.714 and a VIF of 3.50. Significant linear relationships and dependence on all other factors is represented by high values of R^2. Large VIF values at or above 10.00, which correspond to tolerance values of 0.10 or less, indicate a high degree of collinearity among independent (predictor) variables (Hair et al., 1998). As Table 9 illustrates, the highest VIF score of 3.57 was produced by strategy, and the lowest score came from process. Multicollinearity did not appear to be an issue since the VIF score for each variable was well below the common threshold of 10.00.

Table 9.

Variance Inflation Factor Assessment

Variables	R^2	Tolerance	Variance Inflation Factor
Leadership	0.714	0.286	3.50
Strategic Planning	0.720	0.280	3.57
Customer & Market Focus	0.601	0.399	2.51
Measurement, Analysis, & Knowledge (Information)	0.695	0.305	3.28
Workforce Focus (HR)	0.718	0.282	3.55
Process Management	0.532	0.469	2.13
QMS Audit Readiness	0.604	0.396	2.53
Common Threshold Values	0.900	0.100	10.00

Visual analysis of residuals via scatterplot helped to assess the degree of normality, linearity, and heteroscedasticity present in each model. Normality was also evaluated using skewness and kurtosis scores, K-S test scores of standardized residuals, and through analyzing histograms and box plots of standardized residuals. Residuals were evaluated to assess multivariate linearity and normality, and, according to

Tabachnick and Fidell (2001), “if there is multivariate normality in ungrouped data, each variable is itself normally distributed and the relationship between pairs of variables, if present, is linear and homoscedastic” (p. 72). Lack of homoscedasticity in residuals, however, can still create problems with standard errors, confidence intervals (e.g., narrow), and significance tests (Hayes & Cai, in press). However, it is widely accepted that regression analysis involving large samples is robust against nonnormality of residuals to the extent that nonnormality will not lead to serious problems with interpretation of significance tests (Cohen et el, 2003, p. 120; Hair et al., 1998; Tabachnick & Fidell, 2001). More discussion regarding homoscedasticity of residuals follows in later sections.

The histogram representing the distribution of residuals, with customer performance entered as the dependent variable, was the only instance that showed visual signs of nonnormal behavior in the errors of that predicted. Normality enhancing transformations of the dependent variable (e.g., log, square root) were investigated but resulted in no significant improvements in form. Scatterplots of residuals for each model presented no visual indications of nonlinear patterns in the residuals. Overall, the regression equations were found to meet the assumption of normality and linearity.

Multivariate outliers were investigated using Mahalanobis Distance and Cook’s Distance. Influential outliers are concerning because they have potential to bias the model and to affect major assumptions. Two cases for both job satisfaction and organizational commitment were a significant distance from the model and, as result, were identified as outliers needing further investigation. Mahalanobis distance is based on a chi square distribution (Tabachnick & Fidell, 2001, p. 157). The chi square critical value with 6 degrees of freedom (6 primary IVs) and an alpha of 0.001 was 22.458. Estimated Cook's distances were not to exceed the calculated 0.02439 cut-off. This result is from using the equation, 4 / (n - k - 1), as suggested by Hair et al., 1998, p. 225. The two cases mentioned exceeded the specified thresholds for Mahalanobis distance and Cook's distance, respectively, and were believed to have some influence on the model.

However, upon review of the original survey data, the suspect cases were retained because of a lack of practical evidence to substantiate removal. One individual had low opinions in nearly every category, but it is hard to say that other cases drawn from the same population would not produce similar results. Each independent variable had more than one observation in the lower regions, which seems to indicate that low scoring views are not uncommon. The responses were essentially bounded between one and seven, and most distributions were negatively skewed, meaning the odds of seeing high scores near seven are more likely to happen, and chances of seeing lower scores in the area of one or two are less likely to happen but not impossible. The research maintains that the two suspect cases are actually from the population studied and, therefore, were retained (Hair et al., 1998). Appendices J through R contain more details concerning multivariate outlier analysis using Mahalanobis distance and Cook's distance.

Mild cases of heteroscedasticity were present in most standardized scatterplots of residuals. However, according to Cohen, Cohen, Aiken, & West (2003), "When there is heteroscedasticity, the estimates of the regression coefficients remain unbiased, but the standard errors and hence significance tests and confidence intervals will be incorrect. In practice, the significance tests and confidence intervals will be very close to the correct values unless the degree of nonconstant variance is large. A rule of thumb for identifying a large degree of nonconstant variance is that the ratio of the conditional variances at different values of X exceeds 10" (p. 120, see also p. 146). Moreover, Hayes & Cai maintain that "Relatively mild heteroscedasticity is not going to produce profound problems and is unlikely to swing the outcome of an analysis drastically one way or the other" (p. 6 of 2007 manuscript, in press). In this study, there was not a single case where the conditional variance ratio between extremes exceeded 10. The largest variance ratio, measured between the 10th percentiles and the 90th percentiles, was 3.031. Appendices J through R contain more details regarding homoscedasticity evaluations.

Hypothesis Testing & Regression Analysis

Various regression models tested the hypothesis posited in Chapter 1. The first phase of this analysis examines hypothesis (H1), which proposed that critical quality factors would have a significant positive association with work outcomes. The second phase examined hypothesis (H2), which proposed that critical quality factors would be positively associated with perceived audit readiness as a process effectiveness outcome. The third phase looked at hypothesis (H3), which proposed that perceived audit readiness would be positively associated with work-related outcomes such that it would partially mediate the relationship between QMS factors and work-related outcomes. Figure 1 located in Chapter 1 illustrates the theoretical proposition.

According to ISO/TS 16949 and the MBNQA, there are several independent variables understood to be critical to quality, which include leadership, strategic planning, customer and market focus, measurement, analysis and knowledge (information), workforce focus (HR), and process management. Multiple regression methods were utilized to examine the hypotheses and test whether the stated quality factors had a significant and positive effect on work outcomes and performance.

Existing quality models and standards, like TS and MBNQA, verify that the critical factors of quality will occur at distinct levels within a collective system and that each independent variable within the system must be steered in the direction of positive performance (NIST, 2006). Levels of leadership and process management, for example, exist in most organizations but the levels at which they operate will vary between organizations and thus produce varying levels of performance (Adam & Foster, 2000). Understanding which variables are the most critical to performance will help explain the nature of the relationship between quality management and high performance.

A priori assumption determined that the six major variables of the MBNQA, which cover most of the elements of the TS2 standard, can enter all at once into the regression model as a collective system of independent factors. The relationship between the independent factors and various performance outcomes (business results, organizational commitment, job satisfaction, and customer performance metrics) make up the first series of hypotheses to be tested.

Hypothesis test 1.

Test results, from the first phase of analysis between the independent variables and business results (H1a), indicate that the overall model was significant ($F = 6.745$, $p < .001$) as it predicts nearly 20% of the variance in business results. According to the model, HR is positively associated with business outcomes ($\beta = .319$, $p < .05$). Process management nears significance ($\beta = .166$, $p < .10$) when it is viewed as part of a quality management system. This study utilized backward stepwise regression (BSR) as a second step to define more clearly the critical factors in a given model. BSR confirmed the initial regression results and showed that HR ($\beta = .272$, $p < .01$) and process management ($\beta = .203$, $p < .05$) are critical factors of quality. Increases in these areas specifically can have a significant and positive impact on business results.

Results of the test between the independent variables and job satisfaction (H1b) indicate that the overall model was significant ($F = 25.937$, $p < .001$) as it predicts nearly 50% of the variance in job satisfaction. Leadership and HR are both positively associated with job satisfaction ($\beta = .331$, $p < .01$ and $\beta = .376$, $p < .001$, respectively) when viewed as part of a quality management system. BSR confirmed the initial regression results, which suggested that leadership and HR are critical factors of quality, and increases in either measure can have a significant and positive impact on job satisfaction.

Results of the test between the independent variables and organizational commitment (H1c) indicate that the overall model was significant ($F = 25.839$, $p < .001$) to the extent that it predicts nearly 50% of the variance in organizational commitment. HR, when part of a collective system, was positively associated with organizational commitment ($\beta = .203$, $p < .001$). Leadership and customer focus approach significance when part of a system ($\beta = .203$ and $\beta = .150$, $p < .10$, respectively). BSR, however, rejected customer focus as a critical variable but retained HR ($\beta = .502$, $p < .001$) and leadership ($\beta = .222$, $p < .05$) as critical factors of quality. Any increase in HR and/or leadership can have a significant and positive impact on organizational commitment.

Results of the test between the independent variables and customer metrics (H1d) show a significant model ($F = 3.025$, $p < .01$) that explains nearly 10% of the variance in customer metrics. However, not a single variable in the system showed a significant association with the dependent variable. BSR results suggest that process management and leadership do in fact approach significance ($\beta = .174$ and $\beta = .158$, $p < .10$, respectively). The H1d hypothesis was not supported. Table 10 summarizes the simultaneous and stepwise regression results for factors predicting work-related outcomes and performance.

Hypothesis test 2.

The second phase of the analysis analyzed the same set of independent variables, but this time they were entered into the model as predictors of QMS audit readiness, which served as a process outcome measure in terms of effectively meeting mandatory requirements. Table 10 contains more details. Results of the test between the independent variables and QMS audit readiness and effectiveness (H2) indicate that the overall model was significant ($F = 40.719$, $p < .001$) as it predicts nearly 60% of the variance in QMS audit readiness. According to the model, customer focus and process management, when part of the system, are positively associated with QMS audit readiness ($\beta = .381$, $p < .001$ and $\beta = .196$, $p < .01$, respectively). HR nears significance in the system ($\beta = .165$, $p < .10$). As in the first phase, BSR was utilized to define the critical factors stemming from the system. BSR confirmed the initial regression results and showed that customer focus ($\beta = .393$, $p < .001$) and process management ($\beta = .200$, $p < .01$) were critical along with HR ($\beta = .179$, $p < .05$) rounding out the significant variables retained. BSR also showed leadership as approaching significance ($\beta = .134$, $p < .10$). The results suggest that customer focus, process management, and HR are critical factors of quality. Any increase in these variable measures can have a significant and positive impact on meeting specific mandatory requirements of ISO/TS QMS audit. The significant variables can influence QMS audit readiness and process effectiveness.

Hypothesis test 3.

The third phase tested the role of audit readiness to determine if QMS readiness had a mediating effect on the relationship between the six major independent variables and the four work-related outcomes. This test employed stepwise regression to investigate the contribution, if any, of QMS audit readiness in enhancing outcomes and performance. To test these relationships, the QMS audit readiness variable is treated as an additional factor within the quality system (i.e., audit readiness is treated as another independent variable) and was stepped into the models described in phase 1. Table 11 summarizes the backward stepwise regression results for factors predicting work-related outcomes and performance.

Results of the test between the controlled independent variables (from phase 1) plus the added QMS audit readiness variable and business results (H3a) indicate that the overall model was significant ($F = 5.809$, $p < .001$) as it appears to predict nearly 20% of the variance in business results, but the change in R^2 was insignificant ($\Delta F = .349$, $p > .05$ [$p = .556$]). The QMS variable was not positively associated with business results ($\beta = -.065$, $p > .05$ [$p = .556$]). Hypothesis 3a was not supported.

Results of the test between the independent variables plus the added QMS audit readiness variable and job satisfaction (H3b) indicate that the overall model was significant ($F = 22.530$, $p < .001$) as it predicts nearly 50% of the variance in job satisfaction, but, as in the previous test, the change in R^2 was insignificant ($\Delta F = 1.562$, $p > .05$ [$p = .213$]). The QMS variable was not positively associated with job satisfaction ($\beta = -.110$, $p > .05$ [$p = .213$]). Hypothesis 3b was not supported.

Results of the test between the independent variables plus the added QMS audit readiness variable and organizational commitment (H3c) indicate that the overall model was significant ($F = 22.123$, $p < .001$) as it predicts 48.5% of the variance in organizational commitment. The change in R^2 was insignificant ($\Delta F = .396$, $p > .05$ [$p = .530$]). The QMS variable was not positively associated with job satisfaction ($\beta = -.056$, $p > .05$ [$p = .530$]). Hypothesis 3c was not supported.

Results of the test between the independent variables plus the added QMS audit readiness variable and customer metrics (H3d) indicate that the overall model was significant ($F = 2.627$, $p < .05$) as it predicts 10.1% of the variance in customer metrics. The change in R^2 was insignificant ($\Delta F = .312$, $p > .05$ [$p = .577$]). The QMS variable was not positively associated with job satisfaction ($\beta = -.065$, $p > .05$ [$p = .577$]). Hypothesis H3d was not supported.

Table 10.

Summary of Simultaneous and Hierarchical Regression Analysis for Variables Predicting Work-Related Outcomes and Performance (n = 172)

	Business Results		**Job Satisfaction**		**Organizational Commitment**		**Customer Performance Metrics**		**QMS Audit Readiness**
Variable	*Step 1* (H1a)	*Step 2* (H3a)	*Step 1* (H1b)	*Step 2* (H3b)	*Step 1* (H1c)	*Step 2* (H3c)	*Step 1* (H1d)	*Step 2* (H3d)	-- (H2)
	β	**β**	**β**	**β**	**β**	**β**	**β**	**β**	**β**
Leadership	-.130	-.123	.331**	.343**	.203†	.208*	.190	.196	.104
Strategic Planning	.020	-.020	-.056	-.055	-.081	-.081	.100	.100	.007
Customer Focus	.140	.165	.114	.156†	.150†	.171†	.096	.121	.381***
Information	-.027	-.023	-.010	-.003	.026	.029	-.133	-.130	.057
HR	.319*	.329*	.376***	.394***	.547***	.556***	-.055	-.044	.165†
Process Management	.166†	.179†	.016	.038	-.110	-.099	.148	.161	.196**
QMS Audit Readiness		-.065		-.110		-.056		-.065	
F	6.745***	5.809***	25.937***	31.546***	25.839***	22.123***	3.025**	2.627*	40.719***
R^2	.197	.199	.485	.490	.484	.486	.099	.101	.597
ΔR^2		.002		.005		.001		.002	
F for ΔR^2		.349		1.562		.396		.312	

Notes:
*** $p < .001$
** $p < .01$
* $p < .05$
† $p < .10$

Table 11.

Summary of Backward Stepwise Regression Analysis for Variables Predicting Work-Related Outcomes and Performance (n = 172)

	Business Results		**Job Satisfaction**		**Organizational Commitment**		**Customer Performance Metrics**		**QMS Audit Readiness**
Variable	*Step 1* (H1a)	*Step 2* (H3a)	*Step 1* (H1b)	*Step 2* (H3b)	*Step 1* (H1c)	*Step 2* (H3c)	*Step 1* (H1d)	*Step 2* (H3d)	-- (H2)
	β	**β**	**β**	**β**	**β**	**β**	**β**	**β**	**β**
Leadership			.361***	.361***	.222*	.222*	.158†	.158†	.134†
Strategic Planning									
Customer Focus									.393***
Information									
HR	.272**	.272**	.376***	.376***	.502***	.502***			.179*
Process Management	.203*	.203*					.174†	.174†	.200**
QMS Audit Readiness									
F	18.887***	18.887***	77.142***	77.142***	75.256***	75.256***	8.102***	8.102***	61.527***
R^2	.183	.183	.477	.477	.471	.471	.088	.088	.596

Notes:
*** $p < .001$
** $p < .01$
* $p < .05$
† $p < .10$

Summary

The first phase of this analysis tested a series of hypotheses, H1a through H1d, which proposed that critical quality factors would have a significant positive association with selected work outcomes. The H1 series of tests examined leadership (LEAD), strategic planning (STRA), customer focus (CUST), measurement, analysis and knowledge (INFO), workforce focus (HR), and process management (PROC) in relation to separate outcome variables, specifically business results (H1a), job satisfaction (H1b), organizational commitment (H1c), and customer metrics (H1d). Several critical factors emerged during phase one. For example, as Table 12 illustrates, HR and process management had a positive association with business results.

The second phase examined hypothesis (H2), which proposed that critical quality factors would be positively associated with perceived audit readiness as a process effectiveness outcome. The regression model for this test was significant as several critical factors emerged. Process management, customer focus, and HR had a positive association with QMS audit readiness/process effectiveness.

The third phase looked at another series of hypotheses, H3a through H3d, which proposed that QMS perceived audit readiness (QMS) would be positively associated with work-related outcomes such that, as an added independent variable, QMS would partially mediate the relationship between critical quality factors and work-related outcomes. The H3 series of tests examined the same relationships as in H1, with the only difference being the inclusion of QMS as an independent variable. The additional variable was an insignificant predictor across all outcome variables.

Table 12.

Summary of Results

	Quality Factors (IVs)	**Outcome (DV)**	**Critical Factors & Results**
H1a	LEAD, STRA, CUST, INFO, HR, PROC	Business Results	Process Management & HR
H1b	LEAD, STRA, CUST, INFO, HR, PROC	Job Satisfaction	Leadership & HR
H1c	LEAD, STRA, CUST, INFO, HR, PROC	Organizational Commitment	Leadership & HR
H1d	LEAD, STRA, CUST, INFO, HR, PROC	Customer Metrics	None
H2	LEAD, STRA, CUST, INFO, HR, PROC	QMS Audit Readiness	Customer Focus, Process Management, & HR
H3a	LEAD, STRA, CUST, INFO, HR, PROC, QMS	Business Results	Process Management & HR*
H3b	LEAD, STRA, CUST, INFO, HR, PROC, QMS	Job Satisfaction	Leadership & HR*
H3c	LEAD, STRA, CUST, INFO, HR, PROC, QMS	Organizational Commitment	Leadership & HR*
H3d	LEAD, STRA, CUST, INFO, HR, PROC, QMS	Customer Metrics	None*

**Note:* QMS was not a significant predictor when added to the original model as a potential mediator and independent variable

Factors that emerged as significant predictors of work outcomes were process management, customer focus, leadership, and HR. QMS readiness was insignificant. Table 12 contains a summation of the results. Chapter 5 discusses the conclusions and implications inferred from the results and addresses study limitations and future research.

Chapter 5: Discussion

Chapter 5 includes a discussion concerning the conclusions and implications, limitations, and future research that stem from this study.

Conclusions and Implications

The results of this study support the idea that there are certain critical factors of quality management that influence work-related outcomes and performance. The study examined leadership, strategic planning, customer focus, measurement, analysis and knowledge, workforce focus, and process management in relation to separate outcome variables, specifically business results, job satisfaction, organizational commitment, and customer metrics. In addition, the study tested QMS perceived audit readiness as a possible mediating variable. Several critical factors emerged as significant predictors of work-related outcomes, namely process management, leadership, and HR.

However, strategy did not play a major role in predicting the outcomes used in this study. One explanation might be that strategic planning had high correlations with HR and leadership, which may have created an instance where these two variables, indirectly or through a combination of others, measured strategy. However, according to variance inflation figures, multicollinearity was not a major concern. Prajogo and Sohal (2006) suggest that critical quality factors mediate the relationship between strategy and multidimensional competitive advantage.

Information did not emerge as a critical factor, but the MBNQA criteria establish information as the foundation that supports the entire management system (NIST, 2006).

Prajogo and Sohal (2006) found evidence that information mediates the relationship between strategy and performance. In this study, however, both strategy and information did not surface as critical. Information is a functional part of a complete management system and by nature may be present across all factors. Future research should investigate the interaction and/or integration of information with other system input variables.

The analyses and research findings showed that the inclusion of QMS readiness (QMS) does not appear to shape or meditate the relationship between quality management factors and performance since the variable did not affect the dependent variable when controlling for the original independent variables. When introduced as a mediating variable, QMS did not affect the major outcomes when controlling for the original independent variables; hence, further tests for mediation were not required. However, results did suggest that QMS is a significant outcome in terms of effectiveness and compliance, but it is not likely to influence other performance areas when viewed as an input or meditating variable. In short, quality standards and procedures conformance (i.e., QMS readiness) is not a means to an end but an end in and of itself. Thus, future research should approach it as such to avoid specification error.

The items measured in the QMS composite scale are mandatory requirements of both the ISO9001:2000 (ISO) and ISO/TS16949 (TS2) standards and apply to all organizations directed to maintain ISO or TS2 registered quality systems. Organizations with a TS2 registered systems, for example, must continue to meet the standard or risk noncompliance, which could translate into loss of future business (Johnson, 2001).

Regression results showed that several factors were critically important in predicting work-related outcomes and performance, and some relationships were more pronounced than others. Similar to the findings in Wilson et al. (2000) and Sila et al. (2005), this study found that process management had a significant positive association with business results. However, unlike the Wilson and Sila studies, this research did not find a significant relationship between information and work outcomes. This study did not agree with the benchmark study (i.e. Wilson) in a number of respects. In this study, process management, customer focus, and HR each shared a direct connection with QMS readiness/process effectiveness. In addition, leadership and HR had strong linkages to job satisfaction and organizational commitment. HR emerged as a common variable critical in predicting multiple work-related outcomes. HR has a strong positive association with business results, job satisfaction, and organizational commitment. This latter finding is in line with observations made by the GAO and Mendelowitz et al. (1991). However, the GAO study was limited in that it was mostly observational. Its findings were not statistically supported like the conclusions of this study.

The findings of this study are consistent with what Powell (1995) and Samson and Terziovski (1999) concluded. It agrees with their views that soft methods, like leadership, influence soft outcomes, such as job satisfaction and commitment, while hard methods, like process management, tend to influence harder issues that are generally more defined and technical in nature (e.g., generating sales, meeting specs, conforming to standards). Focusing on soft management items might best address soft issues and outcomes. Hard management processes are perhaps better at addressing some of the more traditional or more defined work related outcome (e.g., ROI, market share, delivery, product specifications). The findings fall short of establishing consensus around what factors are critical to quality management and consistently influence performance. Research can achieve consensus via future studies that are similar in nature and results.

To reap the largest benefit and achieve significant results, organizations should use a systems approach that couples hard and soft methods. The results of the present study indicate that organizations that focus heavily on one area may see limited across-the-board results whereas an organization that focuses on most, if not all, critical factors in a complete quality management system are better positioned to achieve high-performance outcomes. Furthermore, organizations should exercise caution not to focus efforts exclusively on one area and ignore others unless the organization has a single-dimensional objective (e.g., sole purpose to increase market share). The conclusions of this study are similar to Adams (1994) from the standpoint that one quality item may be insufficient when it comes to explaining any significant variation in outcomes and performance. Influence stems from an array of factors. This study suggests that using a single factor approach versus a systems approach might come at the expense of other things, such as employee attitudes, product quality, and/or QMS compliance, depending on the focus. Adopting a partial QMS or only focusing on a single part of the system may result in several shortcomings across several business metrics. At best, the narrow approach may enhance one work outcome. This research demonstrates that organizations cannot achieve multidimensional competitive advantage using an isolated or partial approach. Multiple quality factors must be working successfully in the system in order to maintain high performance.

An alternative interpretation of the findings might be that organizations with little concern for people, for example, could still show positive performance in one or two outcomes by focusing strictly on an isolated part of the management system. Organizations following an isolationist route to business management risk furthering system inadequacies that could result in nonconformance to industry standards, reduced employee morale, and potential loss of business. For broader positive results, a moderate level of bundling or coupling of quality factors is required. Organizations achieve high-performance through integrated quality management systems that do not simply focus on one aspect of business but rather work to balance several critical factors, which can lead to greater results.

Implications from this study suggest to researchers and practitioners that both soft and hard quality factors are critical in terms of having a significant and positive influence on work-related outcomes. HR emerged as a common variable critical in predicting several organizational work outcomes. The findings in this study reinforce the notion that an organization must maintain a distinct workforce focus and that it should maintain a comprehensive QMS focused on internal and external customers because leadership, workforce focus, process management, and customer understanding and satisfaction are critical to success. These items must permeate organizations that wish to achieve multiple goals and objectives. Furthermore, with a recognized and skillfully maintained quality management system in place, critical factors within a broader system can bring an organization closer to the goal of achieving high performance and multidimensional competitive advantage.

Limitations

When evaluating the results and conclusions of this study, readers must take into account several limitations. First, a possible limitation of this study involves the development and definition of composite variables. Factors like leadership can go by many definitions. This study used the MBNQA criteria to define the composite scales.

Second, using responses from quality professionals in certified QMS organizations may limit the generalizability of the findings to this group. Consequently, readers should not interpret the results as being completely relevant to non-certified organizations. Moreover, there may be some cases where non-certified organizations have more advanced quality systems in place. However, consistency in content and approach in conducting this study relative to previous research suggests some implications may be applicable to other populations.

The sample is a third limiting factor. The study was unable to obtain a random sample, which limits both the representativeness of the sample and the generalizability of the results. Hence, generalizability is limited to the study group. The sample size was adequate to perform the statistical analysis, but it does not guarantee representativeness.

A fourth limitation is that the study used perceptual measures not correlated or used in conjunction with actual objective measures, which may limit the validity of the composites or constructs reported in this study. Number of warranty claims, for example, would have been a more reliable measure had actual numbers been collected from the organization. This research would have also benefited in terms of the reliability of its measures had it used multiple respondents from the same plant. A better approach might direct questions to those most responsible or aware of a particular item. For instance, market share and ROS are questions perhaps better suited for asking executives at the firm level, whereas plant supervisors might be in a position to best answer questions related to defect rates and teamwork because they may deal with these items regularly.

A fifth limitation is that the survey investigated a cross-sectional sample at a specific point in time. Basic requirements in establishing causality are to demonstrate that the cause clearly precedes an effect and that there are no alternative causal variables or explanations (Hair et al., 1998; Spector, 1981). Given that this was not a longitudinal study, it is not possible to meet the requirement for establishing causality. Moreover, this study does not rule out other causal variables nor does it include all competing explanations of the observed relationships between the investigated variables such that the results could suggest that causal relationships exist.

A sixth limitation involves common method variance where correlation coefficients presented in this study might be due in part to a common source (Spector, 1981, p. 34). A common source in this research could be ASQ membership, for example. The survey instrument allowed self-report measures for nearly all variables. It is possible that ASQ members could demonstrate a tendency to answer questions in a similar manner, which, in turn, creates a chance for false correlations in composite variables. Another source for common method variance is the possibility that several respondents were from the same plant, thus creating the same type of limitations to correlation results.

Despite its various limitations, this study adds a greater level of understanding to the field of quality management and adds value to the current body of empirical research in terms of identifying and defining critical factors of quality management and revealing significant connections between critical quality factors and multiple work-related outcomes. In addition, the potential limitations described above create new challenges for the quality management field and lead to several opportunities for future research.

Future Research

As patterns start to emerge in terms of which factors directly influence performance, it is important for research to continue testing new theories and models until researchers can reach consensus. Future research might look to re-create this study in an attempt to validate its findings, accumulate additional knowledge and understanding regarding quality systems, and draw closer to consensus. Additional studies could refine and enhance the instrument to identify other potentially critical factors and add a richer understanding of contemporary quality systems. Future studies might include specific questions concerning advance production systems and new technologies and/or measures beyond mandatory items and the MBNQA criteria.

Other ideas for future research include conducting a longitudinal study to test causality and to assess both main effects and interactions. Testing main effects is a first step in regression analysis. Testing interactions would complement this study as it may reveal other significant variables that are critical to quality and to predicting work outcomes. Regression or structural equation modeling (SEM) can evaluate interactions.

Looking at different variable arrangements and time elements is necessary to test possible leading or lagging relationships. Future research can investigate the role of leadership, for example, as a possible leading indicator to system performance. Testing whether critical QMS factors mediate the relationship between leadership and multiple work-related outcomes warrants further investigation. As illustrated in Appendix S, future research could provide additional knowledge if it were to investigate different variable arrangements and test whether job satisfaction and organizational commitment, for example, are possible mediators or antecedents to work outcomes. It might also be valuable to develop an instrument that measures audit service quality and to test whether internal or external service quality influences performance and multiple work outcomes.

Quality management is a widespread global phenomenon. Similar studies should extend to other industries and locations that utilize quality standards, like aerospace's AS9100 or telecommunications' TL9000. Quality is also pervasive in the service industry and healthcare is a major example where the demand for quality aims to assure high-performance. Healthcare organizations are concerned about outcomes such as efficiencies and the bottom line, but they are even more concerned with customer (patient) safety and satisfaction. Last, this study recommends that researchers conduct similar studies in other areas of the world to acquire global perspectives and new worldly insights via cultural comparisons. Differences in the results of this study and the results of the Samson and Terziovski (1999) study, which looked at Australian manufacturers, suggest that critical quality factors found in one country may differ from the next.

Research Summary

This study contributes to existing literature and research by suggesting that process management, customer focus, leadership, and HR are critical factors in registered quality management systems that have a significant positive influence on work outcomes. Enhanced levels in the areas of process management and customer focus lead to higher levels of conformance to quality standards in terms of QMS process effectiveness.

Enhanced levels of leadership and HR lead to higher levels of job satisfaction and commitment (i.e., engagement), while enhanced levels of process management and HR have a significant and positive influence on ROI, ROS, and market share.

Different factors within a quality system can influence different outcomes, which demonstrate the importance of taking a systems approach to managing multiple quality factors rather than simply focusing on a single factor. This is especially important when an organizational goal is to achieve multidimensional competitive advantage or to move up on a key supplier list. Organizations must bundle critical QMS factors, and there is reason to believe that they may not have to integrate them totally, but it is imperative that they manage quality factors as a comprehensive system in order to achieve high-performance across a spectrum of measures (e.g., satisfaction, quality, cost, and timing).

Last, failure to manage critical quality factors successfully may come at a cost of decreased performance, not just in terms of market share or employee attitudes, but also in terms of meeting mandatory requirements of existing quality standards. For organizations in the automotive industry, compliance to the TS2 standard can afford an organization sustainability stemming from new and continued business. Since meeting the standard is a mandatory outcome, organizations in the automotive industry must have an effective process that assures a compliant QMS to sustain its position in industry.

Managing critical factors within a certified QMS system, like TS2, can bring an organization closer to the goal of achieving high performance and multidimensional competitive advantage. To achieve significant results, organizations must use a systems approach that focuses on leadership, process management, HR, and the customer. These quality factors are the ones that are most critical to an organization's success.

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Appendix A

EASTERN MICHIGAN UNIVERSITY

September 22, 2006

Mr. Sean Goffnet
School of Engineering Technology

Dear Mr. Sean Goffnet:

The Human Subjects Institutional Review Board (IRB) of Eastern Michigan University has granted approval to your proposal, "High-Performance Quality Management Systems and Work Related Outcomes: Exploring the Mediating Role of Registered Quality Management Systems' Audit Readiness".

After careful review of your completion application, the IRB determined that the rights and welfare of the individual subjects involved in this research are carefully guarded. Additionally, the methods used to obtain informed consent are appropriate, and the individuals participating in your study are not at a risk.

You are reminded of your obligation to advise the IRB of any change in the protocol that might alter your research in any manner that differs from that upon which this approval is based. Approval of this project applies for one year from the date of this letter. If your data collection continues beyond the one-year period, you must apply for a renewal.

On behalf of the Human Subjects Committee, I wish you success in conducting your research.

Sincerely,

Deb de Laski-Smith

Deb de Laski-Smith
Graduate Studies & Research
Administrative Co-Chair
Human Subjects Committee

Copy: Dr. Karen Saules, Faculty Co-Chair
Dr. Walter Tucker

Graduate Studies & Research • Office of the Dean • Starkweather Hall • Ypsilanti, Michigan 48197
Phone: 734.487.0042 FAX: 734.487.0050

Appendix B

Survey Communications

Content Review

October 23, 2006

Dear

Eastern Michigan University researchers need your assistance in helping to validate a survey research instrument that will be used in a significant automotive industry study. The purpose of this survey [scale] is to understand levels of audit readiness with respect to seven mandatory quality management system procedures: document control, record maintenance, training, internal audits, control of non-conformities, corrective and preventive action.

If you would be willing to respond and aid in this effort, simply complete the following steps.

Instructions:
1. Review the survey questions (below)
  a. Analyze content: do the concepts or questions used herein operationalize audit readiness for mandatory quality management system procedures?
  b. Analyze format: is the order, appearance, phrasing, wording, and so forth customary and acceptable?
2. Reply by October 31 with any suggestions (additions/deletions/revisions), comments, questions, or remarks that you might have regarding the content validity of this instrument.

Thank you for assisting with this matter.

Respectfully,
Sean Goffnett

Pre-test & On-line Pilot Run

December 7, 2006

Subject: ASQ Automotive Division - QMS Survey - Response Requested

Dear Valued ASQ Member,

We are working with academic researchers to conduct an important web-based automotive industry survey that explores the relationships between employee perceptions, quality systems, and workplace outcomes, and your response would be appreciated.

Here is a link to the web-based survey:
http://www.surveymonkey.com/s.asp?u=915523002742

We kindly ask that you complete the survey within the next few days. If you have any difficulty in accessing or taking the survey, please contact Mr. Sean Goffnett, lead researcher for Eastern Michigan University, at sgoffnet@emich.edu.

Thank you for your participation,
ASQ Automotive Division Council and Executive Board

Phase I (Administered)

January 4, 2007

Subject: ASQ Automotive Division – 2007 QMS Survey - Response Requested

Dear Valued ASQ Member,

We are working with academic researchers to conduct an important web-based automotive industry survey that explores the relationships between employee perceptions, quality systems, and workplace outcomes, and your response would be greatly appreciated.

To participate, please click on the address provided below. If selecting the link does not launch the survey in a new browser window, simply enter or copy/paste the link into your Internet browser address bar and hit enter.

Here is a link to our survey:
http://www.surveymonkey.com/s.asp?u=610803076505

We kindly ask that you complete the survey within the next few days, and respond no later than January 31, 2007.

If you have any difficulty in accessing or taking the survey, please contact Mr. Sean Goffnett, lead researcher for Eastern Michigan University, at sgoffnet@emich.edu.

Thank you for your participation,
ASQ Automotive Division Council and Executive Board

Phase II (Administered)

January 26, 2007

Dear ASQ Member,

The ASQ Automotive Division is in need of some valuable input and assistance. Approximately two weeks ago, you were sent some information asking you to participate in an important automotive industry survey. You were selected because of your membership in the ASQ and because of your recognized automotive expertise. This second invitation is being issued in an effort to increase the survey response rate.

The purpose of this research is to explore the relationships between employee perceptions, quality systems, and workplace outcomes. In order to increase the potential significance of our results, your response would be greatly appreciated.

To participate, please click on the address provided below. If selecting the link does not launch the survey in a new browser window, simply enter or copy/paste the survey address link into your Internet browser address bar and hit enter.

Here is a link to the survey:
http://www.surveymonkey.com/s.asp?u=610803076505

If you have already completed the survey, the researchers would like to extend our sincere thanks for helping us work to improve the quality management field. If you have not had an opportunity to participate, please try to complete the survey within the next few days, and respond on or before January 31, 2007.

Any questions or comments concerning the survey can be directed to Mr. Sean Goffnett, lead researcher for Eastern Michigan University. He can be reached at sgoffnet@emich.edu.

Thank you for your participation,
ASQ Automotive Division Council and Executive Board

Note. The survey was open through February, 2007. During the first week of February, ASQ sent out, as part of a mass email to its Automotive Division members, a link to the survey with a note stating there was still time to participate.

Appendix C

Survey Instrument

HIGH PERFORMANCE QUALITY MANAGEMENT SYSTEMS AND WORK RELATED OUTCOMES: EXPLORING THE ROLE OF AUDIT READINESS

Survey Instrument

INTRODUCTION & INFORMED CONSENT AGREEMENT

Dear ASQ Member,

You have been selected to participate in an important automotive industry survey that is being made available to you through a collaboration between the American Society for Quality and Eastern Michigan University. Our survey consists of 90 quick-response questions that, for the most part, only require you to mark the box that reflects your best answer to a given question. This survey is completely confidential and anonymous and it should take approximately 30 minutes to complete.

Purpose:
The purpose of this research is to better understand the relationships between employee perceptions, quality systems and standards (e.g., ISO/TS 16949, MBNQA), and workplace outcomes. The results of this research will help identify variables that make automotive quality systems function at high-performing levels.

Participation:
If you agree to participate, simply click on the NEXT button (below) to get started. The NEXT button advances you to the next page that needs completed. Your confidential answers will automatically be saved and stored in a secure database. Your voluntary participation is appreciated.

Privacy:
There are no foreseeable risks associated with this project. However, if you are at all uncomfortable with answering any questions, you can skip a question or withdraw from the study at any time without penalty. To leave the survey, simply click "exit this survey" in the upper right hand corner of the screen. You can leave the survey temporarily and return where you left off. All individual responses and company information will be kept confidential.

Publication:
Your responses will be combined with those of other respondents. A summary of the results will be available upon request. Summary results will also be published per University requirements in Dissertation Abstracts International and in other accepted sources like ASQ magazines, journals, or conference proceedings.

If you have any questions, please contact the lead researcher, Mr. Sean Goffnett, at sgoffnet@emich.edu. Thank you for your participation. We look forward to receiving your response.

"This research protocol has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee and if you have any questions on the approval process, please contact Dr. Deb deLaski-Smith [734.487.0042, Deb.deLaski-Smith@emich.edu], Interim Dean, Eastern Michigan University Graduate School."

BASIC INSTRUCTIONS

Please answer the following questions by placing a mark next to the most appropriate response or by commenting in the designated area. Scroll down as necessary. If a question is not applicable to you or your organization, then please enter the phrase "NA" or "No Opinion" in the space provided. Select the "next" button at the bottom of the page to advance to the next page.

GENERAL INFORMATION

Please answer the following questions by placing a mark next to the most appropriate response or by commenting in the designated area.

a. What position best describes your job title?

Quality Manager	___	Quality Engineer	___
Quality Engineering Tech	___	Continuous Improvement Specialist	___
Reliability Engineer	___	Quality Auditor	___
Plant Manager	___	Operations Manager	___
Director	___	Vice President	___
President/Chief Executive	___	Other (Please Specify): ________	

b. What professional certifications do you hold (CQI, QA, QE, MQ, RE, SSBB, PE)? __

c. What year range below best describes your age? 18-29 30-39 40-49 50-59 60-69 >70

d. What is the highest level of education that you have achieved?

High School	___	Some College	___
Associate's Degree	___	Bachelor's Degree	___
Some Graduate Work	___	Master's Degree	___
Doctorate	___	Other (please specify):	____

e. How many years have you worked in the automotive industry?<1 1-5 6-10 11-15 >16

f. How many years have you worked for your current employer? <1 1-5 6-10 11-15 >16

g. What is the major product/service offered to the customer by your location? ________

h. What industry position best describes your organization?

OEM ___ Tier I ___ Tier II ___ Tier III ___ Other ___

i. Who is your main automotive customer? ___________________

j. How many people in total are employed at your specific location?

1-50 ___ 51-100 ___ 101-250 ___ 251-500 ___ 501 or more ___

k. Where are you located? U.S. ___ Other ___

l. What quality management system registrations has your organization attained?
ISO9001:2000 __ QS9000 __ ISO/TS16949 __ ISO14001 __ Other(s): _______
m. What is your level of knowledge regarding ISO/TS 16949:2002?
Very Low Low Medium High Very High
n. Does your organization have a formal internal audit team/committee?
o. Are you a member of an internal audit team/committee within your organization?
p. Approximately how many months before the next scheduled third-party audit takes place at the facility you work? 0-3 4-6 7-9 10-12 >12
q. Approximately how many non-conformances (total major and minor) were identified during the last third-party audit at your facility? 0-3 4-6 7-9 10-12 >12
r. What is your level of knowledge regarding the Malcolm Baldrige National Quality Award (MBNQA)? Very Low Low Medium High Very High

---

QUICK NOTE

That was quick! And so is the rest of the survey! There are eight (8) sections remaining, which cover: leadership, information analysis and strategic planning, human resource management, process management, customer focus and business results, and employee focus. The following sections are much shorter than the first. Each of the following sections contains roughly 8-12 quick-response questions.

The concepts covered herein refer to elements of popular quality management systems and awards. Your response to these questions will help us better understand the importance of each concept presented.

LEADERSHIP

Please indicate your level of agreement or disagreement with the following statements: Scale anchors: *Strongly Disagree (1), Neither Agree nor Disagree (4), Strongly Agree (7), No Opinion (9)*

Senior Leadership, Governance & Social Responsibilities

a. All major department heads within our plant accept their responsibility for quality.
b. Our top management strongly encourages employee involvement in the production process.
c. There is a high degree of senior management participation in quality management activities.
d. Senior managers are easily accessible to customers.
e. Employees can clearly articulate upper management’s vision for success.
f. Employees know what their performance objectives are with respect to customer requirements.
g. Promoting legal and ethical behavior is a top priority for all employees at this facility

----

MEASUREMENT, ANALYSIS, AND KNOWLEDGE
(FORMERLY INFORMATION AND DATA)

Please indicate the degree of emphasis placed on the following activities:
Scale anchors: *No Emphasis (1), Moderate Emphasis (4), Extreme Emphasis (7), No Opinion (9)*

Measurement & Management of Information

a. Ensuring that employees have rapid access to reliable quality-related data.
b. Collecting performance feedback data from customers/interested parties.
c. Integrating knowledge and data from across the organization to support business planning.
d. Evaluating the process for collecting and analyzing data.

STRATEGIC PLANNING

Please indicate your level of agreement or disagreement with the following statements:
Scale anchors: *Strongly Disagree (1), Neither Agree nor Disagree (4), Strongly Agree (7), No Opinion (9)*

Strategy Development & Deployment

a. Customers and other interested parties are involved in the development of the firm's strategy
b. Competitive comparisons and benchmarks are used to identify strategic opportunities
c. Strategic plans over the short term and long term are well aligned
d. Strategic plans are translated into actionable business drivers and process performance measureables (e.g., waste reduction targets)
e. Strategic plans are fully deployed

WORKFORCE FOCUS
(HR MANAGEMENT)

Please indicate your level of agreement or disagreement with the following statements:
Scale anchors: *Strongly Disagree (1), Neither Agree nor Disagree (4), Strongly Agree (7), No Opinion (9)*

HR – Planning and Evaluation

a. Human resource plan are aligned with business strategies
b. Employee development objectives are derived from strategic objectives
c. Employee recognition and reward are tied to strategic goals and objectives

HR – Employee Well-Being and Satisfaction

a. Improvement activities include employee well-being factors like health, safety, ergonomics, and education.
b. Our work environment is conducive to the satisfaction and well-being of all employees.
c. A variety of methods are used to measure employee views regarding satisfaction and well-being.

Please indicate the degree of emphasis placed on the following activities:
Scale anchors: *No Emphasis (1), Moderate Emphasis (4), Extreme Emphasis (7), No Opinion (9)*

HR – High Performance Work Systems

a. Giving workers a broad range of tasks.
b. Giving workers more responsibility with respect to quality (e.g., planning, inspection, audit, problem-solving, etc).
c. Improving direct labor motivation

HR – Employee Education, Training and Development

a. Employee training in quality principles (e.g., goals, problem-solving, statistical tools, improvement, and teamwork)
b. Involving employees in training development
c. Evaluating training benefits

PROCESS MANAGEMENT

Please indicate your level of agreement or disagreement with the following statements:
Scale anchors: *Strongly Disagree (1), Neither Agree nor Disagree (4), Strongly Agree (7), No Opinion (9)*

Process Management (Work Systems Design)

a. Processes in our facility are designed to be "mistake-proof".
b. A large percent of the key processes and equipment in our facility are currently under statistical quality control. [key processes and core competencies should have direct link]
c. It is a priority that we make extensive use of statistical techniques to reduce variance in processes and improve performance.
d. Process performance charts and diagrams (e.g., cycle time, productivity, process control, defect rate, work instructions) are found in our facility for all processes.

Management of Supplier Performance

a. We strive to establish long-term relationships with high-quality suppliers.
b. Quality is our number one criterion in selecting suppliers.
c. We rely on a small number of high quality suppliers.

Note. Author failed to ask a question about "incorporating new technologies" as specified in process management section by the National Baldrige Program Award 2007 Criteria for Performance Excellence (NIST, 2006, p. 29).

AUDIT OF REGISTERED QMS MANDATORY PROCEDURES
(PERCEIVED AUDIT READINESS)

NOTE: Assume your organization were to undergo a third-party audit of its quality system starting today, please mark the response that most accurately assesses your site's current position with respect to conformance/compliance to the following procedures:

Please indicate your level of agreement or disagreement with the following statements: Scale anchors: *Strongly Disagree (1), Neither Agree nor Disagree (4), Strongly Agree (7), No Opinion (9)*

Registered QMS – Mandatory Documented Procedures

a. We have a documented procedure that is proven to be successful in practice with regard to controlling documents within our quality management system.
b. Our documented records maintenance procedure is proven to be effective in practice.
c. We have a documented training procedure that is proven to be effective in practice with regard to achieving trained competence of personnel
d. We have a documented internal audit procedure that is proven to be successful in practice as it helps determine our level of conformance to the quality standard.
e. Our documented procedure for controlling non-conforming products is proven to be effective in practice as it assures only conforming items are delivered to our customers for use.
f. We have an effective documented corrective action procedure that, in practice, includes thorough documentation of actions taken to identify and control causes of non-conformities.
g. We have a documented preventive action procedure that is proven to be successful in practice in that it consistently prevents causes of non-conformities from occurring.
h. We have documented procedures that are proven to be successful in practice for all required customer oriented processes.

Sources:

Hoyle, D. (2005). Automotive quality systems handbook: ISO/TS 16949: 2002 edition (2nd ed.). Oxford : Elsevier Butterworth-Heinemann. [p. 132-135]

AIAG (2004) TS RULES-2: automotive certification scheme for ISO/TS 16949:2002, rules for achieving IATF recognition. Southfield, MI: AIAG.

QMI (n.d.). ISO/TS 16949:2002 new automotive quality standard focuses on continual improvement and customer satisfaction. Toronto, Canada: M. Willem, Table 3, p. 4.

Note. Questions for this scale were derived from ISO clauses: 4.2.3, 4.2.4, 6.2.2.2, 8.2.2, 8.3, 8.5.2, and 8.5.3, respectively.

CUSTOMER FOCUS & SATISFACTION

Please indicate your level of agreement or disagreement with the following statements: Scale anchors: *Strongly Disagree (1), Neither Agree nor Disagree (4), Strongly Agree (7), No Opinion (9)*

Customer Focus (IV)

a. We are frequently in close contact with our customers.
b. We understand our customer's needs and expectations.
c. Our complaint management process ensures effective elimination of all "causes" of customer complaints.
d. Our main customer is likely to return and conduct more business with us.

Please indicate your plant's position compared to your competitors:
Scale anchors: *Significantly Lower (1), Equal (4), Significantly Higher (7), No Opinion (9)*

Customer Satisfaction Results (DV)

a. Incomplete Orders/Missed Shipments/Deliveries (R)
b. Returns and Warranty Claims (R)
c. Defect rates (e.g., PPM) (R)
d. Overall product/service quality (conformance to specifications and requirements, performance, reliability, etc.)
e. Overall level of innovativeness demonstrated in the main product, process, or service (newness, originality, or uniqueness)
f. Overall customer satisfaction

BUSINESS RESULTS

Over the past two years, please indicate the change in each of the following financial indicators by placing a mark next to the most appropriate response:

Scale anchors: *Significant Decrease (1), No Change (4), Significant Increase (7), No Opinion (9)*

Company Financial Results

a. Market share
b. Return on investment (ROI)
c. Return on sales (ROS)

Source for MBNQA related Categories one through seven:

NIST (2006). 2007 *Baldrige national quality program: criteria for performance excellence.* Gaithersburg, MD: US Department of Commerce, National Institute of Standards and Technology.

Wilson, D. D. & Collier, D. A. (2000). An empirical investigation of the Malcolm Baldrige National Quality Award Causal Model. Decision Sciences, 31(2), Appendix A, pp. 384-390. Adapted instrument with permission from first author.

EMPLOYEE ATTITUDES

Please indicate your level of agreement or disagreement with the following statements: Scale anchors: *Strongly Disagree (1), Neither Agree nor Disagree (4), Strongly Agree (7), No Opinion (9)*

Affective Commitment

a. I would be very happy to spend the rest of my career with this organization.
b. I really feel as if this organization's problems are my own.
c. I feel like "part of the family" at my organization.
d. I feel "emotionally attached" to this organization.
e. This organization has a great deal of personal meaning for me.
f. I feel a strong sense of belonging to my organization.

Overall Job Satisfaction

a. All in all, I am satisfied with my job.
b. In general, I don't like my job. (R)
c. In general, I like working here.

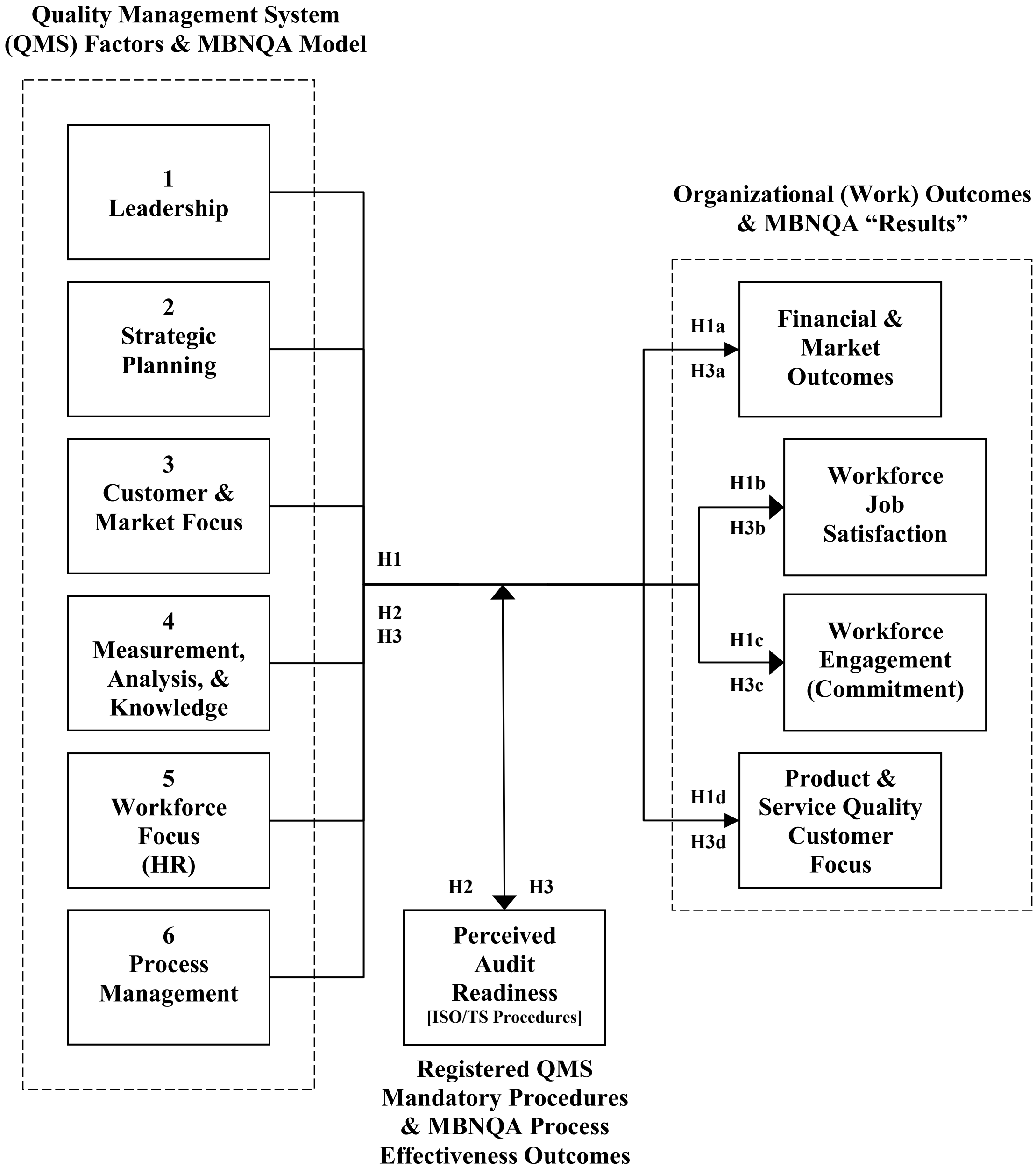
Sources:

[Job Satisfaction]: Excerpt from Cammann, C., Fichman, M., Jenkins, D., & Klesh, J. (1983). Assessing attitudes and perceptions of organizational members. In S. Seachore, E. Lawler, P. Mirvis, & C. Cammann (Eds.), Assessing organizational change: A guide to methods, measures and practices. New York: John Wiley and Sons, Table 4-2, p. 84.

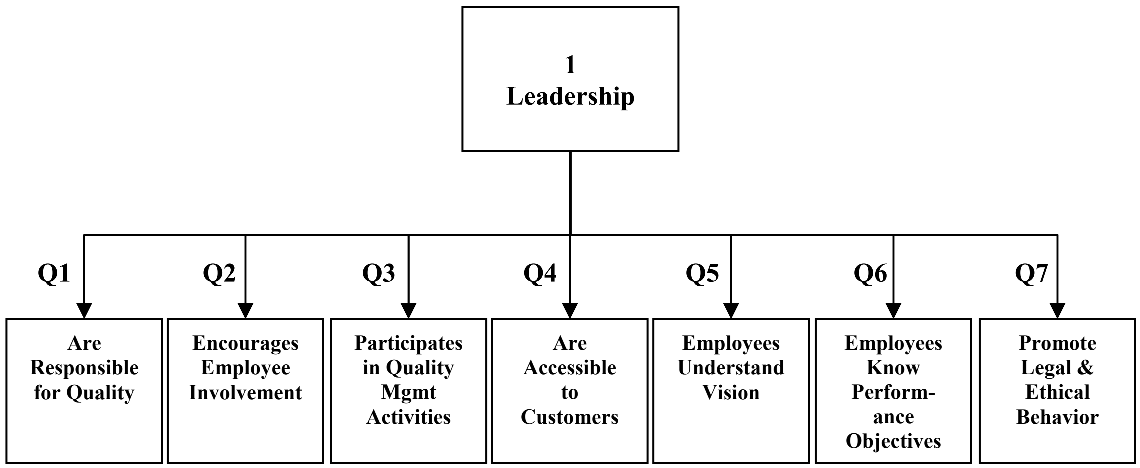
[Organizational Commitment]: Excerpt from Meyer, J. P., & Allen, N. J. (1997). Commitment in the workplace. Thousand Oaks, CA: Sage, Table A-1, p. 118.

Appendix D

Research Model



Appendix E



Note. Factor composite framework graphic for "leadership" with scale items is shown.

Appendix F

Demographics and Sample Characteristics

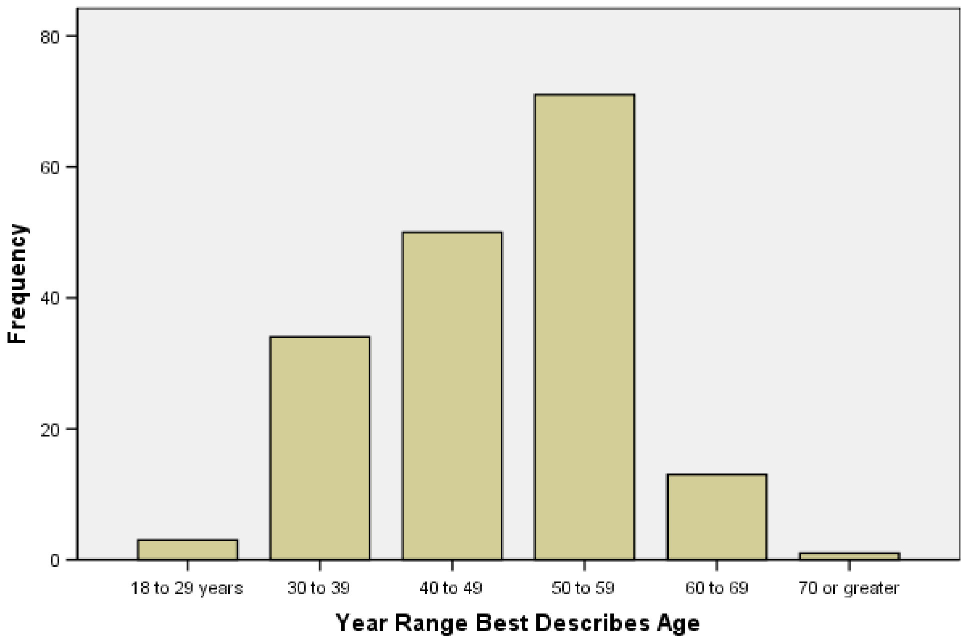
Position in Company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Quality Manager	54	31.4	31.4	31.4
	Quality Engineer	48	27.9	27.9	59.3
	Quality Tech	4	2.3	2.3	61.6
	Quality Continuous Improvement Specialist	10	5.8	5.8	67.4
	Reliability Engineer	2	1.2	1.2	68.6
	Quality Auditor	9	5.2	5.2	73.8
	Operations Manager	2	1.2	1.2	75.0
	Director	12	7.0	7.0	82.0
	VP	3	1.7	1.7	83.7
	President / Executive	1	.6	.6	84.3
	Other	27	15.7	15.7	100.0
	Total	172	100.0	100.0	

Professional Certificates Held Y or N

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	42	24.4	24.4	24.4
	Professional Certification(s) - Yes	130	75.6	75.6	100.0
	Total	172	100.0	100.0	

Year Range Best Describes Age



Highest Level of Education Achieved

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High School	6	3.5	3.5	3.5
	Some College	29	16.9	16.9	20.3
	Associate's Degree	18	10.5	10.5	30.8
	Bachelor's Degree	48	27.9	27.9	58.7
	Some Graduate Work	13	7.6	7.6	66.3
	Master's Degree	50	29.1	29.1	95.3
	Doctorate	5	2.9	2.9	98.3
	Other	3	1.7	1.7	100.0
	Total	172	100.0	100.0	

Years in Auto Industry

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	5	2.9	2.9	2.9
	Less than 1 year	1	.6	.6	3.5
	1 to 5 years	12	7.0	7.0	10.5
	6 to 10 years	32	18.6	18.6	29.1
	11 to 15 years	30	17.4	17.4	46.5
	16 or more years	92	53.5	53.5	100.0
	Total	172	100.0	100.0	

Years employeed at Current Employer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	3	1.7	1.7	1.7
	Less than 1 year	8	4.7	4.7	6.4
	1 to 5 years	51	29.7	29.7	36.0
	6 to 10 years	40	23.3	23.3	59.3
	11 to 15 years	29	16.9	16.9	76.2
	16 or more years	41	23.8	23.8	100.0
	Total	172	100.0	100.0	

Number of Employees at Location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	.6	.6	.6
	1 to 50 employees	18	10.5	10.5	11.0
	51 to 100 employees	23	13.4	13.4	24.4
	101 to 250 employees	34	19.8	19.8	44.2
	251 to 500 employees	36	20.9	20.9	65.1
	501 or more employees	60	34.9	34.9	100.0
	Total	172	100.0	100.0	

Registered TS Company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ISO/TS Registered	118	68.6	68.6	68.6
	Other	54	31.4	31.4	100.0
	Total	172	100.0	100.0	

Note. Other category consisted of mostly ISO9001:2000 registered organizations. All respondents included in the study identified as having ISO/TS or ISO registered quality management systems. ISO/TS is the complete ISO9001:2000 standard with an added technical specification for automotive.

Individual's Level of ISO/TS 16949 Knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	.6	.6	.6
	Very Low Knowledge	7	4.1	4.1	4.7
	Low Knowledge	8	4.7	4.7	9.3
	Medium Knowledge	41	23.8	23.8	33.1
	High Knowledge	68	39.5	39.5	72.7
	Very High Knowledge	47	27.3	27.3	100.0
	Total	172	100.0	100.0	

Individual's Level of MBNQA Knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	3	1.7	1.7	1.7
	Very Low Knowledge	21	12.2	12.2	14.0
	Low Knowledge	47	27.3	27.3	41.3
	Medium Knowledge	70	40.7	40.7	82.0
	High Knowledge	23	13.4	13.4	95.3
	Very High Knowledge	8	4.7	4.7	100.0
	Total	172	100.0	100.0	

Member of Audit Team

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Audit Team Member	132	76.7	76.7	76.7
	Not an Audit Team Member	40	23.3	23.3	100.0
	Total	172	100.0	100.0	

Appendix G

Descriptive Statistics: Items and Composites

Statistics

		LEADrespQ	LEADeeInv	LEADmgPart	LEADmgAcss	LEADeeVisn	LEADprfObj	LEADethics
N	Valid	172	172	172	172	172	172	172
	Missing	0	0	0	0	0	0	0
Mean		4.8779	4.9244	4.6686	5.3314	4.2674	4.9302	5.3837
Median		5.0000	5.0000	5.0000	6.0000	4.0000	5.0000	6.0000
Mode		6.00	6.00	6.00	6.00	6.00	6.00	7.00
Std. Deviation		1.63735	1.66845	1.75737	1.67909	1.65734	1.54686	1.57590
Range		6.00	6.00	6.00	6.00	6.00	6.00	6.00
Minimum		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum		7.00	7.00	7.00	7.00	7.00	7.00	7.00

Statistics

Leadership Composite Variable (IV)

N	Valid	172
	Missing	0
Mean		4.9120
Std. Error of Mean		.10303
Median		5.1429
Mode		6.29
Std. Deviation		1.35123
Variance		1.826
Skewness		-.505
Std. Error of Skewness		.185
Kurtosis		-.658
Std. Error of Kurtosis		.368
Range		5.43
Minimum		1.57
Maximum		7.00
Percentiles	25	4.0000
	50	5.1429
	75	6.1071

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Leadership Composite Variable (IV)	.102	172	.000	.954	172	.000
LEADlogKX	.067	172	.059	.974	172	.002
LEADsqrtKX	.073	172	.025	.975	172	.004

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for leadership are shown.

Statistics

		STRAcusInv	STRAbenchm	STRAalignd	STRAmeasdr	STRAdeploy
N	Valid	172	172	172	171	172
	Missing	0	0	0	1	0
Mean		4.1395	4.8837	4.6221	4.9415	4.5000
Median		4.0000	5.0000	5.0000	5.0000	5.0000
Mode		4.00	6.00	6.00	6.00	6.00
Std. Deviation		1.65195	1.58515	1.67966	1.63674	1.58021
Minimum		1.00	1.00	1.00	1.00	1.00
Maximum		7.00	7.00	7.00	7.00	7.00

Statistics

Strategy Composite Variable (IV)

N	Valid	172
	Missing	0
Mean		4.6174
Std. Error of Mean		.10677
Median		4.8000
Mode		4.00
Std. Deviation		1.40026
Variance		1.961
Skewness		-.378
Std. Error of Skewness		.185
Kurtosis		-.672
Std. Error of Kurtosis		.368
Range		6.00
Minimum		1.00
Maximum		7.00
Percentiles	25	3.6000
	50	4.8000
	75	5.8000

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Strategic Planning Composite Variable (IV)	.097	172	.000	.970	172	.001
STRAlogKX	.097	172	.000	.971	172	.001
STRAsqrtKX	.077	172	.015	.983	172	.031

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for strategic planning are shown.

Statistics

		CUScontact	CUSneeds	CUScomplain	CUSreturn
N	Valid	169	169	169	169
	Missing	3	3	3	3
Mean		5.9349	5.6627	4.8225	5.7515
Median		6.0000	6.0000	5.0000	6.0000
Mode		7.00	6.00	6.00	7.00
Std. Deviation		1.29625	1.35351	1.57108	1.44247
Minimum		1.00	1.00	1.00	1.00
Maximum		7.00	7.00	7.00	7.00

Statistics

Customer Focus Composite Variable (IV)

N	Valid	172
	Missing	0
Mean		5.5429
Std. Error of Mean		.08756
Median		5.7500
Mode		6.25
Std. Deviation		1.14836
Variance		1.319
Skewness		-1.183
Std. Error of Skewness		.185
Kurtosis		1.452
Std. Error of Kurtosis		.368
Range		6.00
Minimum		1.00
Maximum		7.00
Percentiles	25	5.0000
	50	5.7500
	75	6.2500

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Customer & Market Focus Composite Variable (IV)	.144	172	.000	.905	172	.000
CUSTlogKX	.063	172	.088	.977	172	.006
CUSTsqrtKX	.099	172	.000	.958	172	.000

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for customer focus are shown.

Statistics

		INFOaccData	INFOcuFeed	INGOintegr	INFOevalpr
N	Valid	170	171	171	172
	Missing	2	1	1	0
Mean		4.9176	5.0760	4.7251	4.5000
Median		5.0000	5.0000	5.0000	5.0000
Mode		6.00	6.00	6.00	5.00
Std. Deviation		1.42847	1.35476	1.45942	1.53897
Range		6.00	5.00	5.00	6.00
Minimum		1.00	2.00	2.00	1.00
Maximum		7.00	7.00	7.00	7.00

Statistics

Info Data and Knowledge Composite Variable (IV)

N	Valid	172
	Missing	0
Mean		4.8047
Std. Error of Mean		.09446
Median		5.0000
Mode		5.50
Std. Deviation		1.23889
Variance		1.535
Skewness		-.350
Std. Error of Skewness		.185
Kurtosis		-.487
Std. Error of Kurtosis		.368
Range		5.25
Minimum		1.75
Maximum		7.00
Percentiles	25	4.0000
	50	5.0000
	75	5.7500

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Information [Measurement, Analysis, and Knowledge] Composite Variable (IV)	.082	172	.006	.976	172	.004
INFOlogKX	.090	172	.002	.965	172	.000
INFOsqrtKX	.053	172	.200*	.985	172	.062

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for measurement, analysis and knowledge (information) are shown.

Statistics

		HRalignBus	HReeDevelp	HRrecRewrd	HReeWellBe	HRworkEnvi	HReeMeasVw	HRbroadTsk	HReeResQul	HRimpMotiv	HRtrnQulEE	HTtrnDevEE	HRtrnEvBen
N	Valid	172	172	172	172	172	172	172	172	170	172	172	171
	Missing	0	0	0	0	0	0	0	0	2	0	0	1
Mean		4.2965	4.2093	4.0407	4.8605	4.7267	3.9070	4.6570	4.5872	4.1412	4.2151	3.9535	3.7310
Median		4.5000	4.0000	4.0000	5.0000	5.0000	4.0000	5.0000	5.0000	4.0000	4.0000	4.0000	4.0000
Mode		5.00	5.00	5.00	6.00	6.00	2.00	4.00[a]	5.00	5.00	4.00	4.00	4.00
Std. Deviation		1.61114	1.74125	1.80110	1.64486	1.67220	1.78445	1.49612	1.62166	1.58135	1.65971	1.70933	1.66561
Minimum		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum		7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

a. Multiple modes exist. The smallest value is shown

Statistics

HR Focus Composite Variable (IV)

N	Valid	172
	Missing	0
Mean		4.2771
Std. Error of Mean		.10178
Median		4.4167
Mode		2.83[a]
Std. Deviation		1.33489
Variance		1.782
Skewness		-.134
Std. Error of Skewness		.185
Kurtosis		-.796
Std. Error of Kurtosis		.368
Range		5.83
Minimum		1.17
Maximum		7.00
Percentiles	25	3.1667
	50	4.4167
	75	5.3333

a. Multiple modes exist. The smallest value is shown

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
HR [Workforce] Focus Composite Variable (IV)	.069	172	.047	.981	172	.022
HRlogKX	.074	172	.021	.957	172	.000
HRsqrtKX	.067	172	.059	.982	172	.026

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for workforce focus (HR) are shown.

Statistics

		PROCmisprf	PROCinSPC	PROCstats	PROCcharts	PROCsupRel	PROCsupQul	PROCsupSml
N	Valid	170	170	168	170	170	170	169
	Missing	2	2	4	2	2	2	3
Mean		4.5588	3.9471	3.7738	4.3706	4.7941	3.6882	4.0888
Median		5.0000	4.0000	4.0000	4.0000	5.0000	4.0000	4.0000
Mode		5.00	4.00	4.00	6.00	6.00	3.00	4.00
Std. Deviation		1.53058	1.77844	1.73275	1.80999	1.73682	1.70012	1.73834
Minimum		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum		7.00	7.00	7.00	7.00	7.00	7.00	7.00

Statistics

Process Management Composite Variable (IV)

N	Valid	172
	Missing	0
Mean		4.1745
Median		4.2857
Mode		3.29[a]
Std. Deviation		1.25129
Variance		1.566
Skewness		-.279
Std. Error of Skewness		.185
Kurtosis		-.290
Std. Error of Kurtosis		.368
Range		6.00
Minimum		1.00
Maximum		7.00
Percentiles	25	3.2857
	50	4.2857
	75	5.1071

a. Multiple modes exist. The smallest value is shown

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Process Management Composite Variable (IV)	.059	172	.200*	.989	172	.185
PROClogKX	.071	172	.033	.968	172	.001
PROCsqrtKX	.042	172	.200*	.993	172	.601

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for process management are shown.

Statistics

		QMScontDoc	QMSrecMain	QMStraining	QMSintAudt	QMSnonConf	QMScorrAct	QMSprevAct	QMSkeyProc
N	Valid	168	167	169	169	169	167	168	168
	Missing	4	5	3	3	3	5	4	4
Mean		5.9940	5.5868	4.6982	5.5503	5.2959	5.2395	4.5714	5.1310
Median		6.0000	6.0000	5.0000	6.0000	6.0000	6.0000	5.0000	6.0000
Mode		7.00	6.00	5.00	6.00	6.00	6.00	6.00	6.00
Std. Deviation		1.19127	1.28122	1.49126	1.40962	1.39559	1.51780	1.71143	1.43339
Minimum		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum		7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Statistics

QMS Composite Variable (IV) [Perceived Audit Readiness]

N	Valid	172
	Missing	0
Mean		5.2584
Std. Error of Mean		.08432
Median		5.5000
Mode		5.50
Std. Deviation		1.10578
Variance		1.223
Skewness		-.885
Std. Error of Skewness		.185
Kurtosis		.943
Std. Error of Kurtosis		.368
Range		5.63
Minimum		1.38
Maximum		7.00
Percentiles	25	4.6250
	50	5.5000
	75	6.0938

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
QMS Composite Variable (IV) [aka Perceived Audit Readiness] POTENTIAL MEDIATING VARIABLE	.098	172	.000	.950	172	.000
QMSlogKX	.058	172	.200*	.987	172	.124
QMSsqrtKX	.063	172	.092	.986	172	.076

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for QMS perceived audit readiness and process effectiveness are shown.

Statistics

		OUTmktshare	OUTbusROI	OUTbusROS
N	Valid	169	168	168
	Missing	3	4	4
Mean		4.3195	4.3452	4.2083
Median		4.0000	4.0000	4.0000
Mode		4.00	4.00	4.00
Std. Deviation		1.34683	1.34915	1.42204
Minimum		1.00	1.00	1.00
Maximum		7.00	7.00	7.00

Statistics

OUTCOME Business Results Composite Variable (DV)

N	Valid	172
	Missing	0
Mean		4.2910
Std. Error of Mean		.09173
Median		4.0000
Mode		4.00
Std. Deviation		1.20303
Variance		1.447
Skewness		-.132
Std. Error of Skewness		.185
Kurtosis		.399
Std. Error of Kurtosis		.368
Range		6.00
Minimum		1.00
Maximum		7.00
Percentiles	25	4.0000
	50	4.0000
	75	5.0000

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
OUTCOME Business Results Composite Variable (DV)	.166	172	.000	.967	172	.000
OUTbrLOGkx	.168	172	.000	.893	172	.000
OUTbrSQRTkx	.140	172	.000	.952	172	.000

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for business results (financial and market focus) are shown.

Statistics

		OCcareer	OCorgprob	OCfamily	OCattach	OCmeaning	OCbelong	JSoverall	JSlikejob	JSlikework
N	Valid	169	169	169	169	169	169	169	168	169
	Missing	3	3	3	3	3	3	3	4	3
Mean		4.7633	4.8639	4.6331	4.5207	4.5799	4.6272	4.9231	5.3214	5.1538
Median		5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	6.0000	6.0000
Mode		7.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Std. Deviation		1.92189	1.82879	1.94761	1.86154	1.78814	1.89849	1.82248	1.65360	1.72861
Minimum		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum		7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Statistics

		OUTCOME Organizational Commitment Composite Variable (DV)	OUTCOME Job Satisfaction Composite Variable (DV)
N	Valid	172	172
	Missing	0	0
Mean		4.6647	5.1328
Std. Error of Mean		.12482	.12356
Median		5.0000	5.5000
Mode		6.00	6.00
Std. Deviation		1.63697	1.62053
Variance		2.680	2.626
Skewness		-.574	-.805
Std. Error of Skewness		.185	.185
Kurtosis		-.606	-.230
Std. Error of Kurtosis		.368	.368
Range		6.00	6.00
Minimum		1.00	1.00
Maximum		7.00	7.00
Percentiles	25	3.5417	4.3333
	50	5.0000	5.5000
	75	6.0000	6.3333

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
OUTCOME Organizational Commitment Composite Variable (DV)	.111	172	.000	.942	172	.000
OUTocLOGkx	.062	172	.200*	.963	172	.000
OUTocSQRTkx	.072	172	.030	.968	172	.001

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
OUTCOME Job Satisfaction Composite Variable (DV)	.163	172	.000	.902	172	.000
OUTjsLOGkx	.128	172	.000	.934	172	.000
OUTjsSQRTkx	.135	172	.000	.935	172	.000

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for job satisfaction and organizational commitment (engagement) are shown.

Statistics

		OUTordrMis	OUTreturns	OUTdefRate	OUTpsQual	OUTinnovat	OUTcustsat	OUTCOME orders missed REV	OUTCOME Warranty Returns and Claims REV	OUTCOME defect rate REV
N	Valid	167	166	166	167	166	166	167	166	166
	Missing	5	6	6	5	6	6	5	6	6
Mean		3.2156	3.2349	3.2530	4.8263	4.7470	4.8434	4.7844	4.7651	4.7470
Median		3.0000	3.0000	3.0000	5.0000	4.5000	5.0000	5.0000	5.0000	5.0000
Mode		4.00	4.00	4.00	6.00	4.00	4.00[a]	4.00	4.00	4.00
Std. Deviation		1.64690	1.70532	1.67581	1.63538	1.52031	1.49733	1.64690	1.70532	1.67581
Minimum		1.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00
Maximum		7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

a. Multiple modes exist. The smallest value is shown

Statistics

OUTCOME Customer Performance Measure Composite Variable (DV)

N	Valid	172
	Missing	0
Mean		4.7855
Std. Error of Mean		.07717
Median		4.5000
Mode		4.00
Std. Deviation		1.01214
Variance		1.024
Skewness		.489
Std. Error of Skewness		.185
Kurtosis		-.359
Std. Error of Kurtosis		.368
Range		5.33
Minimum		1.67
Maximum		7.00
Percentiles	25	4.0000
	50	4.5000
	75	5.5000

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
OUTCOME Customer Performance Measure Composite Variable (DV)	.154	172	.000	.924	172	.000
OUTcusLOGkx	.184	172	.000	.858	172	.000
OUTcustSQRTkx	.158	172	.000	.898	172	.000

a. Lilliefors Significance Correction

Note. Descriptive statistics and normality test graphics for product & service quality / customer focus (customer performance metrics) are shown.

Appendix H

Intercorrelations

Correlations[a]

		Leadership Composite (IV)	Strategy Composite (IV)	Customer Market Focus Composite (IV)	Information Composite (IV)	HR Composite (IV)	Process Mgmt Composite (IV)	QMS Composite (IV) [Mediator]	Work Outcome Business Performance Measures COMPOSITE (DV)	Work Outcome Employee Org Commitment COMPOSITE (DV)	Work Outcome Employee Job Satisfaction COMPOSITE (DV)	Work Outcome Customer Performance Measures COMPOSITE (DV)
Leadership Composite (IV)	Pearson Correlation	1	.730**	.596**	.783**	.761**	.588**	.621**	.288**	.604**	.647**	.260**
	Sig. (1-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Strategy Composite (IV)	Pearson Correlation	.730**	1	.631**	.742**	.794**	.586**	.611**	.344**	.550**	.559**	.243**
	Sig. (1-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000	.001
Customer Market Focus Composite (IV)	Pearson Correlation	.596**	.631**	1	.623**	.556**	.633**	.698**	.341**	.469**	.489**	.252**
	Sig. (1-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000
Information Composite (IV)	Pearson Correlation	.783**	.742**	.623**	1	.705**	.587**	.612**	.296**	.538**	.554**	.197**
	Sig. (1-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000	.005
HR Composite (IV)	Pearson Correlation	.761**	.794**	.556**	.705**	1	.609**	.621**	.396**	.671**	.650**	.218**
	Sig. (1-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000	.002
Process Mgmt Composite (IV)	Pearson Correlation	.588**	.586**	.633**	.587**	.609**	1	.636**	.369**	.405**	.474**	.267**
	Sig. (1-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000
QMS Composite (IV) [Mediator]	Pearson Correlation	.621**	.611**	.698**	.612**	.621**	.636**	1	.291**	.444**	.445**	.198**
	Sig. (1-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000	.005
Work Outcome Business Performance Measures	Pearson Correlation	.288**	.344**	.341**	.296**	.396**	.369**	.291**	1	.266**	.299**	.093
	Sig. (1-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000	.111
Work Outcome Employee Org Commitment	Pearson Correlation	.604**	.550**	.469**	.538**	.671**	.405**	.444**	.266**	1	.837**	.141*
	Sig. (1-tailed)	.000	.000	.000	.000	.000	.000	.000	.000		.000	.033
Work Outcome Employee Job Satisfaction	Pearson Correlation	.647**	.559**	.489**	.554**	.650**	.474**	.445**	.299**	.837**	1	.125
	Sig. (1-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000		.052
Work Outcome Customer Performance Measures	Pearson Correlation	.260**	.243**	.252**	.197**	.218**	.267**	.198**	.093	.141*	.125	1
	Sig. (1-tailed)	.000	.001	.000	.005	.002	.000	.005	.111	.033	.052	

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

a. Listwise N=172

Appendix I

Internal Consistency Reliability

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.919	.918	7

Note. Leadership reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.913	.913	5

Note. Strategic planning reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.833	.835	4

Note. Customer focus reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.881	.881	4

Note. Information reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.949	.949	12

Note. Workforce focus reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.856	.857	7

Note. Process mgmt. reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.907	.908	8

Note. QMS perceived audit readiness and process effectiveness reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.863	.862	3

Note. Business results reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.707	.706	6

Note. Customer metrics reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.942	.942	6

Note. Commitment reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.937	.938	3

Note. Job satisfaction reliability is given.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.922	.921	6

Note. MBNQA model reliability is given.

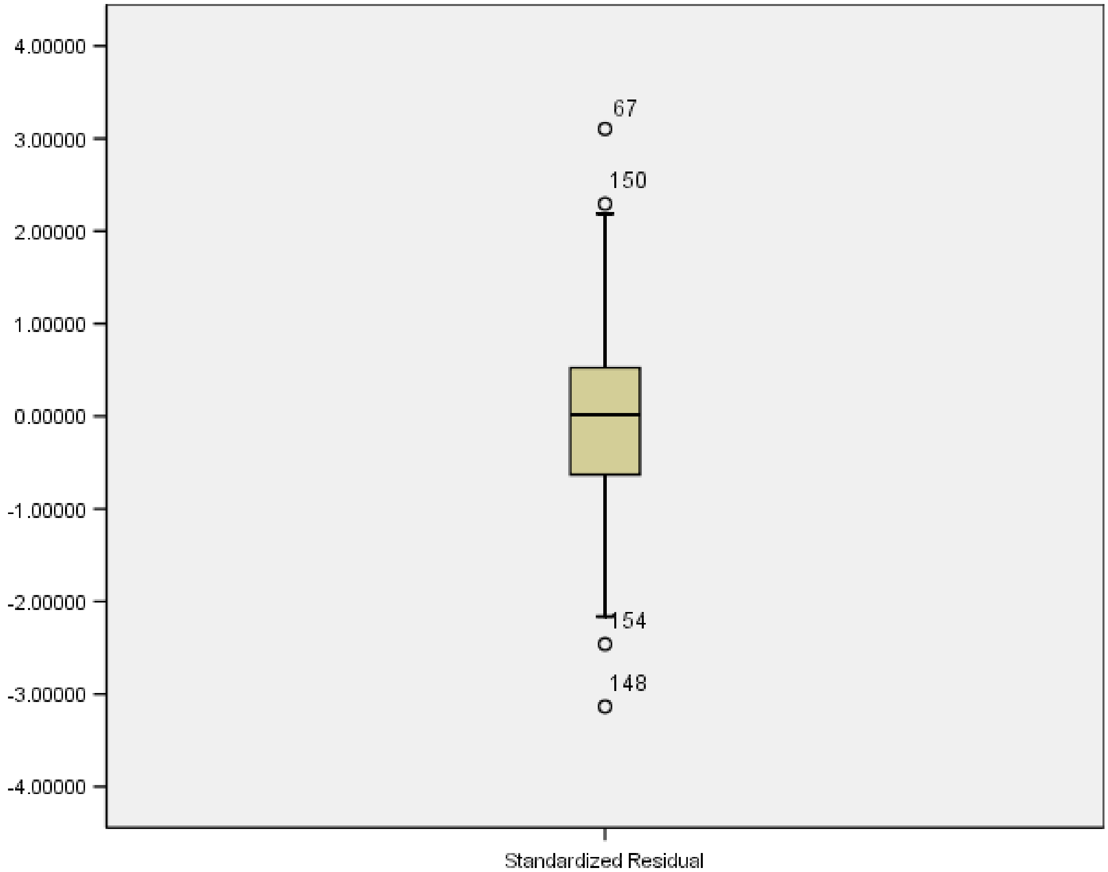
Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.929	.930	7

Note. MB+QMS model reliability is given.

Appendix J

H1a Regression Assumptions & Analyses Graphics MB → BUS



	Bus Case	Mahalanobis Distance	Cook's Distance
1	66	31.35871	0.00615
2	20	23.62110	0.01477
3	3	21.07625	0.00000
4	100	20.44766	0.00062
5	13	18.17878	0.00079
6	90	18.04721	0.00583
7	89	18.01455	0.05007
8	165	16.73057	0.00806
9	63	16.64283	0.00005
10	136	15.98157	0.00151

Note. Multivariate outlier and influential case analysis graphics for H1a are shown. Suspect cases were retained due to a lack of practical evidence to substantiate removal.

VIF R-sq THRESHOLD	0.900	0.100	10.00
	R-sq	Tolerance	VIF
LEAD	0.714	0.286	3.50
STRA	0.720	0.280	**3.57**
CUST	0.601	0.399	2.51
INFO	0.695	0.305	3.28
HR	0.718	0.282	3.55
PROC	0.531	0.469	2.13
QMS	0.604	0.396	2.53
Average	0.655	0.345	3.008
Maximum	0.720		3.57

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions						
				(Constant)	Leadership Composite (IV)	Strategy Composite (IV)	Customer Market Composite (IV)	Information [MAK] Composite (IV)	HR Composite (IV)	Process Mgt Composite (IV)
1	1	6.831	1.000	.00	.00	.00	.00	.00	.00	.00
	2	.059	10.721	.32	.01	.06	.03	.00	.09	.00
	3	.039	13.190	.10	.02	.02	.00	.02	.00	.82
	4	.023	17.329	.10	.28	.18	.00	.24	.19	.00
	5	.021	18.154	.15	.07	.36	.16	.04	.37	.02
	6	.014	21.994	.22	.18	.08	.64	.31	.03	.11
	7	.013	23.319	.10	.44	.31	.15	.39	.33	.05

a. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Collinearity Diagnostics[a]

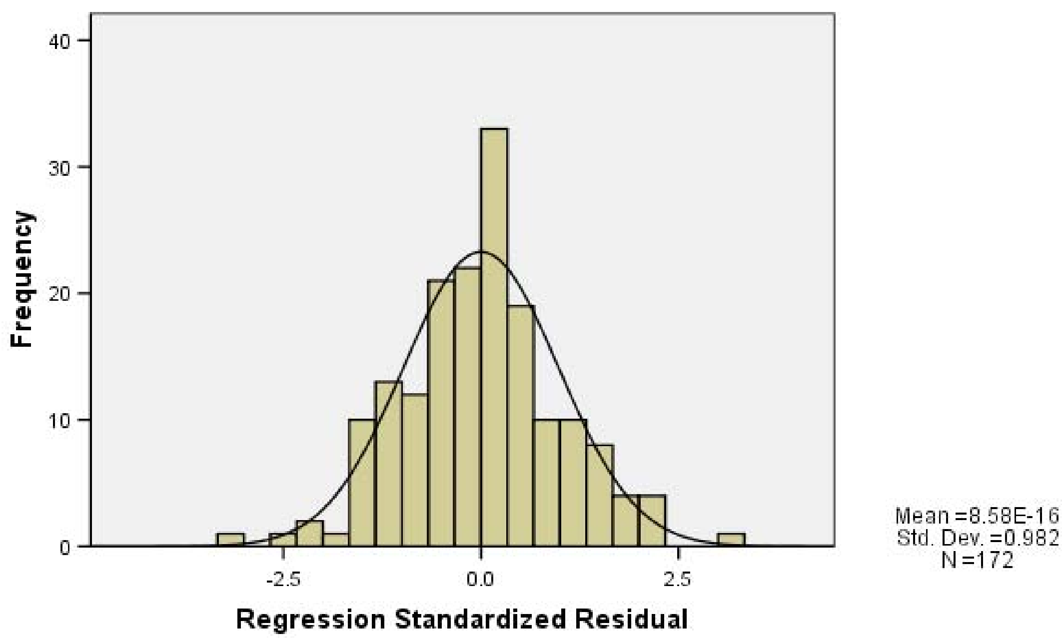
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions						
				(Constant)	Leadership Composite (IV)	Strategy Composite (IV)	Customer Market Composite (IV)	Information [MAK] Composite (IV)	HR Composite (IV)	Process Mgt Composite (IV)
1	1	6.831	1.000	.00	.00	.00	.00	.00	.00	.00
	2	.059	10.721	.32	.01	.06	.03	.00	.09	.00
	3	.039	13.190	.10	.02	.02	.00	.02	.00	.82
	4	.023	17.329	.10	.28	.18	.00	.24	.19	.00
	5	.021	18.154	.15	.07	.36	.16	.04	.37	.02
	6	.014	21.994	.22	.18	.08	.64	.31	.03	.11
	7	.013	23.319	.10	.44	.31	.15	.39	.33	.05

a. Dependent Variable: QMS Composite (DV)(IV) [Mediator]

Note. Variance inflation factors and collinearity diagnostics graphics for H1a are shown.

Histogram

Dependent Variable: Outcome Business Performance COMPOSITE (DV)

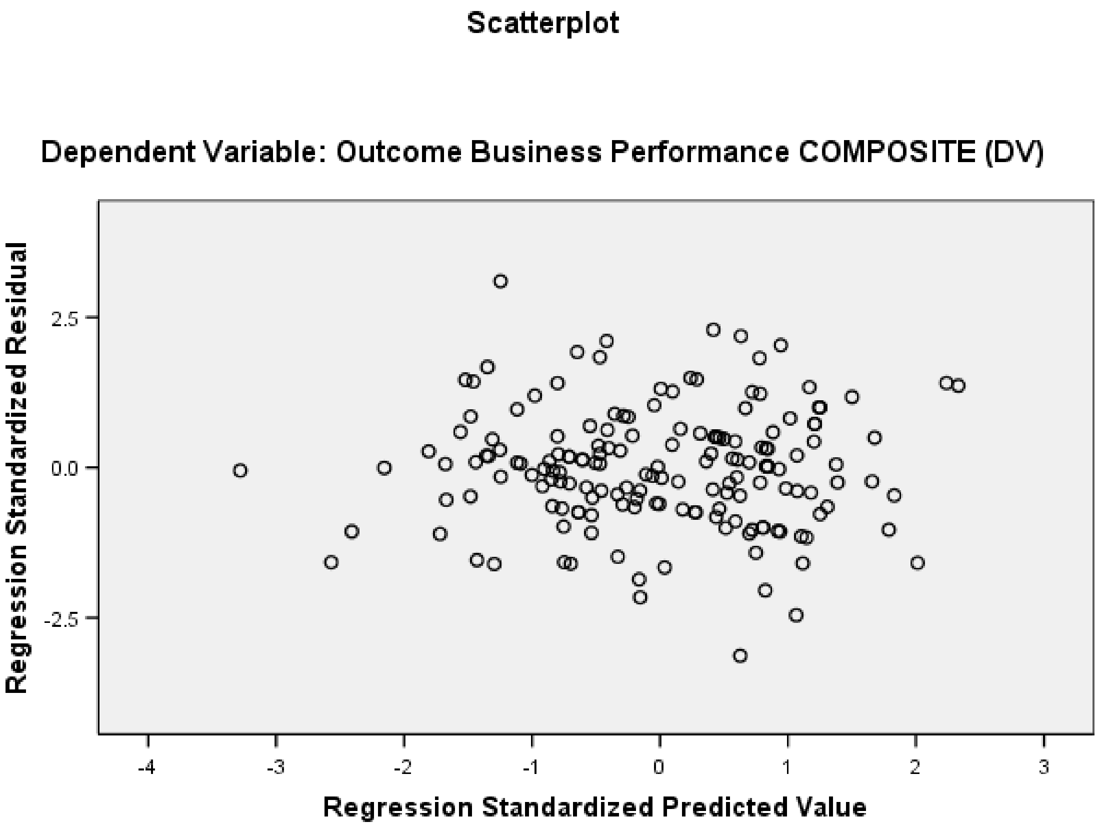


Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.051	172	.200*	.994	172	.692

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



Note. Normality and linearity check graphics for H1a are shown.

MB = BUS		Variance Ratio	> 10 Threshold
25%	75%	0.92	N
10%	**90%**	**1.10**	**N**
5%	95%	1.56	N

Note. Homoscedasticity check via conditional variance ratio graphic for H1a is listed (cf. Cohen et al, 2003, p. 120). Assumptions have been met in order to continue with complete regression analysis for MBNQA → Business Results (i.e., Financial & Market Outcomes).

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.444[a]	.197	.168	1.12634	.197	6.745	6	165	.000	2.080

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.346	6	8.558	6.745	.000[a]
	Residual	209.326	165	1.269		
	Total	260.672	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.043	.437		4.672	.000	1.180	2.907					
	Leadership Composite (IV)	-.119	.118	-.130	-1.004	.317	-.353	.115	.288	-.078	-.070	.290	3.450
	Strategy Composite (IV)	.017	.115	.020	.150	.881	-.210	.245	.344	.012	.010	.282	3.549
	Customer Market Composite (IV)	.151	.109	.140	1.381	.169	-.065	.366	.341	.107	.096	.470	2.128
	Information [MAK] Composite (IV)	-.026	.125	-.027	-.211	.833	-.274	.221	.296	-.016	-.015	.308	3.243
	HR Composite (IV)	.295	.121	.319	2.439	.016	.056	.534	.396	.187	.170	.285	3.508
	Process Mgt Composite (IV)	.164	.098	.166	1.674	.096	-.030	.358	.369	.129	.117	.493	2.028

a. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Note. Regression summary and independent errors test (D-W) graphics for H1a are shown.

Model Summary[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.444[a]	.197	.168	1.12634	.197	6.745	6	165	.000	
2	.444[b]	.197	.173	1.12302	.000	.023	1	165	.881	
3	.444[c]	.197	.177	1.11976	.000	.032	1	166	.858	
4	.435[d]	.190	.175	1.12141	-.007	1.496	1	167	.223	
5	.427[e]	.183	.173	1.12279	-.007	1.416	1	168	.236	2.054

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

c. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), HR Composite (IV)

e. Predictors: (Constant), Process Mgt Composite (IV), HR Composite (IV)

f. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

ANOVA[f]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.346	6	8.558	6.745	.000[a]
	Residual	209.326	165	1.269		
	Total	260.672	171			
2	Regression	51.317	5	10.263	8.138	.000[b]
	Residual	209.354	166	1.261		
	Total	260.672	171			
3	Regression	51.276	4	12.819	10.224	.000[c]
	Residual	209.395	167	1.254		
	Total	260.672	171			
4	Regression	49.400	3	16.467	13.094	.000[d]
	Residual	211.271	168	1.258		
	Total	260.672	171			
5	Regression	47.620	2	23.810	18.887	.000[e]
	Residual	213.052	169	1.261		
	Total	260.672	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

c. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), HR Composite (IV)

e. Predictors: (Constant), Process Mgt Composite (IV), HR Composite (IV)

f. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Coefficients[a]

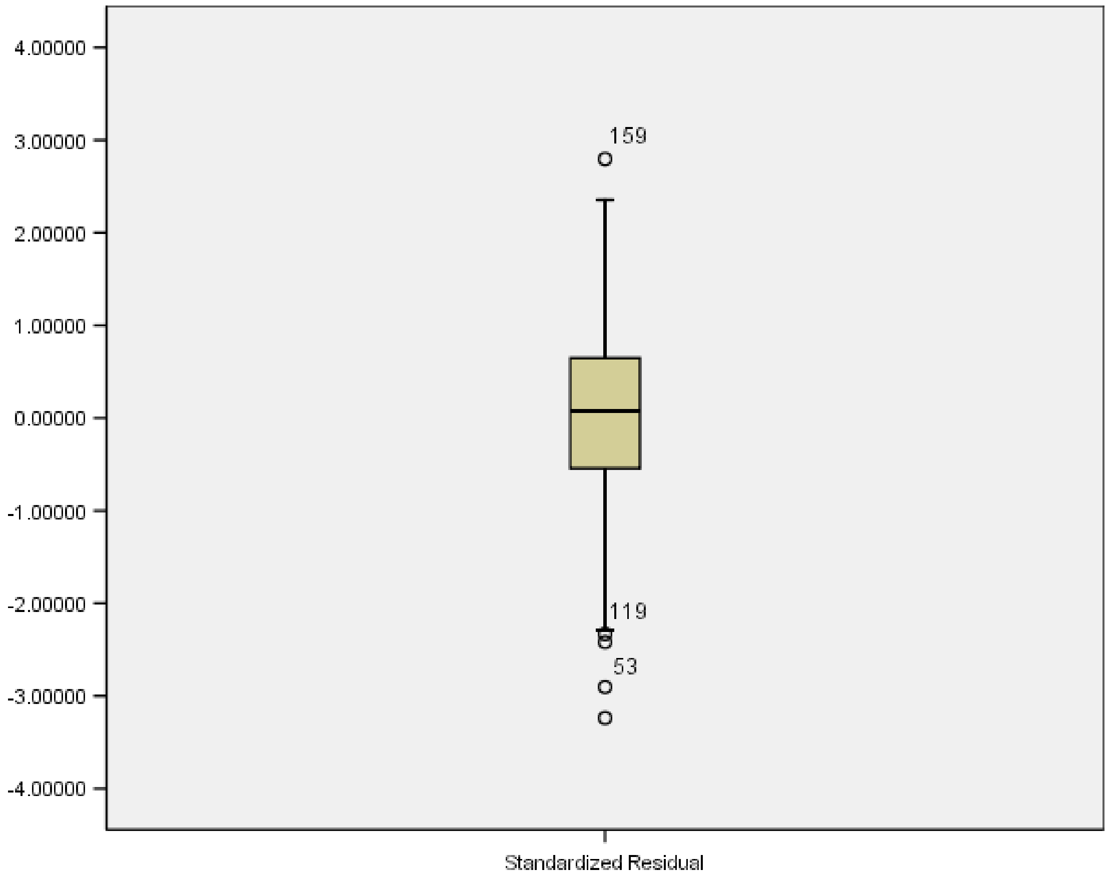
Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.043	.437		4.672	.000	1.180	2.907					
	Leadership Composite (IV)	-.119	.118	-.130	-1.004	.317	-.353	.115	.288	-.078	-.070	.290	3.450
	Strategy Composite (IV)	.017	.115	.020	.150	.881	-.210	.245	.344	.012	.010	.282	3.549
	Customer Market Composite (IV)	.151	.109	.140	1.381	.169	-.065	.366	.341	.107	.096	.470	2.128
	Information [MAK] Composite (IV)	-.026	.125	-.027	-.211	.833	-.274	.221	.296	-.016	-.015	.308	3.243
	HR Composite (IV)	.295	.121	.319	2.439	.016	.056	.534	.396	.187	.170	.285	3.508
	Process Mgt Composite (IV)	.164	.098	.166	1.674	.096	-.030	.358	.369	.129	.117	.493	2.028
2	(Constant)	2.036	.434		4.697	.000	1.180	2.892					
	Leadership Composite (IV)	-.117	.118	-.128	-.997	.320	-.350	.115	.288	-.077	-.069	.292	3.423
	Customer Market Composite (IV)	.154	.106	.144	1.453	.148	-.055	.364	.341	.112	.101	.494	2.025
	Information [MAK] Composite (IV)	-.022	.121	-.022	-.180	.858	-.260	.217	.296	-.014	-.012	.329	3.039
	HR Composite (IV)	.303	.107	.328	2.841	.005	.093	.514	.396	.215	.198	.364	2.750
	Process Mgt Composite (IV)	.164	.098	.166	1.680	.095	-.029	.357	.369	.129	.117	.493	2.028
3	(Constant)	2.026	.428		4.728	.000	1.180	2.872					
	Leadership Composite (IV)	-.127	.104	-.139	-1.223	.223	-.332	.078	.288	-.094	-.085	.372	2.688
	Customer Market Composite (IV)	.150	.103	.140	1.454	.148	-.054	.353	.341	.112	.101	.520	1.923
	HR Composite (IV)	.299	.104	.324	2.870	.005	.093	.505	.396	.217	.199	.378	2.643
	Process Mgt Composite (IV)	.163	.097	.165	1.675	.096	-.029	.355	.369	.129	.116	.496	2.014
4	(Constant)	1.951	.425		4.594	.000	1.113	2.790					
	Customer Market Composite (IV)	.119	.100	.111	1.190	.236	-.079	.317	.341	.091	.083	.553	1.808
	HR Composite (IV)	.224	.084	.242	2.657	.009	.058	.391	.396	.201	.185	.581	1.722
	Process Mgt Composite (IV)	.149	.097	.151	1.542	.125	-.042	.340	.369	.118	.107	.503	1.987
5	(Constant)	2.279	.324		7.030	.000	1.639	2.918					
	HR Composite (IV)	.252	.081	.272	3.104	.002	.092	.412	.396	.232	.216	.629	1.590
	Process Mgt Composite (IV)	.200	.087	.203	2.315	.022	.030	.371	.369	.175	.161	.629	1.590

a. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Note. Backward stepwise regression summary graphics for H1a are shown.

Appendix K

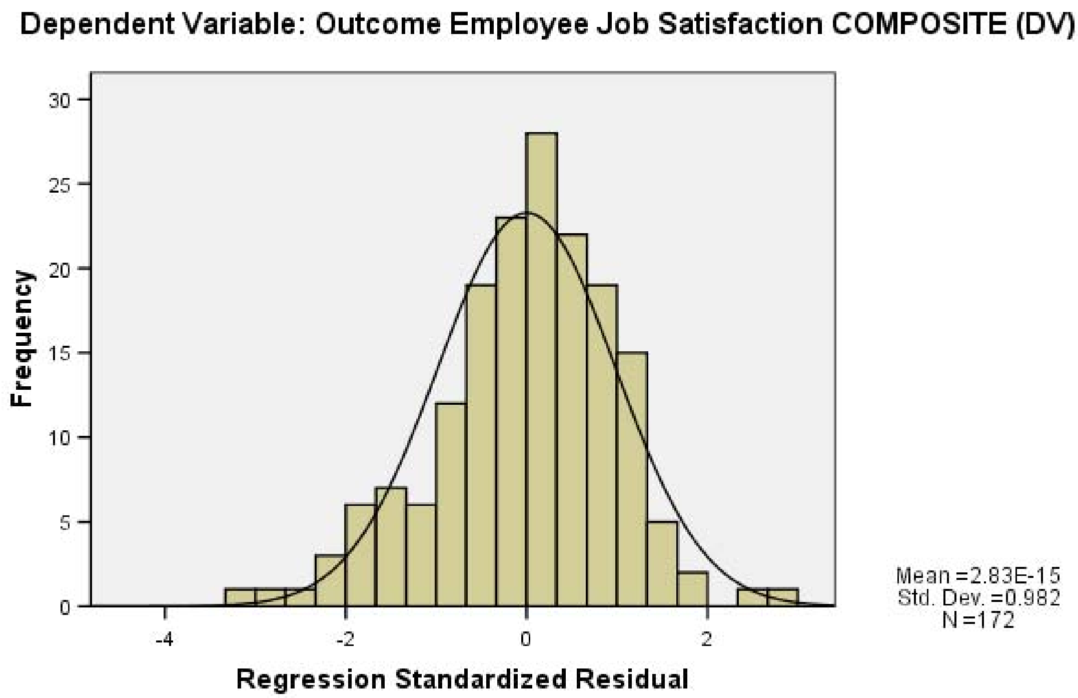
H1b Regression Assumptions & Analysis MB→Job Satisfaction



	JS Case	Mahalanobis Distance	Cook's Distance
1	66	31.35871	0.22786
2	20	23.62110	0.06485
3	3	21.07625	0.01683
4	100	20.44766	0.01938
5	13	18.17878	0.02572
6	90	18.04721	0.02750
7	89	18.01455	0.00003
8	165	16.73057	0.00325
9	63	16.64283	0.01040
10	136	15.98157	0.01527

Note. Multivariate outlier and influential case analysis graphics for H1b are shown.

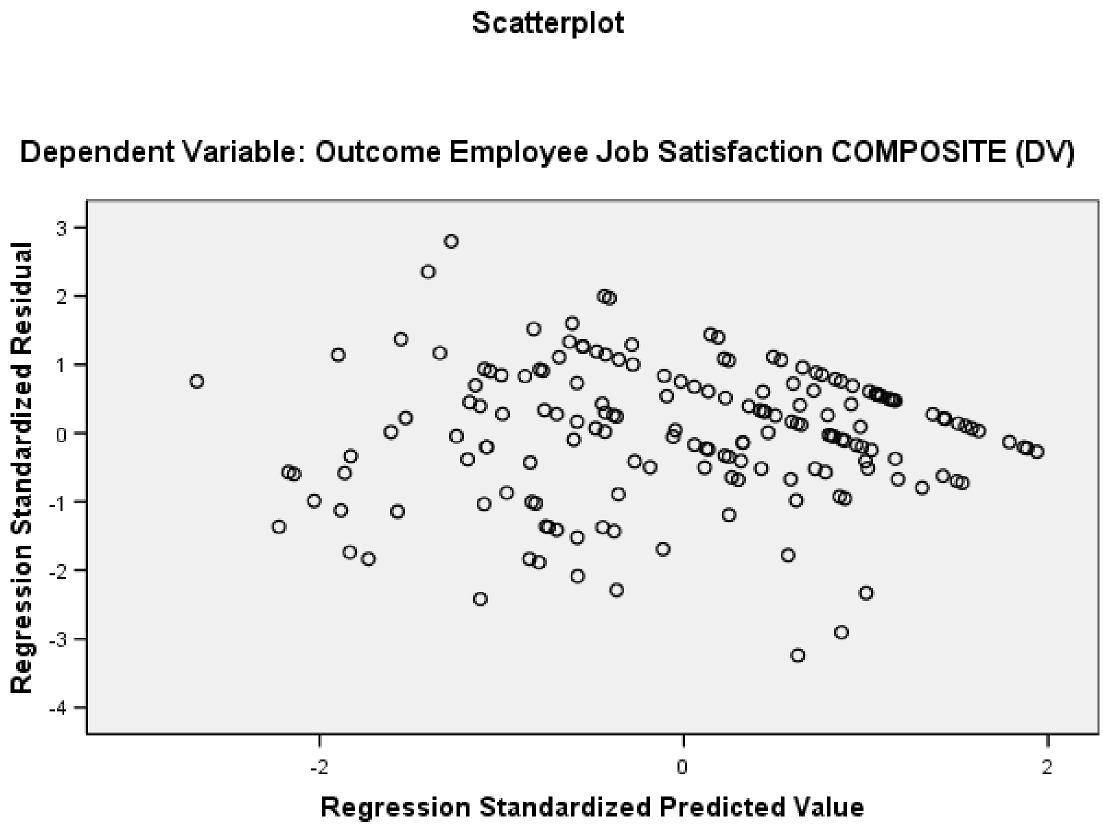
Histogram



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.063	172	.092	.983	172	.031

a. Lilliefors Significance Correction



Note. Normality and linearity check graphics for H1b are shown.

MB = JS		Variance Ratio	> 10 Threshold
25%	75%	2.10	N
10%	**90%**	**1.34**	**N**
5%	95%	0.97	N

Note. Homoscedasticity check via conditional variance ratio graphics for H1b are shown (cf. Cohen et al, 2003, p. 120). Assumptions have been met in order to continue with complete regression analysis for MBNQA → Job Satisfaction Outcomes.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.697[a]	.485	.467	1.18529	.485	25.937	6	165	.000	2.001

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	218.633	6	36.439	25.937	.000[a]
	Residual	231.810	165	1.405		
	Total	450.444	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.603	.460		1.309	.192	-.306	1.511					
	Leadership Composite (IV)	.398	.125	.331	3.194	.002	.152	.644	.647	.241	.178	.290	3.450
	Strategy Composite (IV)	-.065	.121	-.056	-.534	.594	-.304	.175	.559	-.042	-.030	.282	3.549
	Customer Market Composite (IV)	.161	.115	.114	1.400	.163	-.066	.387	.489	.108	.078	.470	2.128
	Information [MAK] Composite (IV)	-.013	.132	-.010	-.096	.923	-.273	.247	.554	-.007	-.005	.308	3.243
	HR Composite (IV)	.457	.127	.376	3.594	.000	.206	.708	.650	.269	.201	.285	3.508
	Process Mgt Composite (IV)	.021	.103	.016	.205	.838	-.183	.225	.474	.016	.011	.493	2.028

a. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

Note. Regression summary and independent errors test (D-W) graphics for H1b are shown.

Model Summary[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.697[a]	.485	.467	1.18529	.485	25.937	6	165	.000	
2	.697[b]	.485	.470	1.18175	.000	.009	1	165	.923	
3	.697[c]	.485	.473	1.17834	.000	.039	1	166	.843	
4	.696[d]	.484	.475	1.17599	-.001	.330	1	167	.567	
5	.691[e]	.477	.471	1.18040	-.007	2.269	1	168	.134	1.992

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

c. Predictors: (Constant), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Predictors: (Constant), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

e. Predictors: (Constant), Leadership Composite (IV), HR Composite (IV)

f. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

ANOVA[f]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	218.633	6	36.439	25.937	.000[a]
	Residual	231.810	165	1.405		
	Total	450.444	171			
2	Regression	218.620	5	43.724	31.309	.000[b]
	Residual	231.823	166	1.397		
	Total	450.444	171			
3	Regression	218.565	4	54.641	39.353	.000[c]
	Residual	231.878	167	1.388		
	Total	450.444	171			
4	Regression	218.107	3	72.702	52.570	.000[d]
	Residual	232.336	168	1.383		
	Total	450.444	171			
5	Regression	214.969	2	107.485	77.142	.000[e]
	Residual	235.474	169	1.393		
	Total	450.444	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

c. Predictors: (Constant), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Predictors: (Constant), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

e. Predictors: (Constant), Leadership Composite (IV), HR Composite (IV)

f. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

Coefficients[a]

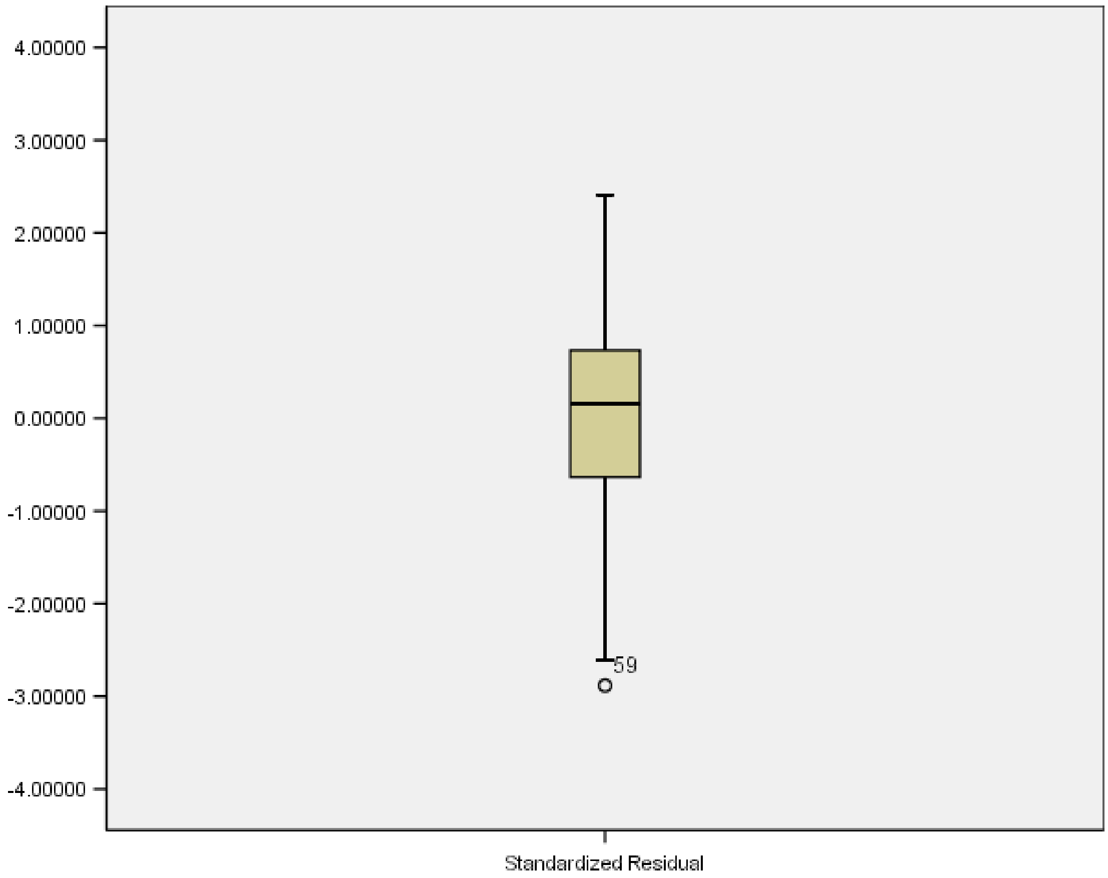
Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Correlations Zero-order	Correlations Partial	Correlations Part	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	.603	.460		1.309	.192					
	Leadership Composite (IV)	.398	.125	.331	3.194	.002	.647	.241	.178	.290	3.450
	Strategy Composite (IV)	-.065	.121	-.056	-.534	.594	.559	-.042	-.030	.282	3.549
	Customer Market Composite (IV)	.161	.115	.114	1.400	.163	.489	.108	.078	.470	2.128
	Information [MAK] Composite (IV)	-.013	.132	-.010	-.096	.923	.554	-.007	-.005	.308	3.243
	HR Composite (IV)	.457	.127	.376	3.594	.000	.650	.269	.201	.285	3.508
	Process Mgt Composite (IV)	.021	.103	.016	.205	.838	.474	.016	.011	.493	2.028
2	(Constant)	.596	.453		1.314	.191					
	Leadership Composite (IV)	.393	.113	.327	3.494	.001	.647	.262	.195	.354	2.827
	Strategy Composite (IV)	-.068	.117	-.059	-.578	.564	.559	-.045	-.032	.301	3.326
	Customer Market Composite (IV)	.159	.113	.113	1.407	.161	.489	.109	.078	.482	2.075
	HR Composite (IV)	.457	.127	.375	3.604	.000	.650	.269	.201	.286	3.498
	Process Mgt Composite (IV)	.020	.103	.016	.199	.843	.474	.015	.011	.496	2.016
3	(Constant)	.597	.452		1.320	.189					
	Leadership Composite (IV)	.396	.112	.329	3.546	.001	.647	.265	.197	.358	2.794
	Strategy Composite (IV)	-.067	.117	-.058	-.574	.567	.559	-.044	-.032	.301	3.323
	Customer Market Composite (IV)	.168	.104	.119	1.607	.110	.489	.123	.089	.563	1.776
	HR Composite (IV)	.462	.124	.380	3.736	.000	.650	.278	.207	.299	3.350
4	(Constant)	.615	.450		1.367	.174					
	Leadership Composite (IV)	.381	.108	.317	3.514	.001	.647	.262	.195	.377	2.651
	Customer Market Composite (IV)	.149	.099	.106	1.506	.134	.489	.115	.083	.621	1.612
	HR Composite (IV)	.426	.106	.350	4.013	.000	.650	.296	.222	.404	2.475
5	(Constant)	1.051	.346		3.042	.003					
	Leadership Composite (IV)	.433	.103	.361	4.202	.000	.647	.308	.234	.420	2.380
	HR Composite (IV)	.457	.104	.376	4.377	.000	.650	.319	.243	.420	2.380

a. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

Note. Backward stepwise regression summary graphics for H1b are shown.

Appendix L

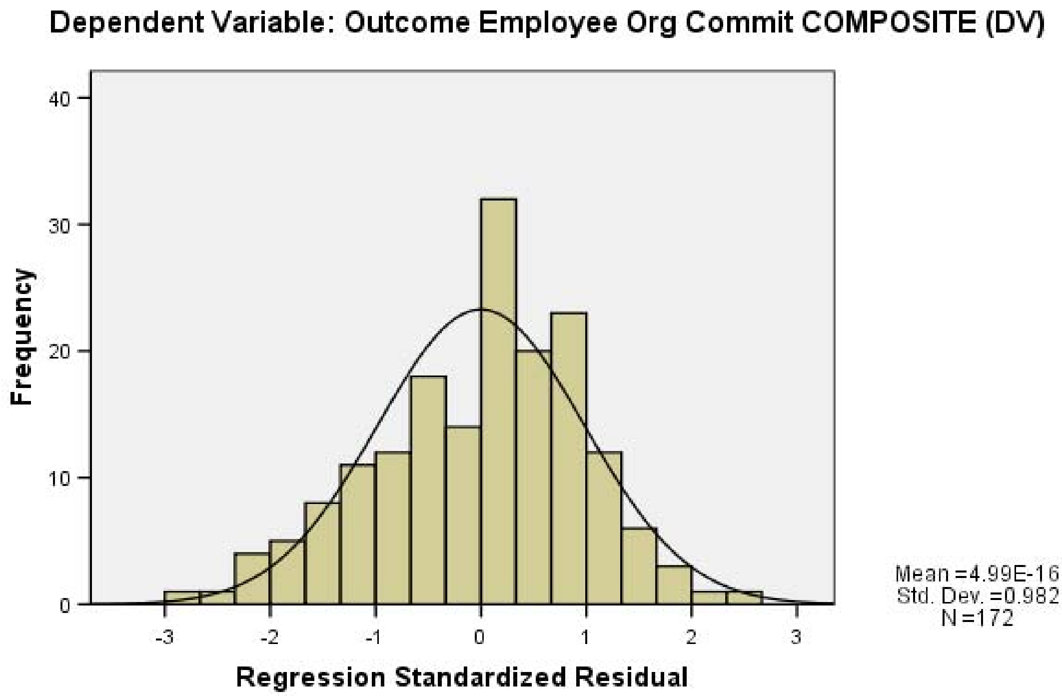
H1c Regression Assumptions & Analysis MB → Commitment



	OC Case	Mahalanobis Distance	Cook's Distance
1	66	31.35871	0.06183
2	20	23.62110	0.11983
3	3	21.07625	0.00083
4	100	20.44766	0.10719
5	13	18.17878	0.03045
6	90	18.04721	0.00222
7	89	18.01455	0.00010
8	165	16.73057	0.00067
9	63	16.64283	0.00001
10	136	15.98157	0.06436

Note. Multivariate outlier and influential case analysis graphics for H1c are shown.

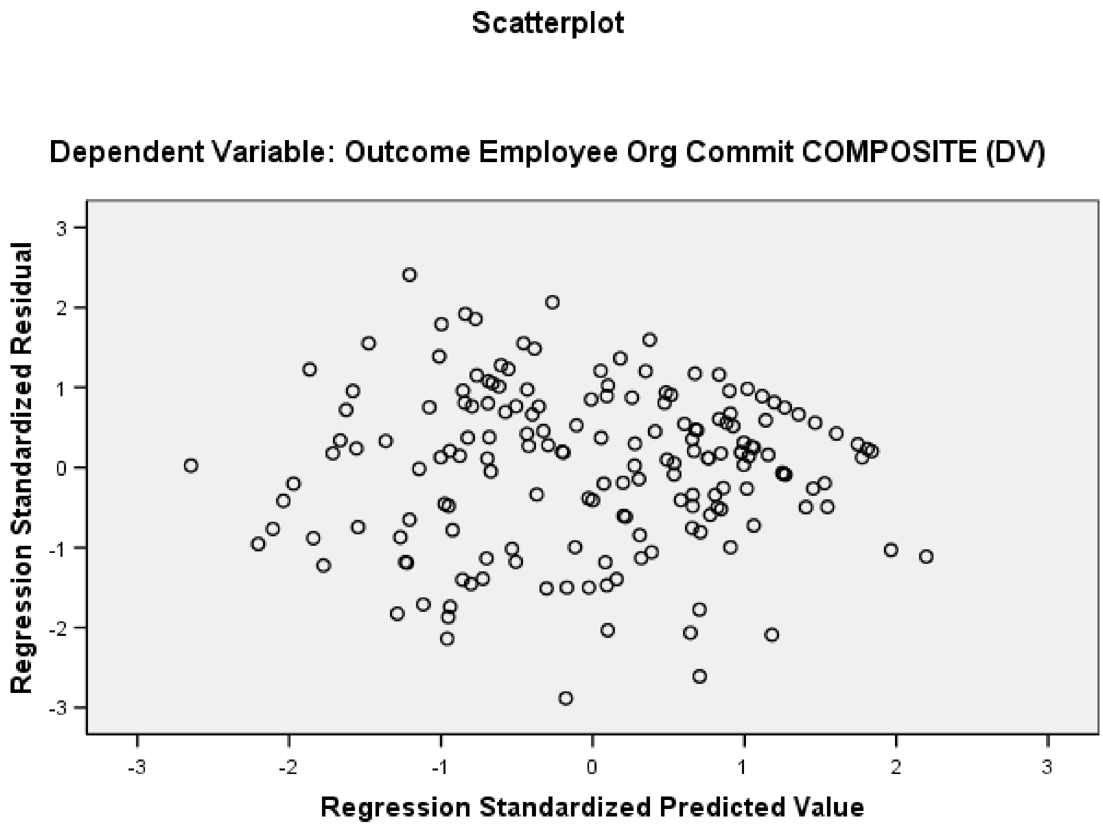
Histogram



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.086	172	.003	.987	172	.106

a. Lilliefors Significance Correction



Note. Normality and linearity check graphics for H1c are shown.

MB = OC		Variance Ratio	> 10 Threshold
25%	75%	1.73	N
10%	**90%**	**1.36**	**N**
5%	95%	1.50	N

Note. Homoscedasticity check via conditional variance ratio graphic for H1c is shown (cf., Cohen et al, 2003, p. 120). Assumptions have been met in order to continue with complete regression analysis for MBNQA → Organizational Commitment Outcomes.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.696[a]	.484	.466	1.19850	.484	25.839	6	165	.000	1.932

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	222.690	6	37.115	25.839	.000[a]
	Residual	237.008	165	1.436		
	Total	459.698	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.272	.465		.584	.560	-.647	1.191					
	Leadership Composite (IV)	.246	.126	.203	1.952	.053	-.003	.495	.604	.150	.109	.290	3.450
	Strategy Composite (IV)	-.095	.123	-.081	-.773	.440	-.337	.147	.550	-.060	-.043	.282	3.549
	Customer Market Composite (IV)	.213	.116	.150	1.838	.068	-.016	.442	.469	.142	.103	.470	2.128
	Information [MAK] Composite (IV)	.034	.133	.026	.254	.800	-.229	.297	.538	.020	.014	.308	3.243
	HR Composite (IV)	.672	.129	.547	5.226	.000	.418	.926	.671	.377	.292	.285	3.508
	Process Mgt Composite (IV)	-.144	.104	-.110	-1.382	.169	-.350	.062	.405	-.107	-.077	.493	2.028

a. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

Note. Regression summary and independent errors test (D-W) graphics for H1c are shown.

Model Summary[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.696[a]	.484	.466	1.19850	.484	25.839	6	165	.000	
2	.696[b]	.484	.469	1.19512	.000	.065	1	165	.800	
3	.695[c]	.483	.470	1.19348	-.002	.541	1	166	.463	
4	.690[d]	.477	.467	1.19681	-.006	1.939	1	167	.166	
5	.686[e]	.471	.465	1.19948	-.005	1.754	1	168	.187	1.898

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

c. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Predictors: (Constant), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

e. Predictors: (Constant), Leadership Composite (IV), HR Composite (IV)

f. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

ANOVA[f]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	222.690	6	37.115	25.839	.000[a]
	Residual	237.008	165	1.436		
	Total	459.698	171			
2	Regression	222.597	5	44.519	31.169	.000[b]
	Residual	237.101	166	1.428		
	Total	459.698	171			
3	Regression	221.825	4	55.456	38.933	.000[c]
	Residual	237.873	167	1.424		
	Total	459.698	171			
4	Regression	219.062	3	73.021	50.980	.000[d]
	Residual	240.635	168	1.432		
	Total	459.698	171			
5	Regression	216.549	2	108.275	75.256	.000[e]
	Residual	243.148	169	1.439		
	Total	459.698	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

c. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Predictors: (Constant), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

e. Predictors: (Constant), Leadership Composite (IV), HR Composite (IV)

f. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.272	.465		.584	.560	-.647	1.191					
	Leadership Composite (IV)	.246	.126	.203	1.952	.053	-.003	.495	.604	.150	.109	.290	3.450
	Strategy Composite (IV)	-.095	.123	-.081	-.773	.440	-.337	.147	.550	-.060	-.043	.282	3.549
	Customer Market Composite (IV)	.213	.116	.150	1.838	.068	-.016	.442	.469	.142	.103	.470	2.128
	Information [MAK] Composite (IV)	.034	.133	.026	.254	.800	-.229	.297	.538	.020	.014	.308	3.243
	HR Composite (IV)	.672	.129	.547	5.226	.000	.418	.926	.671	.377	.292	.285	3.508
	Process Mgt Composite (IV)	-.144	.104	-.110	-1.382	.169	-.350	.062	.405	-.107	-.077	.493	2.028
2	(Constant)	.290	.458		.633	.528	-.615	1.195					
	Leadership Composite (IV)	.260	.114	.214	2.283	.024	.035	.484	.604	.174	.127	.354	2.827
	Strategy Composite (IV)	-.087	.118	-.075	-.735	.463	-.321	.147	.550	-.057	-.041	.301	3.326
	Customer Market Composite (IV)	.218	.114	.153	1.907	.058	-.008	.444	.469	.146	.106	.482	2.075
	HR Composite (IV)	.674	.128	.549	5.261	.000	.421	.927	.671	.378	.293	.286	3.498
	Process Mgt Composite (IV)	-.142	.104	-.108	-1.371	.172	-.347	.063	.405	-.106	-.076	.496	2.016
3	(Constant)	.314	.457		.688	.492	-.587	1.216					
	Leadership Composite (IV)	.241	.111	.199	2.177	.031	.022	.460	.604	.166	.121	.372	2.688
	Customer Market Composite (IV)	.195	.110	.137	1.776	.078	-.022	.412	.469	.136	.099	.520	1.923
	HR Composite (IV)	.627	.111	.511	5.642	.000	.408	.847	.671	.400	.314	.378	2.643
	Process Mgt Composite (IV)	-.144	.104	-.110	-1.393	.166	-.349	.060	.405	-.107	-.078	.496	2.014
4	(Constant)	.310	.458		.676	.500	-.594	1.214					
	Leadership Composite (IV)	.223	.110	.184	2.023	.045	.005	.441	.604	.154	.113	.377	2.651
	Customer Market Composite (IV)	.134	.101	.094	1.325	.187	-.066	.333	.469	.102	.074	.621	1.612
	HR Composite (IV)	.588	.108	.479	5.452	.000	.375	.801	.671	.388	.304	.404	2.475
5	(Constant)	.700	.351		1.994	.048	.007	1.394					
	Leadership Composite (IV)	.270	.105	.222	2.577	.011	.063	.477	.604	.194	.144	.420	2.380
	HR Composite (IV)	.616	.106	.502	5.813	.000	.407	.826	.671	.408	.325	.420	2.380

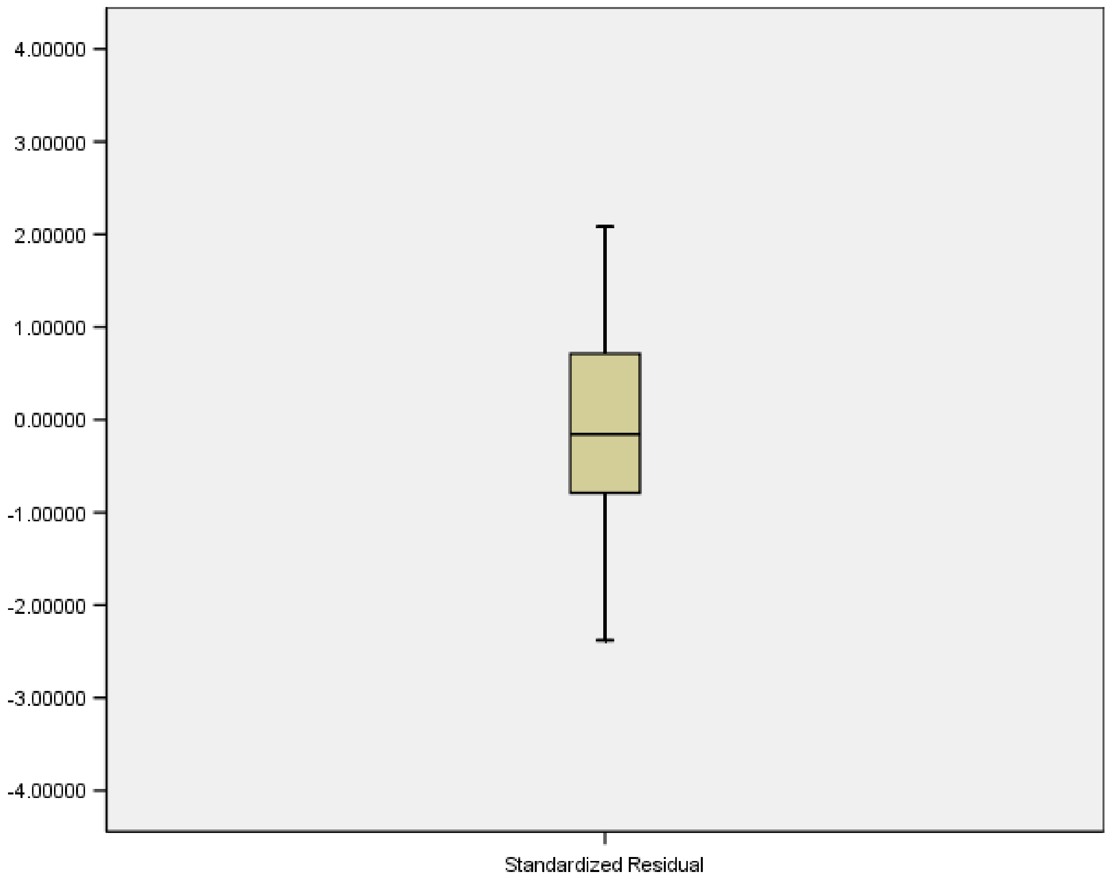
a. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

Note. Backward stepwise regression summary graphics for H1c are shown.

Appendix M

H1d Regression Assumptions & Analysis MB→ Customer Performance Metrics

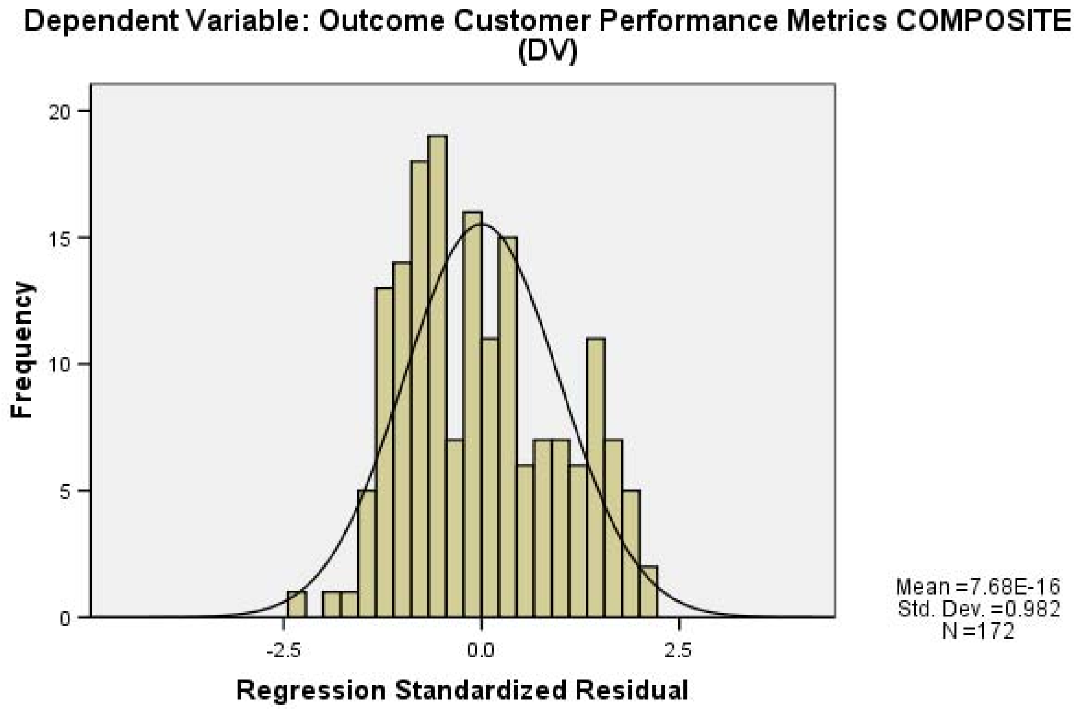
[Product and Service Quality and Customer Focus]



	Cust. Case	Mahalanobis Distance	Cook's Distance
1	66	31.35871	0.00710
2	20	23.62110	0.00783
3	3	21.07625	0.00533
4	100	20.44766	0.00840
5	13	18.17878	0.00435
6	90	18.04721	0.00317
7	89	18.01455	0.00196
8	165	16.73057	0.00010
9	63	16.64283	0.00041
10	136	15.98157	0.00145

Note. Multivariate outlier and influential case analysis graphics for H1d are shown.

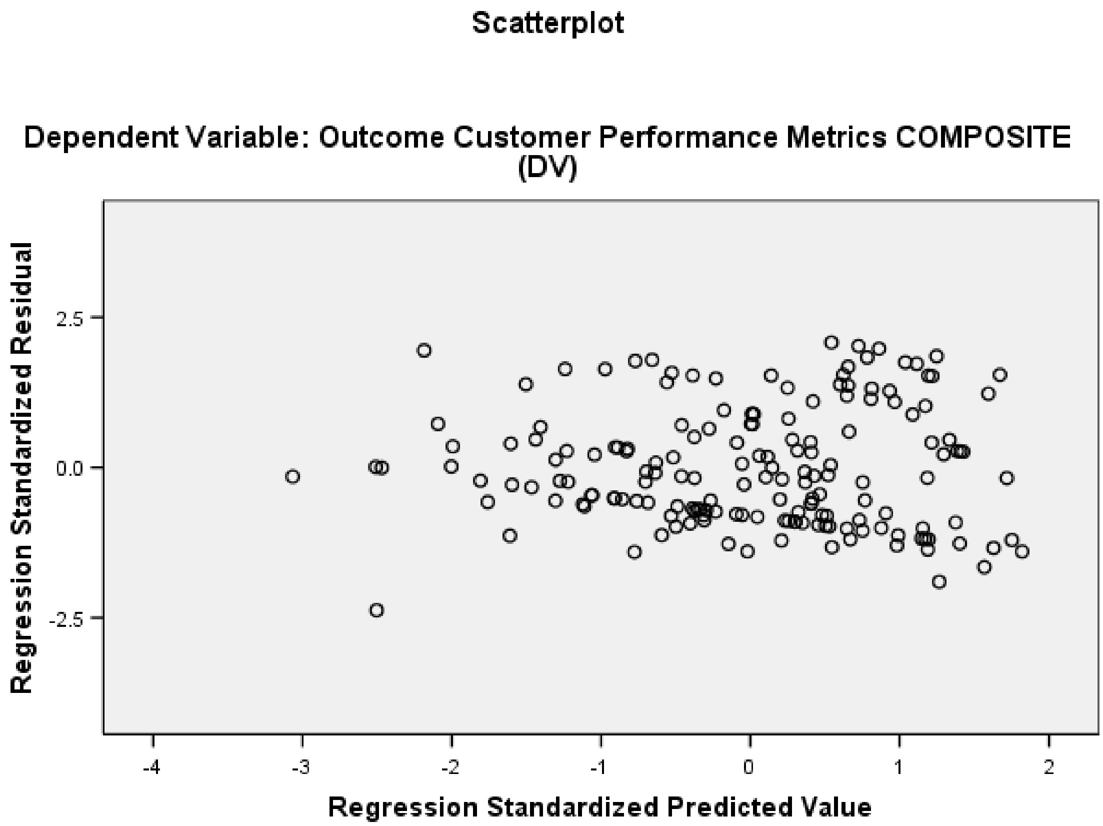
Histogram



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.099	172	.000	.961	172	.000

a. Lilliefors Significance Correction



Note. Normality and linearity check graphics for H1d are shown.

MB = CUST		Variance Ratio	> 10 Threshold
25%	75%	0.62	N
10%	**90%**	**3.03**	**N**
5%	95%	9.53	N

Note. Homoscedasticity check via conditional variance ratio graphic for H1d is shown (cf., Cohen et al, 2003, p. 120). Normality assumption was not met even with attempts at transforming the DV and IVs. However, it is understood that regression analysis using large samples is relatively robust to nonnormality such that large samples will generally diminish the negative effects of nonnormality (Hair et al, 1998, p. 71). Thus, it was decided to continue with a complete regression analysis for MBNQA → Customer Performance Metrics Outcomes.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.315[a]	.099	.066	.97774	.099	3.025	6	165	.008	2.063

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.353	6	2.892	3.025	.008[a]
	Residual	157.735	165	.956		
	Total	175.088	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.497	.380		9.213	.000	2.748	4.247					
	Leadership Composite (IV)	.142	.103	.190	1.382	.169	-.061	.345	.260	.107	.102	.290	3.450
	Strategy Composite (IV)	.072	.100	.100	.716	.475	-.126	.269	.243	.056	.053	.282	3.549
	Customer Market Composite (IV)	.085	.095	.096	.894	.373	-.102	.272	.252	.069	.066	.470	2.128
	Information [MAK] Composite (IV)	-.109	.109	-.133	-1.002	.318	-.324	.106	.197	-.078	-.074	.308	3.243
	HR Composite (IV)	-.042	.105	-.055	-.397	.692	-.249	.166	.218	-.031	-.029	.285	3.508
	Process Mgt Composite (IV)	.120	.085	.148	1.406	.162	-.048	.288	.267	.109	.104	.493	2.028

a. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

Note. Regression summary and independent errors test (D-W) graphics for H1d are shown.

Model Summary[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.315[a]	.099	.066	.97774	.099	3.025	6	165	.008	
2	.313[b]	.098	.071	.97525	-.001	.158	1	165	.692	
3	.310[c]	.096	.075	.97339	-.002	.363	1	166	.548	
4	.303[d]	.092	.076	.97276	-.004	.784	1	167	.377	
5	.296[e]	.088	.077	.97221	-.004	.808	1	168	.370	2.075

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV)

c. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV)

d. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV)

e. Predictors: (Constant), Process Mgt Composite (IV), Leadership Composite (IV)

f. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

ANOVA[f]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.353	6	2.892	3.025	.008[a]
	Residual	157.735	165	.956		
	Total	175.088	171			
2	Regression	17.203	5	3.441	3.617	.004[b]
	Residual	157.886	166	.951		
	Total	175.088	171			
3	Regression	16.858	4	4.214	4.448	.002[c]
	Residual	158.230	167	.947		
	Total	175.088	171			
4	Regression	16.115	3	5.372	5.677	.001[d]
	Residual	158.973	168	.946		
	Total	175.088	171			
5	Regression	15.351	2	7.675	8.120	.000[e]
	Residual	159.737	169	.945		
	Total	175.088	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV)

c. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV)

d. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV)

e. Predictors: (Constant), Process Mgt Composite (IV), Leadership Composite (IV)

f. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

Coefficients[a]

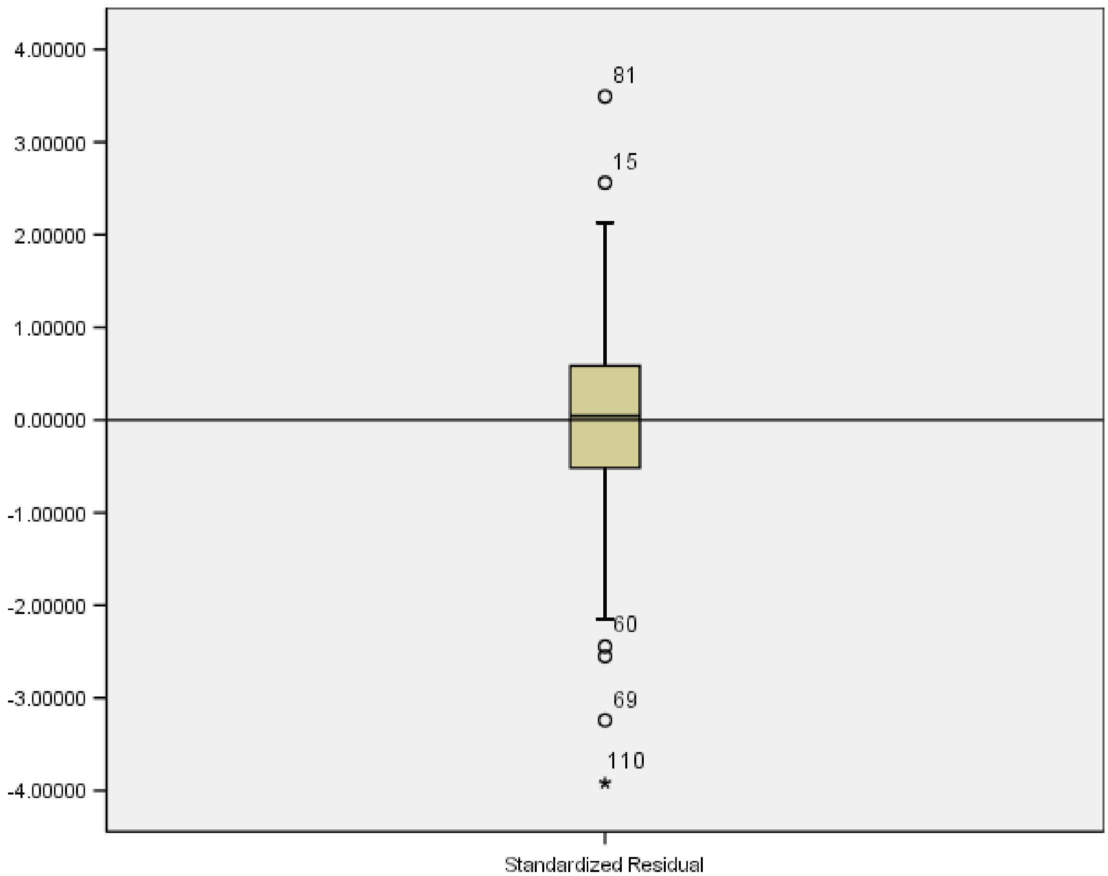
Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.497	.380		9.213	.000	2.748	4.247					
	Leadership Composite (IV)	.142	.103	.190	1.382	.169	-.061	.345	.260	.107	.102	.290	3.450
	Strategy Composite (IV)	.072	.100	.100	.716	.475	-.126	.269	.243	.056	.053	.282	3.549
	Customer Market Composite (IV)	.085	.095	.096	.894	.373	-.102	.272	.252	.069	.066	.470	2.128
	Information [MAK] Composite (IV)	-.109	.109	-.133	-1.002	.318	-.324	.106	.197	-.078	-.074	.308	3.243
	HR Composite (IV)	-.042	.105	-.055	-.397	.692	-.249	.166	.218	-.031	-.029	.285	3.508
	Process Mgt Composite (IV)	.120	.085	.148	1.406	.162	-.048	.288	.267	.109	.104	.493	2.028
2	(Constant)	3.493	.379		9.228	.000	2.746	4.240					
	Leadership Composite (IV)	.129	.097	.172	1.328	.186	-.063	.320	.260	.103	.098	.326	3.072
	Strategy Composite (IV)	.053	.088	.074	.602	.548	-.121	.228	.243	.047	.044	.359	2.782
	Customer Market Composite (IV)	.088	.094	.100	.931	.353	-.098	.274	.252	.072	.069	.473	2.114
	Information [MAK] Composite (IV)	-.111	.108	-.136	-1.027	.306	-.325	.103	.197	-.079	-.076	.309	3.234
	Process Mgt Composite (IV)	.113	.083	.140	1.357	.177	-.051	.277	.267	.105	.100	.514	1.946
3	(Constant)	3.469	.376		9.234	.000	2.727	4.211					
	Leadership Composite (IV)	.145	.092	.194	1.572	.118	-.037	.328	.260	.121	.116	.355	2.815
	Customer Market Composite (IV)	.099	.092	.113	1.081	.281	-.082	.281	.252	.083	.079	.494	2.024
	Information [MAK] Composite (IV)	-.091	.103	-.111	-.885	.377	-.294	.112	.197	-.068	-.065	.342	2.921
	Process Mgt Composite (IV)	.119	.082	.147	1.438	.152	-.044	.282	.267	.111	.106	.521	1.921
4	(Constant)	3.426	.372		9.203	.000	2.691	4.160					
	Leadership Composite (IV)	.095	.073	.127	1.305	.194	-.049	.239	.260	.100	.096	.571	1.751
	Customer Market Composite (IV)	.080	.089	.091	.899	.370	-.096	.257	.252	.069	.066	.523	1.913
	Process Mgt Composite (IV)	.109	.082	.135	1.333	.184	-.052	.270	.267	.102	.098	.530	1.886
5	(Constant)	3.622	.301		12.042	.000	3.029	4.216					
	Leadership Composite (IV)	.118	.068	.158	1.740	.084	-.016	.253	.260	.133	.128	.654	1.528
	Process Mgt Composite (IV)	.141	.073	.174	1.917	.057	-.004	.286	.267	.146	.141	.654	1.528

a. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

Note. Backward stepwise regression summary graphics for H1d are shown.

Appendix N

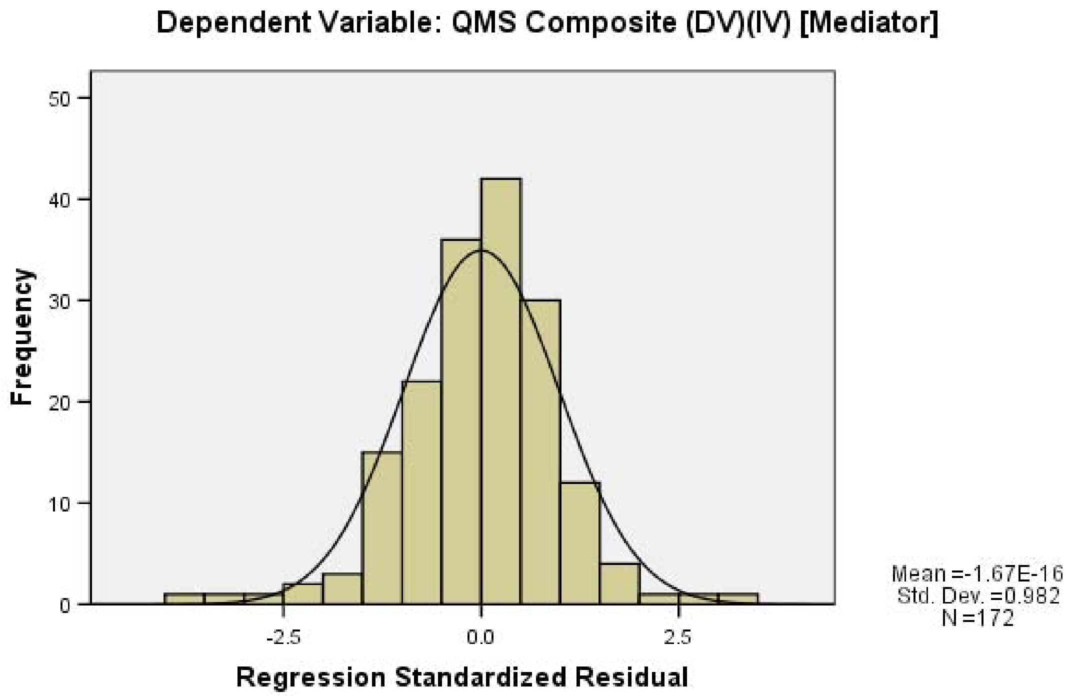
Hypothesis 2: MBNQA Factors → QMS



	QMS Case	Mahalanobis Distance	Cook's Distance
1	66	31.35871	0.01141
2	20	23.62110	0.04073
3	3	21.07625	0.02261
4	100	20.44766	0.00697
5	13	18.17878	0.00063
6	90	18.04721	0.00402
7	89	18.01455	0.09303
8	165	16.73057	0.02019
9	63	16.64283	0.02710
10	136	15.98157	0.00536

Note. Multivariate outlier and influential case analysis graphics for H2 are shown.

Histogram



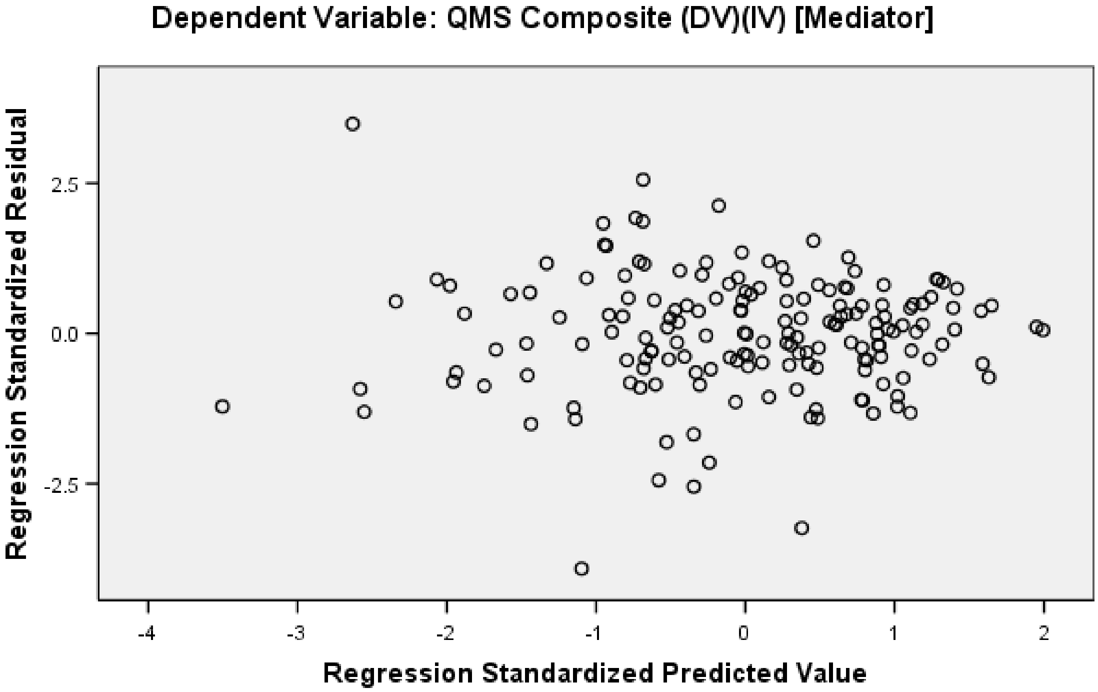
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.054	172	.200*	.973	172	.002

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Scatterplot



Note. Normality and linearity check graphics for H2 are shown.

MB = QMS		Variance Ratio	> 10 Threshold
25%	75%	1.56	N
10%	**90%**	**1.57**	**N**
5%	95%	1.62	N

Note. Homoscedasticity check via conditional variance ratio graphics for H2 is shown (cf., Cohen et al, 2003, p. 120). Assumptions have been met in order to continue with complete regression analysis for MBNQA → QMS.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.773[a]	.597	.582	.71726	.597	40.719	6	165	.000	2.123

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: QMS Composite (DV)(IV) [Mediator]

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	125.692	6	20.949	40.719	.000[a]
	Residual	84.887	165	.514		
	Total	210.580	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Dependent Variable: QMS Composite (DV)(IV) [Mediator]

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	1.219	.278		4.378	.000	.669	1.769					
	Leadership Composite (IV)	.086	.075	.104	1.136	.258	-.063	.235	.621	.088	.056	.290	3.450
	Strategy Composite (IV)	.005	.073	.007	.071	.944	-.140	.150	.611	.006	.003	.282	3.549
	Customer Market Composite (IV)	.367	.069	.381	5.284	.000	.230	.504	.698	.380	.261	.470	2.128
	Information [MAK] Composite (IV)	.051	.080	.057	.640	.523	-.106	.208	.612	.050	.032	.308	3.243
	HR Composite (IV)	.137	.077	.165	1.785	.076	-.015	.289	.621	.138	.088	.285	3.508
	Process Mgt Composite (IV)	.174	.062	.196	2.781	.006	.050	.297	.636	.212	.137	.493	2.028

a. Dependent Variable: QMS Composite (DV)(IV) [Mediator]

Note. Regression summary and independent errors test (D-W) graphics for H2 are shown.

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.773[a]	.597	.582	.71726	.597	40.719	6	165	.000	
2	.773[b]	.597	.585	.71511	.000	.005	1	165	.944	
3	.772[c]	.596	.586	.71396	-.001	.464	1	166	.497	2.131

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

c. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Dependent Variable: QMS Composite (DV)(IV) [Mediator]

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	125.692	6	20.949	40.719	.000[a]
	Residual	84.887	165	.514		
	Total	210.580	171			
2	Regression	125.690	5	25.138	49.157	.000[b]
	Residual	84.890	166	.511		
	Total	210.580	171			
3	Regression	125.453	4	31.363	61.527	.000[c]
	Residual	85.127	167	.510		
	Total	210.580	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

c. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Dependent Variable: QMS Composite (DV)(IV) [Mediator]

Coefficients[a]

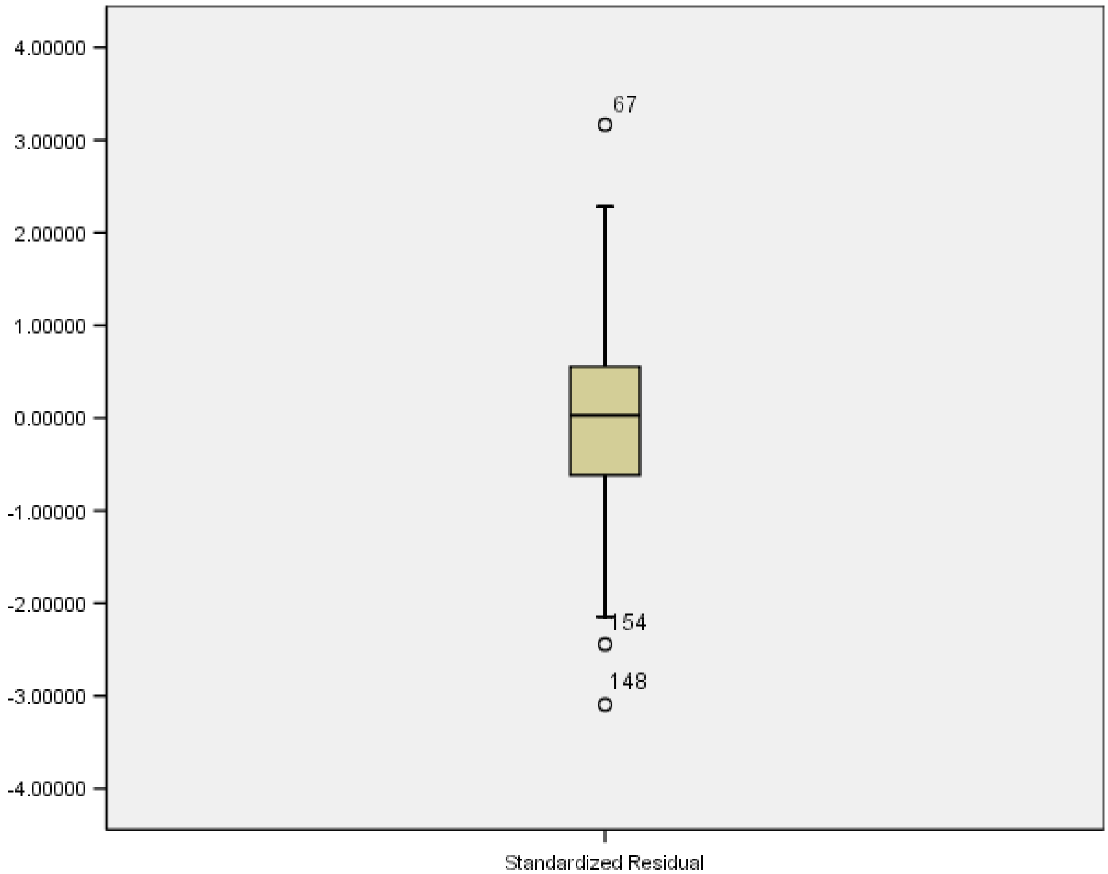
Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part
1	(Constant)	1.219	.278		4.378	.000	.669	1.769			
	Leadership Composite (IV)	.086	.075	.104	1.136	.258	-.063	.235	.621	.088	.056
	Strategy Composite (IV)	.005	.073	.007	.071	.944	-.140	.150	.611	.006	.003
	Customer Market Composite (IV)	.367	.069	.381	5.284	.000	.230	.504	.698	.380	.261
	Information [MAK] Composite (IV)	.051	.080	.057	.640	.523	-.106	.208	.612	.050	.032
	HR Composite (IV)	.137	.077	.165	1.785	.076	-.015	.289	.621	.138	.088
	Process Mgt Composite (IV)	.174	.062	.196	2.781	.006	.050	.297	.636	.212	.137
2	(Constant)	1.217	.276		4.408	.000	.672	1.762			
	Leadership Composite (IV)	.086	.075	.105	1.150	.252	-.062	.234	.621	.089	.057
	Customer Market Composite (IV)	.368	.068	.382	5.448	.000	.235	.502	.698	.389	.268
	Information [MAK] Composite (IV)	.052	.077	.059	.681	.497	-.100	.204	.612	.053	.034
	HR Composite (IV)	.140	.068	.168	2.059	.041	.006	.274	.621	.158	.101
	Process Mgt Composite (IV)	.174	.062	.196	2.789	.006	.051	.297	.636	.212	.137
3	(Constant)	1.242	.273		4.546	.000	.703	1.781			
	Leadership Composite (IV)	.110	.066	.134	1.657	.099	-.021	.241	.621	.127	.082
	Customer Market Composite (IV)	.378	.066	.393	5.758	.000	.249	.508	.698	.407	.283
	HR Composite (IV)	.149	.067	.179	2.241	.026	.018	.280	.621	.171	.110
	Process Mgt Composite (IV)	.177	.062	.200	2.859	.005	.055	.300	.636	.216	.141

a. Dependent Variable: QMS Composite (DV)(IV) [Mediator]

Note. Backward stepwise regression summary graphics for H2 are shown.

Appendix O

H3a Regression Assumptions & Analysis MB+QMS → BR



	BusQ Case	Mahalanobis Distance	Cook's Distance
1	66	31.64635	0.00613
2	20	25.12523	0.01616
3	89	22.81079	0.06581
4	15	22.46286	0.00304
5	110	22.29291	0.05063
6	3	22.04016	0.00006
7	100	20.75617	0.00073
8	81	20.21058	0.01651
9	90	18.25391	0.00555
10	13	18.21097	0.00064

Note. Multivariate outlier and influential case analysis graphics for H3a are shown.

VIF R-sq THRESHOLD	0.900	0.100	10.00
	R-sq	Tolerance	VIF
LEAD	0.714	0.286	3.50
STRA	0.720	0.280	**3.57**
CUST	0.601	0.399	2.51
INFO	0.695	0.305	3.28
HR	0.718	0.282	3.55
PROC	0.531	0.469	2.13
QMS	0.604	0.396	2.53
Average	0.655	0.345	3.008
Maximum	0.720		3.57

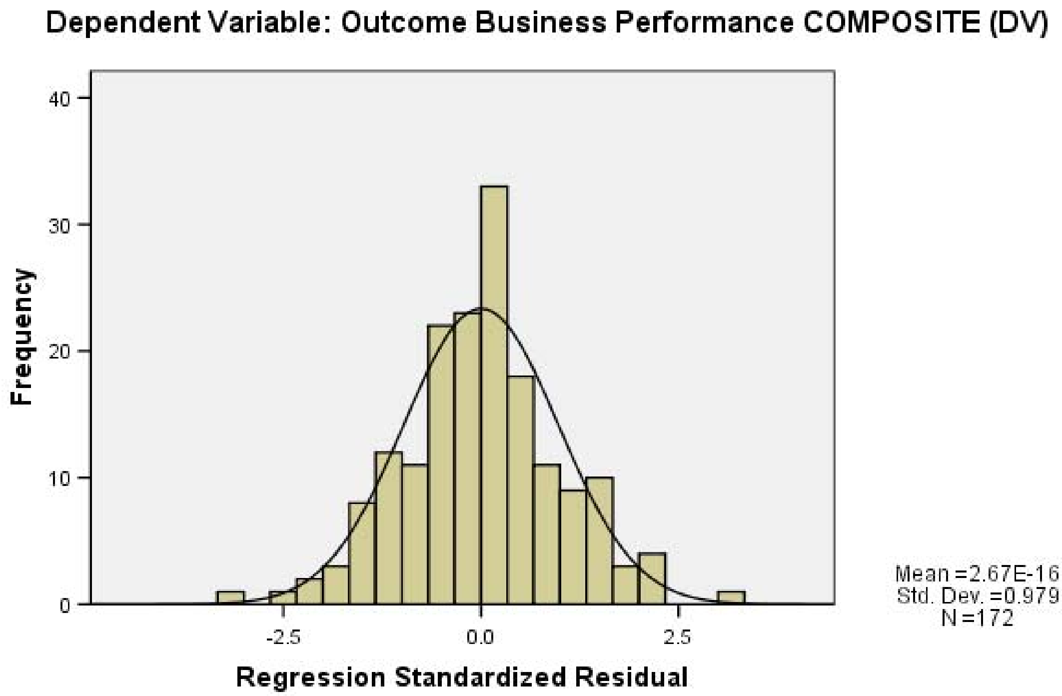
Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions							
				(Constant)	Leadership Composite (IV)	Strategy Composite (IV)	Customer Market Composite (IV)	Information [MAK] Composite (IV)	HR Composite (IV)	Process Mgt Composite (IV)	QMS Composite (DV)(IV) [Mediator]
1	1	6.831	1.000	.00	.00	.00	.00	.00	.00	.00	
	2	.059	10.721	.32	.01	.06	.03	.00	.09	.00	
	3	.039	13.190	.10	.02	.02	.00	.02	.00	.82	
	4	.023	17.329	.10	.28	.18	.00	.24	.19	.00	
	5	.021	18.154	.15	.07	.36	.16	.04	.37	.02	
	6	.014	21.994	.22	.18	.08	.64	.31	.03	.11	
	7	.013	23.319	.10	.44	.31	.15	.39	.33	.05	
2	1	7.813	1.000	.00	.00	.00	.00	.00	.00	.00	.00
	2	.063	11.143	.22	.02	.06	.02	.00	.08	.00	.02
	3	.039	14.095	.11	.02	.01	.00	.02	.00	.76	.00
	4	.023	18.472	.05	.27	.17	.00	.25	.18	.01	.01
	5	.021	19.410	.16	.07	.34	.14	.04	.36	.02	.00
	6	.017	21.507	.43	.04	.12	.09	.06	.02	.19	.44
	7	.013	24.623	.02	.58	.11	.03	.62	.12	.01	.07
	8	.011	26.136	.01	.01	.18	.71	.00	.22	.01	.46

a. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Note. Variance inflation factors and collinearity diagnostics graphics for H3a are shown.

Histogram

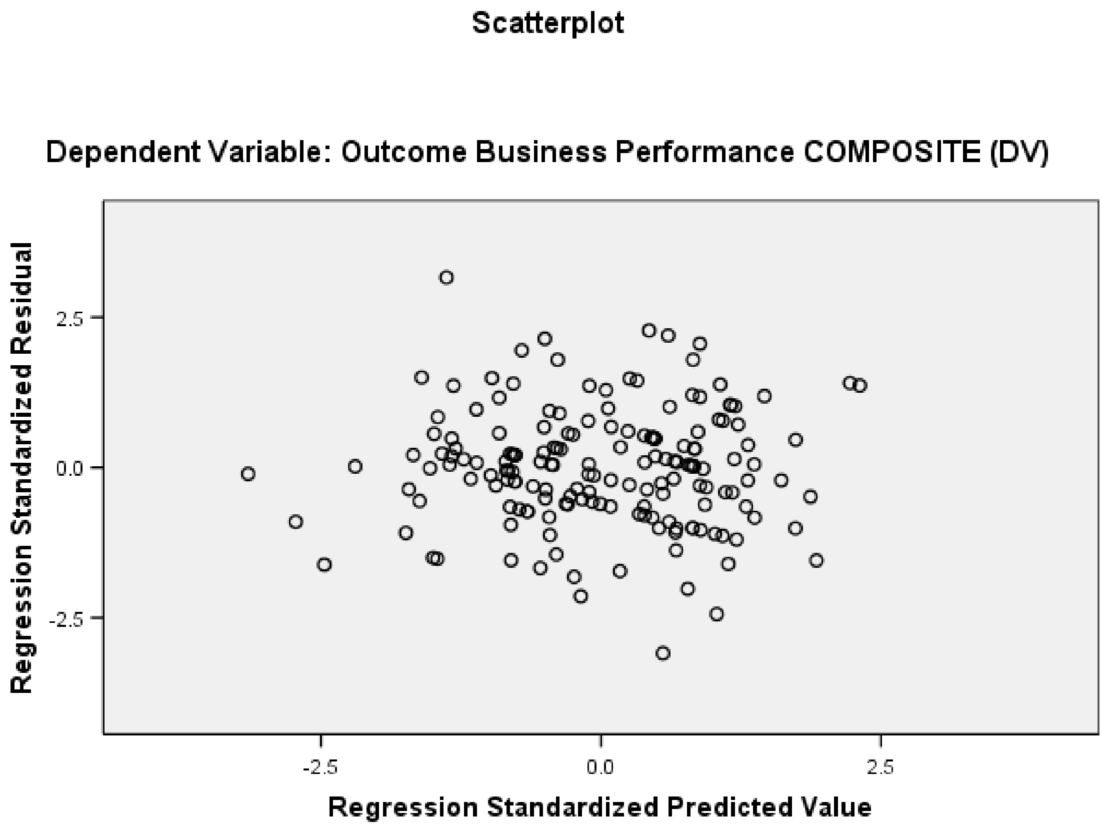


Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.050	172	.200*	.994	172	.734

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



Note. Normality and linearity check graphics for H3a are shown.

MB+QMS = BUS		Variance Ratio	> 10 Threshold
25%	75%	0.90	N
10%	**90%**	**1.00**	**N**
5%	95%	1.14	N

Note. Homoscedasticity check via conditional variance ratio graphic is shown (cf., Cohen et al, 2003, p. 120). Assumptions have been met in order to continue with sequential regression analysis for MBNQA + QMS → Business Results (Financial & Market Outcomes).

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.444[a]	.197	.168	1.12634	.197	6.745	6	165	.000	
2	.446[b]	.199	.164	1.12857	.002	.349	1	164	.556	2.079

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV), QMS Composite (DV)(IV) [Mediator]

c. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.346	6	8.558	6.745	.000[a]
	Residual	209.326	165	1.269		
	Total	260.672	171			
2	Regression	51.790	7	7.399	5.809	.000[b]
	Residual	208.882	164	1.274		
	Total	260.672	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV), QMS Composite (DV)(IV) [Mediator]

c. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.043	.437		4.672	.000	1.180	2.907					
	Leadership Composite (IV)	-.119	.118	-.130	-1.004	.317	-.353	.115	.288	-.078	-.070	.290	3.450
	Strategy Composite (IV)	.017	.115	.020	.150	.881	-.210	.245	.344	.012	.010	.282	3.549
	Customer Market Composite (IV)	.151	.109	.140	1.381	.169	-.065	.366	.341	.107	.096	.470	2.128
	Information [MAK] Composite (IV)	-.026	.125	-.027	-.211	.833	-.274	.221	.296	-.016	-.015	.308	3.243
	HR Composite (IV)	.295	.121	.319	2.439	.016	.056	.534	.396	.187	.170	.285	3.508
	Process Mgt Composite (IV)	.164	.098	.166	1.674	.096	-.030	.358	.369	.129	.117	.493	2.028
2	(Constant)	2.131	.463		4.604	.000	1.217	3.046					
	Leadership Composite (IV)	-.113	.119	-.123	-.946	.346	-.348	.123	.288	-.074	-.066	.288	3.477
	Strategy Composite (IV)	.018	.116	.020	.153	.879	-.211	.246	.344	.012	.011	.282	3.549
	Customer Market Composite (IV)	.177	.118	.165	1.499	.136	-.056	.411	.341	.116	.105	.402	2.487
	Information [MAK] Composite (IV)	-.023	.126	-.023	-.181	.857	-.271	.225	.296	-.014	-.013	.308	3.251
	HR Composite (IV)	.305	.122	.329	2.492	.014	.063	.546	.396	.191	.174	.280	3.576
	Process Mgt Composite (IV)	.177	.101	.179	1.757	.081	-.022	.375	.369	.136	.123	.471	2.123
	QMS Composite (DV)(IV) [Mediator]	-.072	.122	-.065	-.590	.556	-.314	.170	.291	-.046	-.041	.403	2.481

a. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Note. Regression summary and independent errors test (D-W) graphics for H3a are shown.

Model Summary[g]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.446[a]	.199	.164	1.12857	.199	5.809	7	164	.000	
2	.446[b]	.199	.169	1.12523	.000	.023	1	164	.879	
3	.445[c]	.198	.174	1.12191	.000	.022	1	165	.883	
4	.444[d]	.197	.177	1.11976	-.002	.362	1	166	.548	
5	.435[e]	.190	.175	1.12141	-.007	1.496	1	167	.223	
6	.427[f]	.183	.173	1.12279	-.007	1.416	1	168	.236	2.054

a. Predictors: (Constant), QMS Composite (DV)(IV) [Mediator], Strategy Composite (IV), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), QMS Composite (DV)(IV) [Mediator], Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

c. Predictors: (Constant), QMS Composite (DV)(IV) [Mediator], Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

e. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), HR Composite (IV)

f. Predictors: (Constant), Process Mgt Composite (IV), HR Composite (IV)

g. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

ANOVA[g]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.790	7	7.399	5.809	.000[a]
	Residual	208.882	164	1.274		
	Total	260.672	171			
2	Regression	51.760	6	8.627	6.813	.000[b]
	Residual	208.912	165	1.266		
	Total	260.672	171			
3	Regression	51.732	5	10.346	8.220	.000[c]
	Residual	208.939	166	1.259		
	Total	260.672	171			
4	Regression	51.276	4	12.819	10.224	.000[d]
	Residual	209.395	167	1.254		
	Total	260.672	171			
5	Regression	49.400	3	16.467	13.094	.000[e]
	Residual	211.271	168	1.258		
	Total	260.672	171			
6	Regression	47.620	2	23.810	18.887	.000[f]
	Residual	213.052	169	1.261		
	Total	260.672	171			

a. Predictors: (Constant), QMS Composite (DV)(IV) [Mediator], Strategy Composite (IV), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), QMS Composite (DV)(IV) [Mediator], Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

c. Predictors: (Constant), QMS Composite (DV)(IV) [Mediator], Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

d. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), HR Composite (IV)

e. Predictors: (Constant), Process Mgt Composite (IV), Customer Market Composite (IV), HR Composite (IV)

f. Predictors: (Constant), Process Mgt Composite (IV), HR Composite (IV)

g. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Coefficients[a]

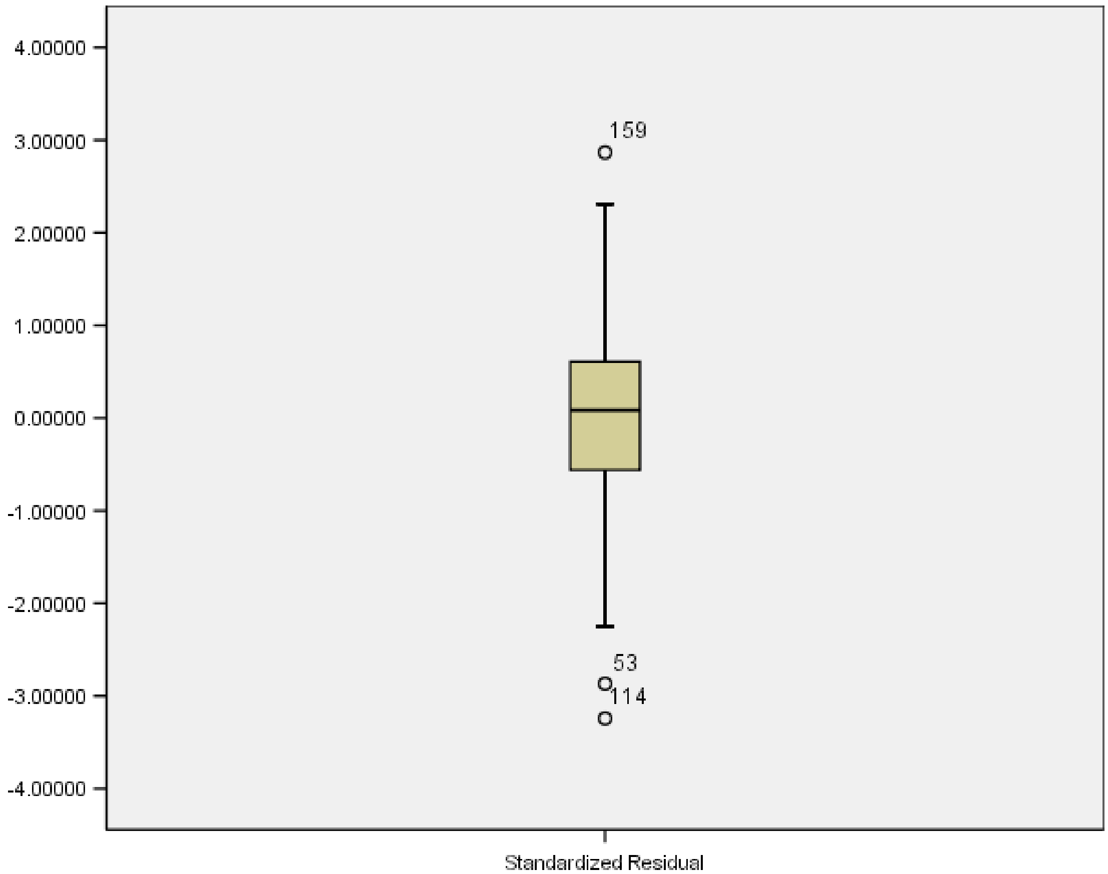
Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	2.131	.463		4.604	.000	1.217	3.046					
	Leadership Composite (IV)	-.113	.119	-.123	-.946	.346	-.348	.123	.288	-.074	-.066	.288	3.477
	Strategy Composite (IV)	.018	.116	.020	.153	.879	-.211	.246	.344	.012	.011	.282	3.549
	Customer Market Composite (IV)	.177	.118	.165	1.499	.136	-.056	.411	.341	.116	.105	.402	2.487
	Information [MAK] Composite (IV)	-.023	.126	-.023	-.181	.857	-.271	.225	.296	-.014	-.013	.308	3.251
	HR Composite (IV)	.305	.122	.329	2.492	.014	.063	.546	.396	.191	.174	.280	3.576
	Process Mgt Composite (IV)	.177	.101	.179	1.757	.081	-.022	.375	.369	.136	.123	.471	2.123
	QMS Composite (DV)(IV) [Mediator]	-.072	.122	-.065	-.590	.556	-.314	.170	.291	-.046	-.041	.403	2.481
2	(Constant)	2.124	.459		4.627	.000	1.218	3.031					
	Leadership Composite (IV)	-.111	.118	-.122	-.939	.349	-.345	.123	.288	-.073	-.065	.290	3.451
	Customer Market Composite (IV)	.181	.115	.169	1.566	.119	-.047	.409	.341	.121	.109	.419	2.387
	Information [MAK] Composite (IV)	-.018	.121	-.018	-.148	.883	-.257	.222	.296	-.012	-.010	.328	3.048
	HR Composite (IV)	.313	.108	.339	2.893	.004	.100	.527	.396	.220	.202	.355	2.820
	Process Mgt Composite (IV)	.177	.100	.179	1.763	.080	-.021	.375	.369	.136	.123	.471	2.123
	QMS Composite (DV)(IV) [Mediator]	-.072	.122	-.065	-.591	.555	-.313	.169	.291	-.046	-.041	.403	2.481
3	(Constant)	2.117	.455		4.652	.000	1.218	3.015					
	Leadership Composite (IV)	-.119	.105	-.130	-1.134	.258	-.326	.088	.288	-.088	-.079	.366	2.732
	Customer Market Composite (IV)	.178	.113	.166	1.571	.118	-.046	.401	.341	.121	.109	.434	2.304
	HR Composite (IV)	.310	.106	.335	2.925	.004	.101	.520	.396	.221	.203	.367	2.723
	Process Mgt Composite (IV)	.176	.100	.178	1.763	.080	-.021	.373	.369	.136	.122	.473	2.113
	QMS Composite (DV)(IV) [Mediator]	-.073	.122	-.066	-.602	.548	-.313	.167	.291	-.047	-.042	.404	2.474
4	(Constant)	2.026	.428		4.728	.000	1.180	2.872					
	Leadership Composite (IV)	-.127	.104	-.139	-1.223	.223	-.332	.078	.288	-.094	-.085	.372	2.688
	Customer Market Composite (IV)	.150	.103	.140	1.454	.148	-.054	.353	.341	.112	.101	.520	1.923
	HR Composite (IV)	.299	.104	.324	2.870	.005	.093	.505	.396	.217	.199	.378	2.643
	Process Mgt Composite (IV)	.163	.097	.165	1.675	.096	-.029	.355	.369	.129	.116	.496	2.014
5	(Constant)	1.951	.425		4.594	.000	1.113	2.790					
	Customer Market Composite (IV)	.119	.100	.111	1.190	.236	-.079	.317	.341	.091	.083	.553	1.808
	HR Composite (IV)	.224	.084	.242	2.657	.009	.058	.391	.396	.201	.185	.581	1.722
	Process Mgt Composite (IV)	.149	.097	.151	1.542	.125	-.042	.340	.369	.118	.107	.503	1.987
6	(Constant)	2.279	.324		7.030	.000	1.639	2.918					
	HR Composite (IV)	.252	.081	.272	3.104	.002	.092	.412	.396	.232	.216	.629	1.590
	Process Mgt Composite (IV)	.200	.087	.203	2.315	.022	.030	.371	.369	.175	.161	.629	1.590

a. Dependent Variable: Outcome Business Performance COMPOSITE (DV)

Note. Backward stepwise regression summary graphics for H3a are shown. BSR removed the less significant variables, with QMS included, and produced the same results as in the phase 1 BSR analyses.

Appendix P

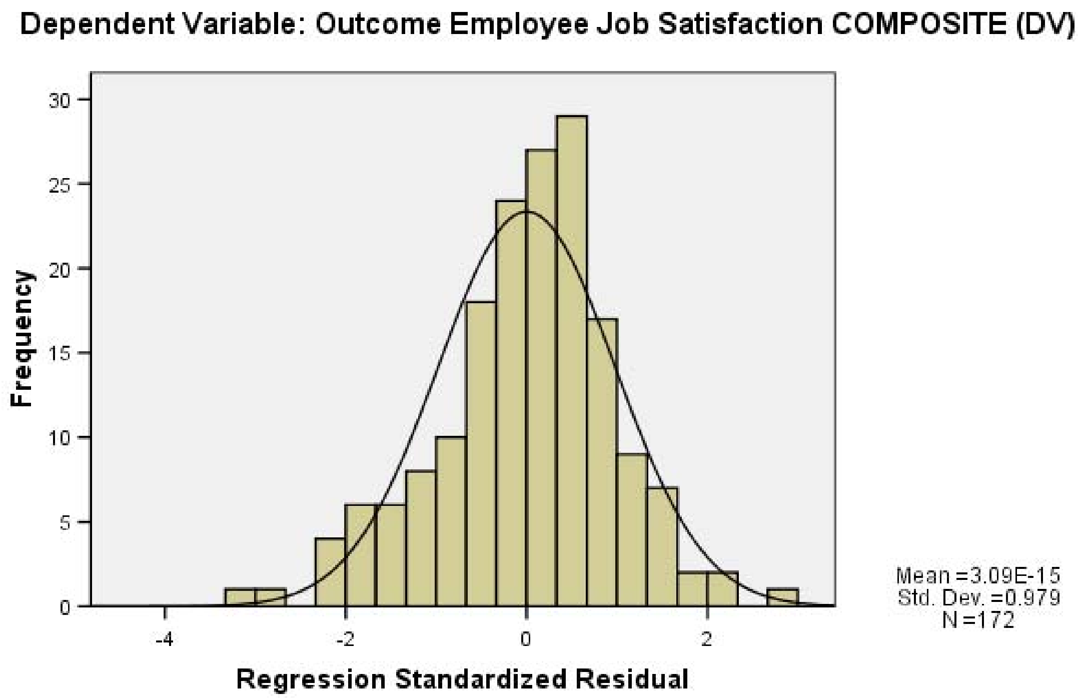
H3b Regression Assumptions & Analysis MB+QMS →JS



	JS QMS Case	Mahalanobis Distance	Cook's Distance
1	66	31.64635	0.19396
2	20	25.12523	0.07153
3	89	22.81079	0.00145
4	15	22.46286	0.01417
5	110	22.29291	0.00683
6	3	22.04016	0.01933
7	100	20.75617	0.01537
8	81	20.21058	0.00108
9	90	18.25391	0.02269
10	13	18.21097	0.02333

Note. Multivariate outlier and influential case analysis graphics for H3b are shown.

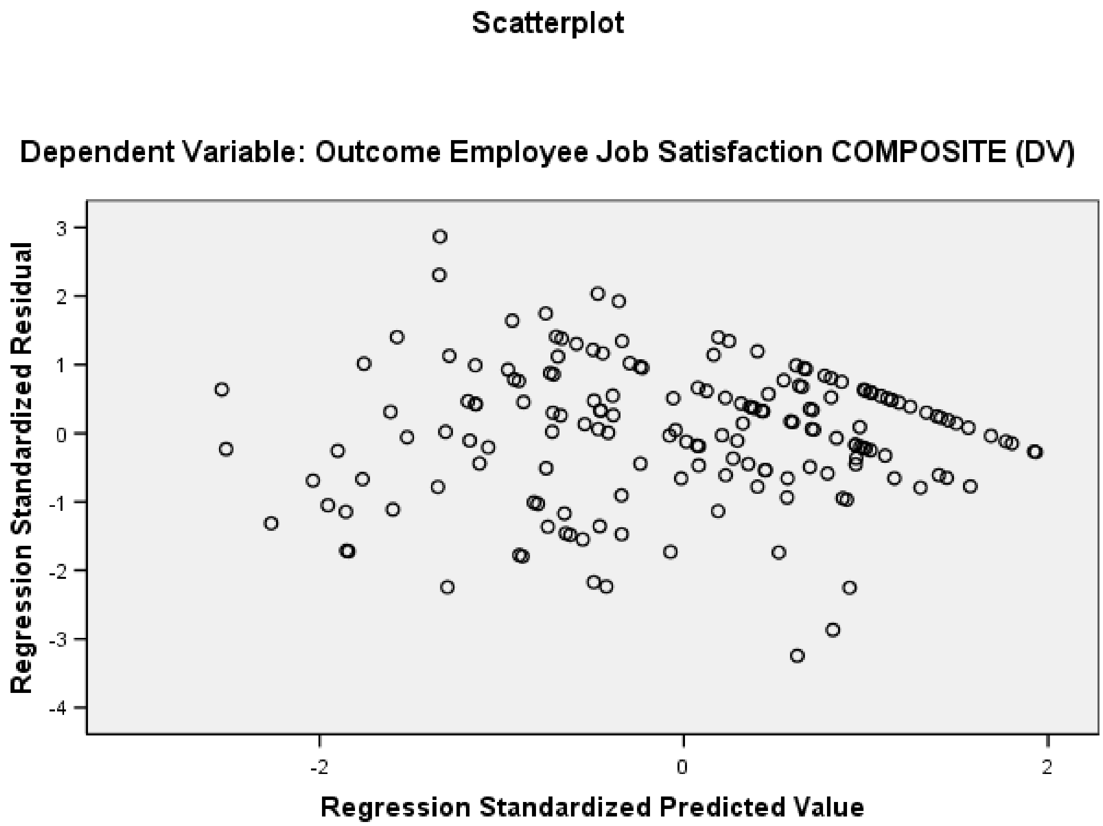
Histogram



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.069	172	.042	.984	172	.043

a. Lilliefors Significance Correction



Note. Normality and linearity check graphics for H3b are shown.

MB+QMS = JS		Variance Ratio	> 10 Threshold
25%	75%	1.74	N
10%	**90%**	**1.22**	**N**
5%	95%	1.04	N

Note. Homoscedasticity check via conditional variance graphics for H3b are shown (cf., Cohen et al, 2003, p. 120). Assumptions have been met in order to continue with sequential regression analysis for MBNQA + QMS → Job Satisfaction Outcomes.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.697[a]	.485	.467	1.18529	.485	25.937	6	165	.000	
2	.700[b]	.490	.468	1.18328	.005	1.562	1	164	.213	1.965

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV), QMS Composite (DV)(IV) [Mediator]

c. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	218.633	6	36.439	25.937	.000[a]
	Residual	231.810	165	1.405		
	Total	450.444	171			
2	Regression	220.820	7	31.546	22.530	.000[b]
	Residual	229.623	164	1.400		
	Total	450.444	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV), QMS Composite (DV)(IV) [Mediator]

c. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

Coefficients[a]

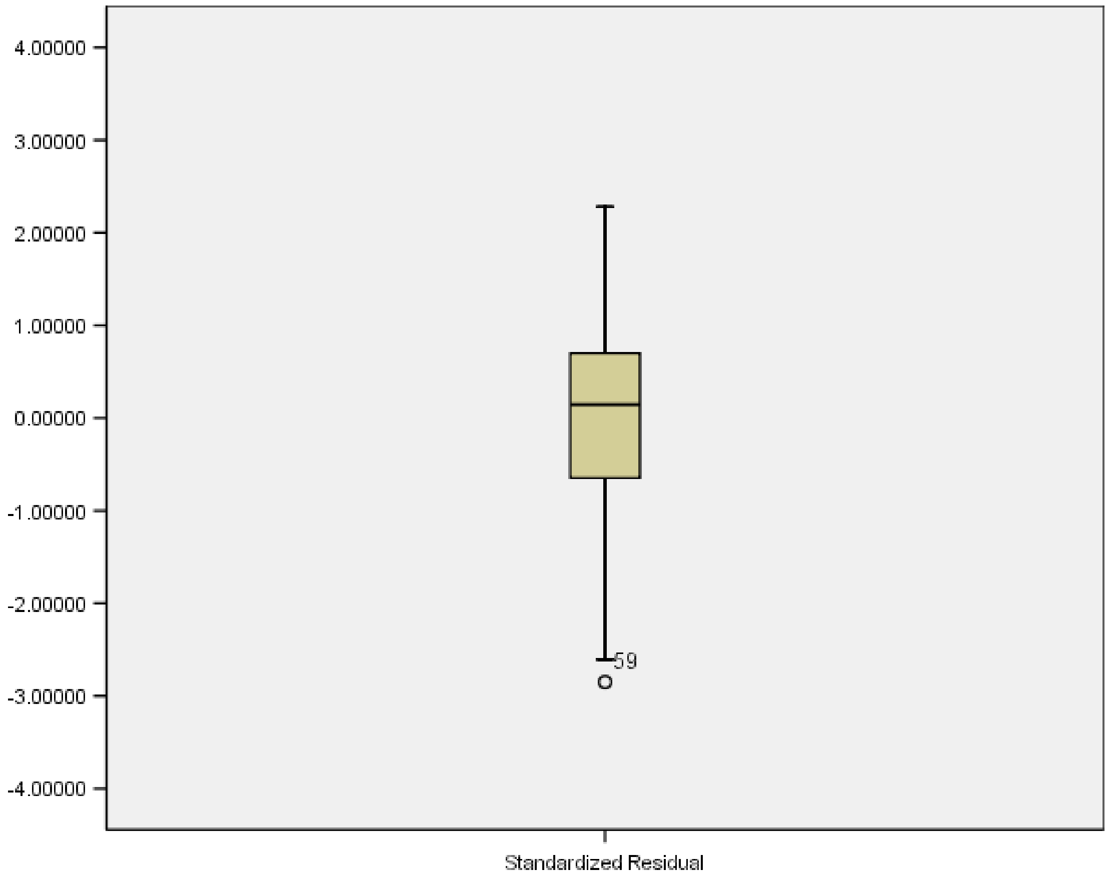
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.603	.460		1.309	.192	-.306	1.511					
	Leadership Composite (IV)	.398	.125	.331	3.194	.002	.152	.644	.647	.241	.178	.290	3.450
	Strategy Composite (IV)	-.065	.121	-.056	-.534	.594	-.304	.175	.559	-.042	-.030	.282	3.549
	Customer Market Composite (IV)	.161	.115	.114	1.400	.163	-.066	.387	.489	.108	.078	.470	2.128
	Information [MAK] Composite (IV)	-.013	.132	-.010	-.096	.923	-.273	.247	.554	-.007	-.005	.308	3.243
	HR Composite (IV)	.457	.127	.376	3.594	.000	.206	.708	.650	.269	.201	.285	3.508
	Process Mgt Composite (IV)	.021	.103	.016	.205	.838	-.183	.225	.474	.016	.011	.493	2.028
2	(Constant)	.798	.485		1.645	.102	-.160	1.757					
	Leadership Composite (IV)	.412	.125	.343	3.297	.001	.165	.659	.647	.249	.184	.288	3.477
	Strategy Composite (IV)	-.064	.121	-.055	-.528	.599	-.303	.175	.559	-.041	-.029	.282	3.549
	Customer Market Composite (IV)	.220	.124	.156	1.773	.078	-.025	.464	.489	.137	.099	.402	2.487
	Information [MAK] Composite (IV)	-.004	.132	-.003	-.034	.973	-.265	.256	.554	-.003	-.002	.308	3.251
	HR Composite (IV)	.479	.128	.394	3.738	.000	.226	.733	.650	.280	.208	.280	3.576
	Process Mgt Composite (IV)	.049	.105	.038	.465	.642	-.159	.257	.474	.036	.026	.471	2.123
	QMS Composite (DV)(IV) [Mediator]	-.161	.128	-.110	-1.250	.213	-.414	.093	.445	-.097	-.070	.403	2.481

a. Dependent Variable: Outcome Employee Job Satisfaction COMPOSITE (DV)

Note. Regression summary and independent errors test (D-W) graphics for H3b are shown.

Appendix Q

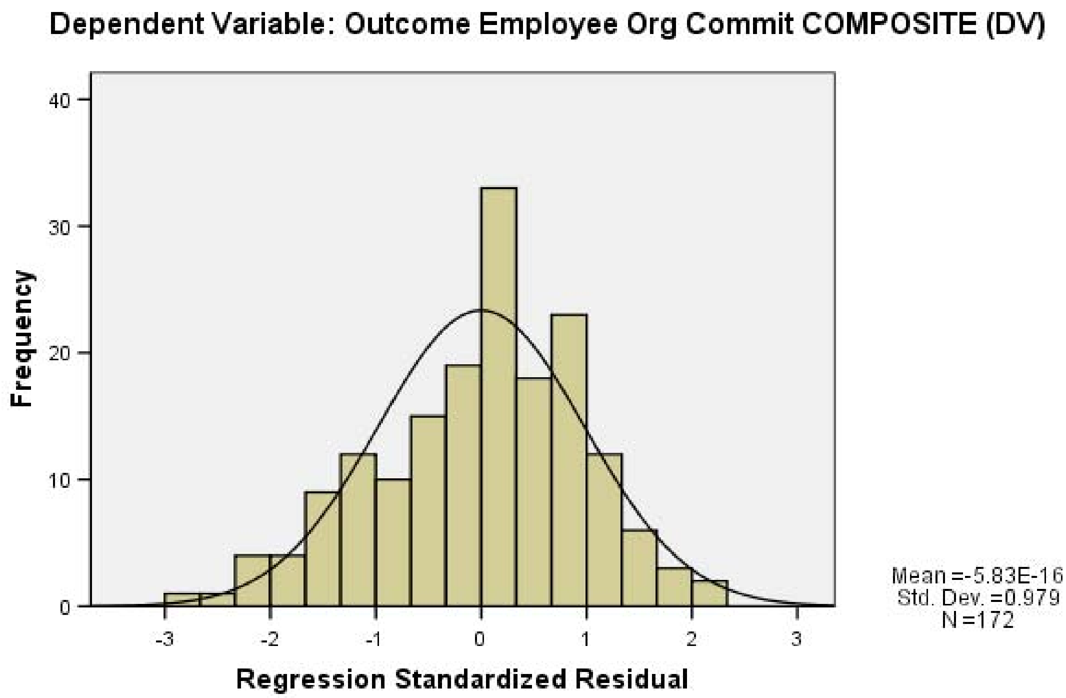
H3c Regression Assumptions & Analysis MB+QMS→OC



	OC QMS Case	Mahalanobis Distance	Cook's Distance
1	66	31.64635	0.05233
2	20	25.12523	0.11974
3	89	22.81079	0.00071
4	15	22.46286	0.05254
5	110	22.29291	0.00075
6	3	22.04016	0.00121
7	100	20.75617	0.09759
8	81	20.21058	0.00121
9	90	18.25391	0.00171
10	13	18.21097	0.02698

Note. Multivariate outlier and influential case analysis graphics for H3c are shown.

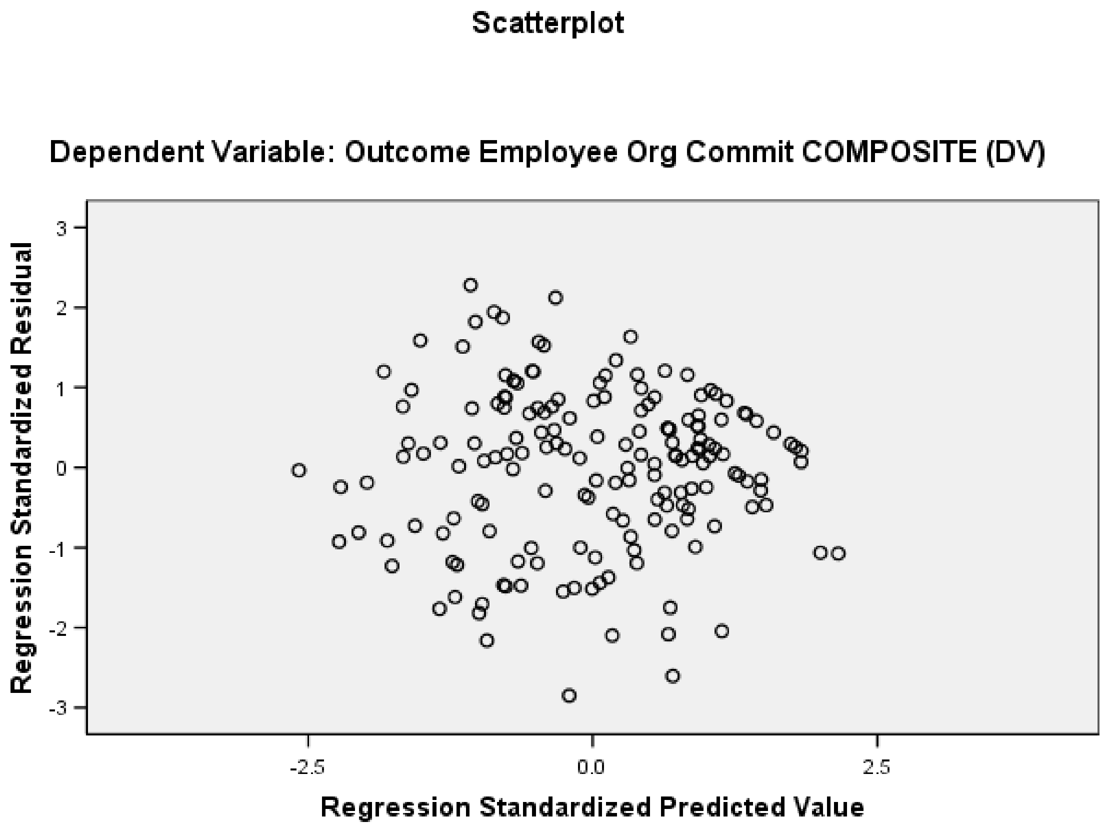
Histogram



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.077	172	.015	.986	172	.091

a. Lilliefors Significance Correction



Note. Normality and linearity check graphics for H3c are shown.

MB+QMS = OC		Variance Ratio	> 10 Threshold
25%	75%	1.65	N
10%	**90%**	**1.30**	**N**
5%	95%	1.98	N

Note. Homoscedasticity check via conditional variance ratio graphics for H3c is shown (cf., Cohen et al, 2003, p. 120). Assumptions have been met in order to continue with complete regression analysis for MBNQA+QMS → Organizational Commitment Outcomes.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.696[a]	.484	.466	1.19850	.484	25.839	6	165	.000	
2	.697[b]	.486	.464	1.20070	.001	.396	1	164	.530	1.910

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV), QMS Composite (DV)(IV) [Mediator]

c. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	222.690	6	37.115	25.839	.000[a]
	Residual	237.008	165	1.436		
	Total	459.698	171			
2	Regression	223.261	7	31.894	22.123	.000[b]
	Residual	236.437	164	1.442		
	Total	459.698	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV), QMS Composite (DV)(IV) [Mediator]

c. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

Coefficients[a]

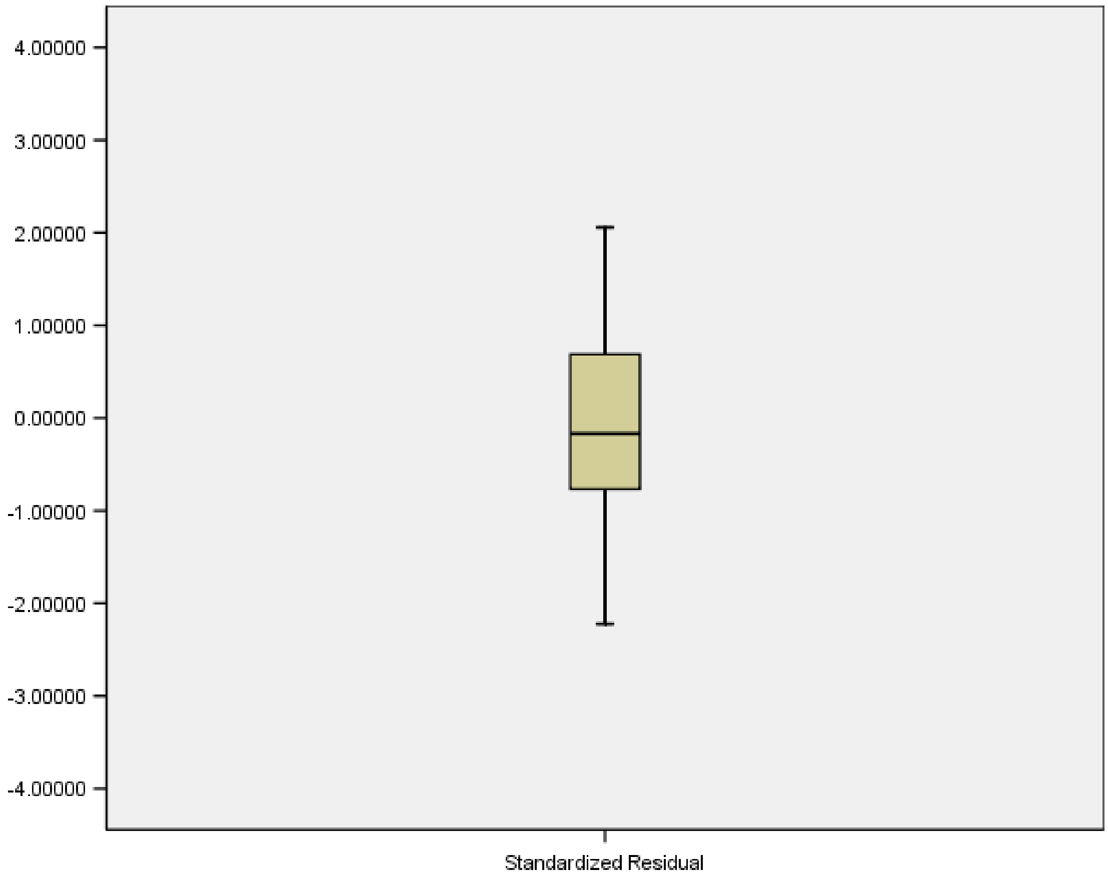
Model		Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	.272	.465		.584	.560	-.647	1.191					
	Leadership Composite (IV)	.246	.126	.203	1.952	.053	-.003	.495	.604	.150	.109	.290	3.450
	Strategy Composite (IV)	-.095	.123	-.081	-.773	.440	-.337	.147	.550	-.060	-.043	.282	3.549
	Customer Market Composite (IV)	.213	.116	.150	1.838	.068	-.016	.442	.469	.142	.103	.470	2.128
	Information [MAK] Composite (IV)	.034	.133	.026	.254	.800	-.229	.297	.538	.020	.014	.308	3.243
	HR Composite (IV)	.672	.129	.547	5.226	.000	.418	.926	.671	.377	.292	.285	3.508
	Process Mgt Composite (IV)	-.144	.104	-.110	-1.382	.169	-.350	.062	.405	-.107	-.077	.493	2.028
2	(Constant)	.372	.493		.755	.451	-.601	1.345					
	Leadership Composite (IV)	.253	.127	.208	1.997	.048	.003	.504	.604	.154	.112	.288	3.477
	Strategy Composite (IV)	-.095	.123	-.081	-.769	.443	-.337	.148	.550	-.060	-.043	.282	3.549
	Customer Market Composite (IV)	.243	.126	.171	1.936	.055	-.005	.492	.469	.149	.108	.402	2.487
	Information [MAK] Composite (IV)	.038	.134	.029	.285	.776	-.226	.302	.538	.022	.016	.308	3.251
	HR Composite (IV)	.684	.130	.556	5.253	.000	.427	.941	.671	.380	.294	.280	3.576
	Process Mgt Composite (IV)	-.130	.107	-.099	-1.215	.226	-.341	.081	.405	-.094	-.068	.471	2.123
	QMS Composite (DV)(IV) [Mediator]	-.082	.130	-.056	-.629	.530	-.339	.175	.444	-.049	-.035	.403	2.481

a. Dependent Variable: Outcome Employee Org Commit COMPOSITE (DV)

Note. Regression summary and independent errors test (D-W) graphics for H3c are shown.

Appendix R

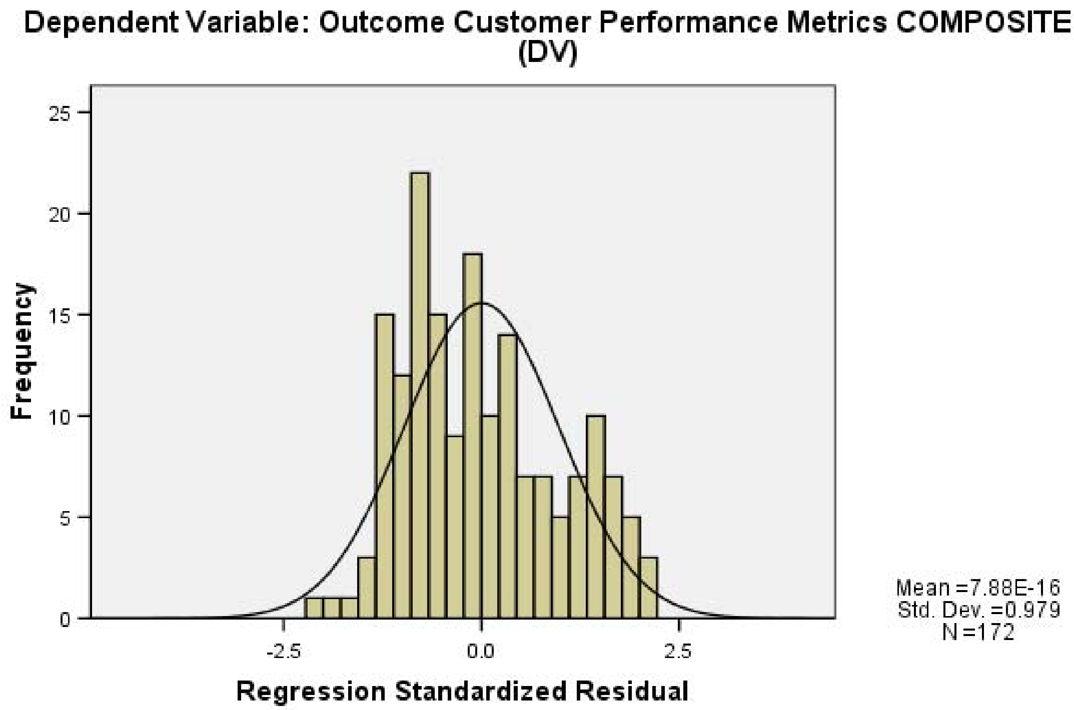
H3d Regression Assumptions & Analysis MB+QMS → CPM



	Cust QMS Case	Mahalanobis Distance	Cook's Distance
1	66	31.64635	0.00560
2	20	25.12523	0.00600
3	89	22.81079	0.00112
4	15	22.46286	0.08318
5	110	22.29291	0.03042
6	3	22.04016	0.00584
7	100	20.75617	0.00806
8	81	20.21058	0.09973
9	90	18.25391	0.00253
10	13	18.21097	0.00393

Note. Multivariate outlier and influential case analysis graphics for H3d are shown.

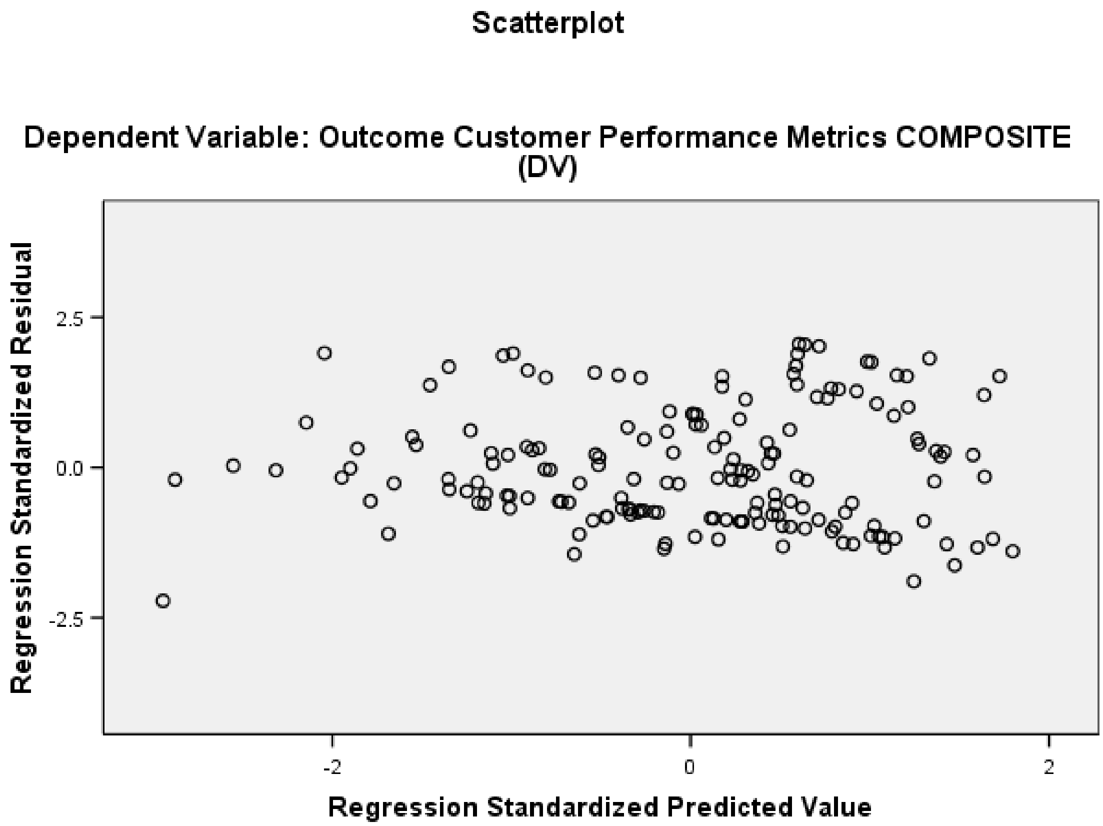
Histogram



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	.094	172	.001	.959	172	.000

a. Lilliefors Significance Correction



Note. Normality and linearity check graphics for H3d are shown.

MB+QMS = CUST		Variance Ratio	> 10 Threshold
25%	75%	0.54	N
10%	**90%**	**2.33**	**N**
5%	95%	9.99	N

Note. Homoscedasticity check via conditional variance ratio graphic for H3d is shown (cf., Cohen et al, 2003, p. 120). Normality assumption was not met even with attempts at transforming the DV and IVs. However, it is understood that regression analysis using large samples is relatively robust to nonnormality such that large samples will generally diminish the negative effects of nonnormality (Hair et al, 1998, p. 71). Thus, it was decided to continue with a complete regression analysis for MBNQA+QMS → Customer Performance Metrics Outcomes.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.315[a]	.099	.066	.97774	.099	3.025	6	165	.008	
2	.318[b]	.101	.062	.97978	.002	.312	1	164	.577	2.057

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV), QMS Composite (DV)(IV) [Mediator]

c. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.353	6	2.892	3.025	.008[a]
	Residual	157.735	165	.956		
	Total	175.088	171			
2	Regression	17.653	7	2.522	2.627	.013[b]
	Residual	157.436	164	.960		
	Total	175.088	171			

a. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV)

b. Predictors: (Constant), Process Mgt Composite (IV), Strategy Composite (IV), Customer Market Composite (IV), Leadership Composite (IV), Information [MAK] Composite (IV), HR Composite (IV), QMS Composite (DV)(IV) [Mediator]

c. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

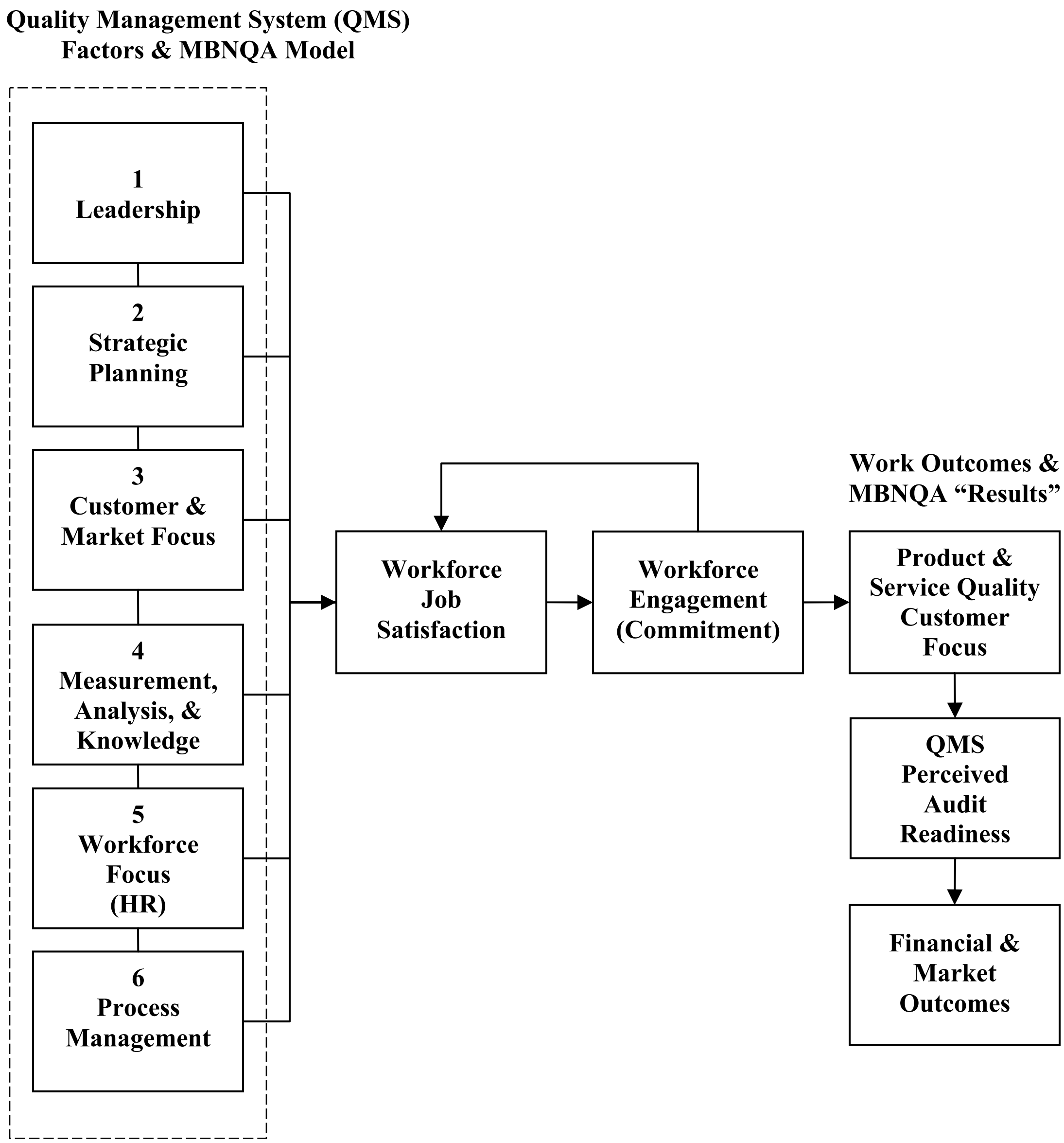
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.497	.380		9.213	.000	2.748	4.247					
	Leadership Composite (IV)	.142	.103	.190	1.382	.169	-.061	.345	.260	.107	.102	.290	3.450
	Strategy Composite (IV)	.072	.100	.100	.716	.475	-.126	.269	.243	.056	.053	.282	3.549
	Customer Market Composite (IV)	.085	.095	.096	.894	.373	-.102	.272	.252	.069	.066	.470	2.128
	Information [MAK] Composite (IV)	-.109	.109	-.133	-1.002	.318	-.324	.106	.197	-.078	-.074	.308	3.243
	HR Composite (IV)	-.042	.105	-.055	-.397	.692	-.249	.166	.218	-.031	-.029	.285	3.508
	Process Mgt Composite (IV)	.120	.085	.148	1.406	.162	-.048	.288	.267	.109	.104	.493	2.028
2	(Constant)	3.570	.402		8.882	.000	2.776	4.363					
	Leadership Composite (IV)	.147	.103	.196	1.422	.157	-.057	.351	.260	.110	.105	.288	3.477
	Strategy Composite (IV)	.072	.100	.100	.718	.474	-.126	.270	.243	.056	.053	.282	3.549
	Customer Market Composite (IV)	.106	.103	.121	1.037	.301	-.096	.309	.252	.081	.077	.402	2.487
	Information [MAK] Composite (IV)	-.106	.109	-.130	-.971	.333	-.321	.109	.197	-.076	-.072	.308	3.251
	HR Composite (IV)	-.034	.106	-.044	-.316	.753	-.243	.176	.218	-.025	-.023	.280	3.576
	Process Mgt Composite (IV)	.130	.087	.161	1.489	.138	-.042	.302	.267	.115	.110	.471	2.123
	QMS Composite (DV)(IV) [Mediator]	-.059	.106	-.065	-.558	.577	-.269	.151	.198	-.044	-.041	.403	2.481

a. Dependent Variable: Outcome Customer Performance Metrics COMPOSITE (DV)

Note. Regression summary and independent errors test (D-W) graphics for H3d are shown.

Appendix S



Note. Future research model graphic, which illustrates different variable arrangements, interactions, and possible critical relationships, is shown.