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THE EFFECT ON CORPORATE PERFORMANCE OF FIRMS THAT WON THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD

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THE EFFECT ON CORPORATE PERFORMANCE OF FIRMS THAT WON THE
MALCOLM BALDRIGE NATIONAL QUALITY AWARD

By
John Richard Horne

A DISSERTATION

Submitted to
H. Wayne Huizenga School of Business and Entrepreneurship
Nova Southeastern University

in partial fulfillment of the requirements
for the degree of

DOCTOR OF BUSINESS ADMINISTRATION
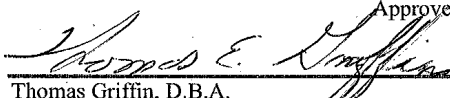
2009

A Dissertation
Entitled

THE EFFECT ON CORPORATE PERFORMANCE OF FIRMS THAT WON
THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD

By

John Richard Horne

We hereby certify that this Dissertation submitted by John Richard Horne conforms to
acceptable standards, and as such is fully adequate in scope and quality. It is therefore
approved as the fulfillment of the Dissertation requirements for the Degree of Doctor of
Business Administration.

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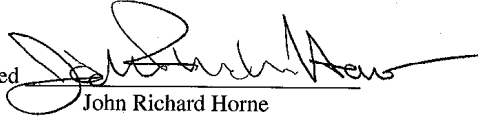
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2009

CERTIFICATION STATEMENT

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John Richard Horne

ABSTRACT

THE EFFECT ON CORPORATE PERFORMANCE OF FIRMS THAT WON THE
MALCOLM BALDRIGE NATIONAL QUALITY AWARD

by

John Richard Horne

This study examined the business results of companies that won the Malcolm Baldrige
National Quality Award (NQA). It used performance data before and after the award to
determine if there were significant differences in three key performance indices after
adoption of those business techniques that enabled these companies to win their NQA.
The three key indicators were return on assets (ROA), earnings per share (EPS) and the
current ratio. The study examined the data in two ways; first tests were made by
comparing company performance before and after winning an NQA. The second way of
testing was by comparing the NQA-winning company's performance with its key
competitors within their market segment.
Using both parametric and nonparametric hypothesis testing techniques, the
preponderance of evidence suggests there was no significant difference in performance
after winning the NQA than before, using the three performance indicators used in this
study. Likewise, there was no evidence to suggest that the NQA-winning firms
outperformed their key competitors within their market segment, for the three
performance indicators used.

ACKNOWLEDGMENTS

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Chapter I

Introduction

"Too many accountants, lawyers and marketing people. What we need are some manufacturers and engineers calling the shots if America is to compete effectively in world markets."

<div align="right">

Malcolm Baldrige
26th Secretary of Commerce, on December 11, 1980
by President Ronald Reagan

</div>

In this increasingly competitive environment, quality management is an indispensable component to a firm's overall business strategy. "If your company doesn't produce high-quality, you must either sell to low-income groups of go out of business" (Kotler, 2000, p. 6). With this in mind, this study attempts to add to understanding of the linkage between quality improvement initiatives and company performance. After understanding the interrelatedness of the many facets of quality, management can lead change toward performance excellence in order to attain and maintain a competitive position in the market.

The current global economy has also introduced a formidable level of competition to American companies. This started after the end of World War II and in fact, the level of competition has increased with the current presence of China, and to an increasing degree, India as premier world exporters. According to the World Trade Organization, China's increase in merchandise exports to the world increased 80% between 2000 and 2007 while India's increased 71% during this period. The United States (U.S.), on the other hand, increased its trade to the world by only 33% during the same period (WTO

<div align="center">1</div>

Trade Data, 2008).

One affect of this change in the U.S. world market share has been that the trade deficit for merchandise for the U.S. went from $261.9 billion in 1998 to $828 billion in 2005 (WTO World Merchandise Trade, 2005).

International Trade Statistics, a document published by the World Trade Organization indicate a decrease in the share of world trade produced by the U.S. in recent years as shown in Table 1.

Table 1

U.S. Share of World Trade

Year	U.S. Share by Percent
1997	12.6%
2000	12.3%
2004	8.9%
2005	8.7%

Note. From WTO World Merchandise Trade, 2005.

While there are many possible explanations for this trend, research has been done which provides an association between poor quality and negative trade outcomes (Hudson & Jones, 2003; Kandogan, 2006). This association can supply at least a partial explanation for the situation. Linder (1961) first noted that richer countries spend a higher proportion of their income on high-quality goods. Hallack (2004) went on to illustrate a sector-level confirmation of the Linder hypothesis.

Product and service quality are important for maintaining a competitive position in the marketplace. At the core of this proposition is the necessity to minimize production costs and to focus on customer satisfaction. After almost a century of modern quality management development, quality management has wide acceptance and application in all business environments. To foster the development of quality in a firm, a structured and discipline approach can help. The Malcolm Baldrige National Quality Award (NQA) program is an annual competition of American firms using a disciplined approach. Although this program has received much publicity, research has not been consistent in substantiating benefits to firms that have won a NQA. To that end, the purpose of this study is to examine the effect on shareholder valuation of firms that won a Malcolm Baldrige National Quality Award (NQA) over a set period, in relation to their key competitors.

Many of the earlier attempts to answer the question of shareholder valuation have been centered on the price of the winning firm's stock. This is rational and extends the use of the Efficient Market Hypothesis (EMH) into the evaluation process. Nevertheless, as detailed in Chapter II of this study, there are inconsistent findings in previous research leading to the lack of conclusive evidence that quality initiatives will provide benefits to a firm. This study departed from previous studies by focusing on the relative efficiency of the firm in relation to its competition. Efficiency in this context is the manner in which a firm uses its resources to generate profit and sales. This conforms to the approach by Healy, Palepu, and Ruback (1992) who indicated that accounting methods were a better way to measure firm performance than stock prices.

Background of the Study

Purpose and Rationale for the Study

To meet increasing competition in the marketplace, many firms have relied on quality and process improvement initiatives to keep competitive. Wilson, Walsh, and Needy (2003) stated, "Internationally, there are nearly 60 programs and awards that reward companies for improving quality" (p. 3). Among the most prestigious quality management programs used is the NQA program. This program, and the value it brings to a company, was the focus of this study. Extending the influence of NQA, thirty-seven state governments in the U.S., have emulated the NQA program and its evaluative structure (The Alliance for Performance Excellence, 2008). The Alliance for Performance Excellence serves as a clearinghouse of information about NQA. It is "a nonprofit network of international, national, state, and local Baldrige-based award programs. Members of The Alliance contribute over $30 million annually to economic competitiveness by assisting organizations in all industries on their journey to excellence" (The Alliance for Performance Excellence, 2008).

The National Institute of Standards and Technology (NIST) manage the NQA program. The NIST is part of the U.S. Department of Commerce. Under the program, annual quality excellence competitions have been held since 1988, with the competition winners being presented their trophies by either the President, or the Vice President of the U.S. The competition has several discrete categories of competition that use one of three separate evaluation criterion; education, health care and all others. These three criteria produce winners in the separate categories of manufacturing, service, small business, health services, and education. Under current development is a separate category for

nonprofit entities (2007 Nonprofit Category).

There is benefit in following up on the value-adding capability of winning a NQA. Between 1995 and 2004, the NQA Program released annual comparisons of publically traded NQA recipients compared to the S&P 500. This comparison is known as the "Baldrige Index". The practice of annually computing the Baldrige Index however, was discontinued in 2004. Among the reasons for the discontinuation of the annual comparisons was that an increasing number of applicants who were not publicly traded companies. The NQA Program is "currently researching alternatives to the stock study and hopes to replace it with an index that better reflects the performance of all recent Award recipients" (NQA Stock Studies, 2008). Below is a summary of the results of these annual comparisons of stock performance of the S&P 500 companies and NQA recipients:
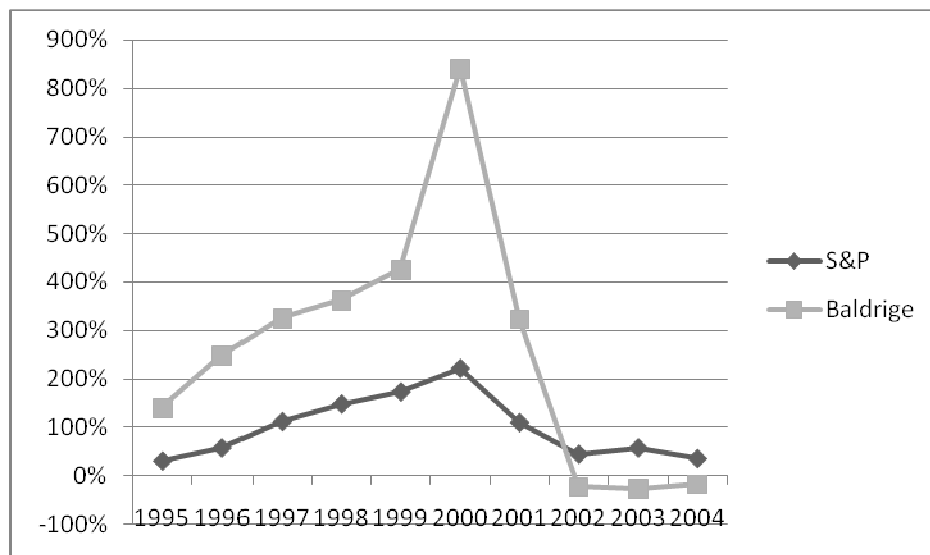
Figure 1. Annual comparison of stock performance between S&P 500 and NQA winners. From Baldrige Stock Results, 2008.

Table 2

1994-2003 Publicly Traded Award Recipients

	$ Investment	$ Value - 12/1/04	Change
1994-2003 Award Recipients	$2,131.30	$1,744.53	18.15%
S&P 500	$2,131.30	$2,889.54	35.58%

Note. From Baldrige Stock Results, 2008.

The results of the stock performance studies as noted previously, presents a dilemma that should be addressed. That is, in the early years of the Baldrige index, firms showed increases in stock price after winning a NQA while in the last years of the study, firms did not out-perform the S&P 500 as one would expect if the markets followed the EMH. Does this mean that firms did not increase their business performance after adapting? Is it possible that firms did increase their own internal performance but this increase was not reflected in the stock price for extraneous reasons related to the market as suggested by EMH? As Koop (2000) noted, "The simple random walk model is a little unreasonable as a description of stock price behavior since most stocks do appreciate in value over time" (p. 168). According to Higgins (2007), there are three weaknesses in using share price to gauge company performance. First is "the difficulty of specifying precisely how operating decisions affect stock price" (p. 56). That is, since there is no certainty in how the market will react to a manager's strategic decisions, then the stock price should not guide the decision in the first place. Secondly is "that managers typically

know more about their company than do outside investors" (p. 56). This should seem fairly obvious that an inside practitioner would have better knowledge than a person outside the company who is relying on only those elements of information that are required to be disclosed for financial reporting reasons. Lastly, the value of a stock price "depends on a whole array of factors outside the company's control. One can never be certain whether an increase in stock price reflects improving company performance or an improving external economic environment" (p. 56).

This study adds new information on value may have been added to firms that have won an NQA by way of business efficiency in using their assets to create sales and profit. As is illustrated below, previous studies present conflicting results whether or not winning the NQA added value to the firm. This study used other metrics that focus on determining if an improvement in internal process efficiencies is in evidence independent of the stock price.

Part of the disparity in the results of the previous studies may lay in that each study measured different parameters. This could be a simple and profound reason why the results of the previous studies providing conflicting evidence. Some of the studies indicated that firms did receive additional value to the value of the winning firms while other studies failed to show added value to the winning firms. The inconsistent outcomes of these studies provide a further rationale for performing this study. To provide a deeper contextual understanding of performance improvement initiatives, the results of firms that implemented Total Quality Management (TQM) programs are also considered. The reason for the examination of both types of quality initiatives is that TQM and the NQA evaluative criteria share many similarities. TQM as an identified quality improvement

strategy started in the mid-1980s while the first year of NQA competition was in 1988. Therefore, the results of implementing one of these quality management initiatives can give insight in implementing the other form of quality management initiative. These similarities are illustrated in Chapter III of this study.

Starting with an early examination of the results of TQM, Singhal and Hendricks (2001) studied the stock price of firm that implemented TQM. They stated that the stock performance of firms that implemented TQM out-performed a control group form 38% to 46%. Interestingly, the authors point out the "the significant positive abnormal returns during the post-implementation period conflict with market efficiency" (Singhal & Hendricks, p. 366). That is, that the market underestimated gains in efficiency after implementing TQM, in contradiction to the EMH. That there is contradictory evidence against the accuracy of the EMH is a significant and recurring theme in this study. Singhal and Hendricks go on to state, "Our interpretation is that the market remain slow to respond to TQM benefits" (p. 367). The evidence of Singhal and Hendricks appears to be contradictory and does little to resolve the dilemma at hand. This study furthers Singhal and Hendrick's work noted previously into testing the value-creating potential to firms that have won a NQA.

Easton and Jarrell (1998) studied 108 firms that implemented some kind of quality program to include TQM or the Baldrige NQA. The study period was from 1981 to 1991. They too measured the TQM firms against a control group of firms that did not declare the implementation of any kind of large-scale quality initiative. The measurement criteria was to look for excess stock performance of the TQM firms over what the expected stock performance was as declared by Value Line analysts.

Morin and Jarrell (2001) generalized this idea of quality initiatives adding value to shareholders by stating, "This is the idea, for example, behind many of the supplier initiatives undertaken within total quality management (TQM) systems. Such linkages can reduce costs and increase differentiation" (p. 17).

Another aspect of the question of valuing participation in quality improvement initiatives is that most firms have been evaluated with a primary focus on stock price performance. The ability of a firm's stock price to reflect accurately the value of the firm is the basis of the EMH ("Efficient Market Hypothesis," 2008). The fact that the stock market acts in a manner prescribed by the EMH in not universally accepted Nagorniak (2005). Koop (2000) for example, suggested a variant to the supposed efficiency of the market he called the "random walk with drift" (p. 168). This drift accounts for the " 'drift' upwards over time" (p. 168). Without the assurance that stock prices reflect the value of a firm, other more direct measures of performance are needed.

On the one hand, Malkiel (2005) subscribes to the efficient market hypothesis. By subscribing to the EMH, he asserts that the price of a stock does reflect the value of a company, that rational, informed customers drive the stock market. That is, "stock market price movements approximate those of a random walk. If new information develops randomly, market prices will too, making the stock market unpredictable apart from its long-run uptrend" (p. 1). Malkiel in summary, bases his contention for the most part on that, "the strongest evidence suggesting that markets are generally quite efficient is that professional investors do not beat the market" (p. 2). On the other hand, Nagorniak (2005) looks at this situation in a different light than Malkiel. He does not view the lack of performance of some managed funds as a validation of the EMH at all. He instead,

proposes that the stock prices do not necessarily reflect a company's true value and that inferior or inappropriate investment models account for the lack of managed fund performance.

As further credence to the previous assertion by Nagorniak, an examination of the current share price for major U.S. firms raises serious question about the efficiency of the market price being an indicator of firm performance. Figure 2 represents data from a grouping of stock on the Value Line Inc. web site called the Value Line 30. An examination for evidence pointing to a relationship between the share price and the earnings ability was made. A correlation and regression was performed on the Value Line 30 and the results follow. The horizontal axis represents the independent variable of earnings per share. This is a viable measure of how much money the firm made per share of outstanding common stock. The vertical axis represent the dependent variable of the share price as of November 23, 2008. There is moderate evidence to indicate that as the earning ability of the firm increases by way of its share price that the price it garners for its stock goes up as well.
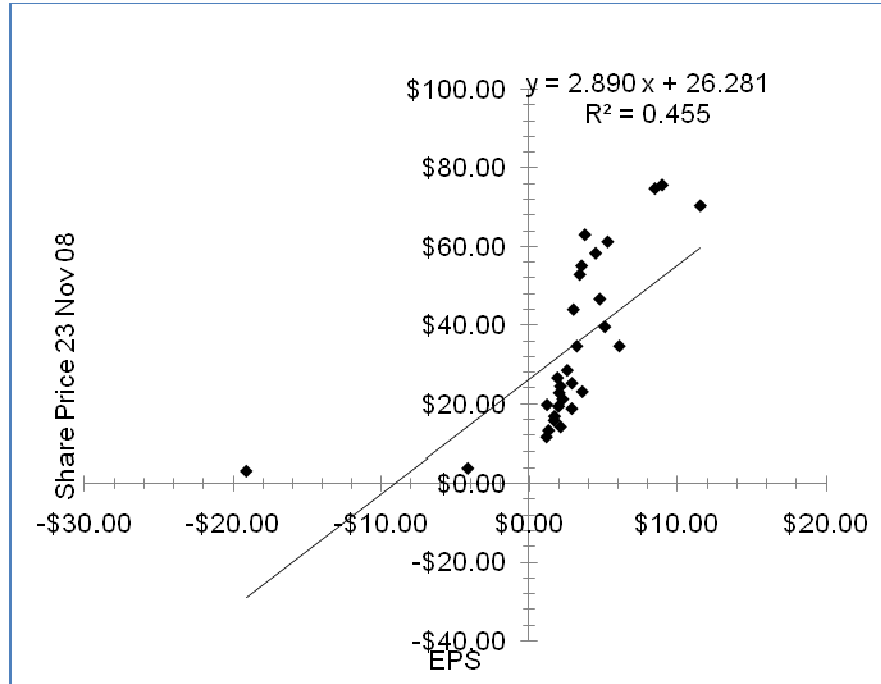
Figure 2. Value line 30 EPS – Share price comparison.

Figure 3 provides more information of the relationship. With the low *p*-value indicated below, the null hypothesis of random variation accounting for the variation can be rejected. Although not conclusive alone, this short example indicates that about two thirds of the change in share price may be related to the EPS, the data also suggests that one third of the share price is driven by factors other than the EPS.

Regression Analysis

r²	0.455		n	30	
r	0.675		k	1	
Std. Error	3.742		Dep. Var.	**EPS**	

ANOVA table

Source	SS	df	MS	F	p-value
Regression	327.4932	1	327.4932	23.39	4.34E-05
Residual	392.0677	28	14.0024		
Total	719.5609	29			

Figure 3. Regression analysis for value line 30 share price and EPS.

By way of comparison, Tuck (2005) also looked at stock performance in light of market efficiencies for firms winning the Malaysian Prime Ministers Quality Award (MPMQA). He found an interesting dichotomy in that service firms responded better to the quality award announcement than did production firms. This phenomenon however, could have several explanations. One explanation is that the market pricing mechanism is inefficient and therefore should not be expected to respond to the announcement adequately. Another explanation is simply that the market did not think winning of the MPMQA would positively influence the future earnings potential of the winning firms. (Tuck, 2005)

While the researchers previously mentioned focused on the immediate change in stock price after winning a quality award, other researchers examined the long-term impact to a winning firm's stock price. Cheah's (2007) approach was to determine if the stock market had "long-term memory" for NQA-winning firms. He examined the stock prices of NQA-winning firms 150 and 200 days after winning. He found no significant differences in the stock performance between the NQA recipients and comparable firms.

To summarize the findings of the previously mentioned studies, there is no clear, consistent, and compelling evidence on the value of winning an NQA with respect to a firm's stock price. The purpose of this study therefore, is to (a) test the performance of firms before and after winning a NQA to determine if there has been a statistically significant improvement in performance, and to (b) test the change in performance compared to like firms in the market segment of the winning firm. This study uses performance-based metrics and show the quantitative relationships between winning the NQA and those internal performance-based metrics. Published company performance metrics are used to identify changes in performance from before to after winning of a NQA.

A Description of the Malcolm Baldrige NQA Program

The history of the NQA traces itself back to U.S. Public Law 100-107 that was signed by President Ronald Reagan in 1987 (The Malcolm Baldrige National Quality Improvement Act of 1987 - Public Law 100-107, 09/25/2001). The Act was named the Malcolm Baldrige National Quality Improvement Act of 1987 in honor of a deceased former U.S. Secretary of Commerce, Malcolm Baldrige, who had championed global completion for U.S. firms. Among the key provisions of this Law are the following:

1. "The leadership of the United States in product and process quality has been challenged strongly (and sometimes successfully) by foreign competition, and our Nation's productivity growth has improved less than our competitors' over the last two decades", and

2. "Strategic planning for quality and quality improvement programs, through a commitment to excellence in manufacturing and services, are becoming more and more essential to the well-being of our Nation's economy and our ability to compete effectively in the global marketplace" (The Malcolm Baldrige National Quality Improvement Act of 1987 - Public Law 100-107, 2001)

The impact of the program has extended beyond its origins. There are now 44 state and local quality programs in 41 states (MBNQA Factsheet, 2007). Many of these award programs use evaluation criteria similar to the NQA. The state of Florida, for example, has the Governor's Sterling Award (GSA) program. The GSA evaluation categories are the same as the NQA categories, which are shown later in this study. Different in the two competitions however, are the points assigned to each of the evaluation categories. Nevertheless, the processes share many commonalities. The basic approach to these competitions is multi-phased. That is, to start the competition process, a firm will usually perform a detailed internal examination of itself using the seven categories of competition. Some firms do not intend to compete, but only to examine themselves using the evaluation criteria, for the sake of process improvement. The NQA evaluation criteria are an excellent strategic management model by which to perform business transformation.

Extending beyond the U.S., the NQA program has networked with other quality

organizations internationally. NQA is a member of the (Global Excellence Model Council Awards, 2005) Global Excellence Model Council. Along with the NQA, member nations include:

Table 3

Global Excellence Model Council Members

Nation	Name of Quality Model	Components of Model
Australia	Australian Business Excellence Framework	Leadership, Customer and Market Focus, Strategy and Planning, People, Information and Knowledge, Process Management, Improvement and Innovation, and Success and Sustainability (SAI Global, 2001)
Europe	EFQM Excellence Model	Performance, Customers, People and Society, Leadership, Policy and Strategy, People, Partnerships and Resources, and Processes (EFQM Model, 2008)
India	CII Exim Bank Award for Business Excellence	Based on the EFQM (GEM Council, 2008)
Brazil, Mexico, Spain	Iberoamerican Excellence Model for Management	Leadership and Style of Management, Policy and Strategy, People Development, Resources and Associates, Customers, Customer Results, People Development Results, Society Results, and Global Results (IEM Model, 2008)

Nation	Name of Quality Model	Components of Model
Japan	Japan Quality Award	Modeled after the MBNQA
Singapore	Singapore Quality Award	Leadership, Planning, Information, People, Processes, Customers, Results, Innovation, and Learning (GEM Council, 2008)

Note. From Global Excellence Model Council Awards, 2005

Statement of the Problem

This quantitative study examines the impact on firm performance of those that competed for and won a Baldrige NQA. This study uses internal performance metrics to measure and contrast with stock price performance. The current problem is that companies have no clear and consistent evidence to indicate that competing in the NQA, or other quality improvement initiatives, will improve performance. As indicated in the various studies the follow, there has been conflicting assessments on the value of winning a NQA. This same concern was been raised before with respect to the value to a firm to becoming ISO 9000 certified, a quality improvement effort similar in many ways to NQA. Dunu and Ayokanmbi (2008) examined the issue of the value of ISO 9000 certification to a firm's performance. While they found evidence of an increase in revenues and net income, further evidence using ratios of revenues to assets and operating income to assets did not exist. Saravanan and Rao (2007) also noted that increases in performance as a result of quality improvements are unequivocal. They found, "The ways, commitment and the competence with which the quality improvement

efforts are carried out play a vital role in determining the success of the firms than the duration… (p. 204). Likewise, Pinar and Ozgur (2007) examined the impact of ISO 9000 certification and variance of stock prices of Turkish firms. Although some evidence of less variance of stock prices for the ISO 9000 certified firms was found, this was not "for all time period/scenarios" (p. 37). In fact, the stock prices of the ISO 9000 and non-ISO 9000 firms "converged after nine years" (p. 37), thereby raising questions as to the value of the effort to begin with.

This study examines available evidence of the change in performance of firms that won a NQA. The research hypothesis is that winning NQA positively effects the competitive position of the firm and hence, shareholder value by the improvement of internal performance metrics. The study attempts to create a viable business case for competing in quality competitions to the shareholders benefit. Confirmation of this benefit to shareholders is demonstrated by way of financial performance metrics and the efficiency by which assets are turned into profit.

Consequently, a broader perspective is used instead of focusing on the stock price of a firm. A number of studies in the past have examined the effect of winning an NQA on stock prices. Furthermore, the results of these studies have been inconsistent. Some studies have shown an increase in stock price performance (General Accounting Office [GAO], 1991; Hendrick & Singhal, 1996). While other studies have shown either no change or even a loss in stock value after winning a NQA (Jensen, 2002; Tuck, 2005). This is similar to the situation found by Healy et al. (1992) where they found strong evidence of increased corporate cash flows following corporate mergers but the stock prices did not follow the same strong pattern.

The previously citied cases of contrary evidence leaves business managers with a dilemma of whether quality initiatives are worth the time and effort. Therefore, a different approach is used for this study. The internal performance metrics are the focus of this study and not the stock price as with most other studies.

Research Design and Research Questions

The design for this quantitative study is based on Creswell's (2003) quasi-experimental non-equivalent control group design (p. 169). This design choice was appropriate in that, as is the case in this study, "the investigator use control and experimental groups but does not randomly assign participants to groups (e.g., they may be intact groups available to the researcher" (p. 167). For this study two segments are tested. The experimental group used are the firms that won a NQA, both pre-NQA award and post-NQA award performance. The control groups are the key competitors in the market segment of the NQA winning firms. Sekaran (2003) goes into further detail in explaining this type of experimental design as shown in the following tables. In order to test the first research question, the following format (see Figure 4) was used and adapted from Sekaran (2003):

Group	Pre-award results	Adaptation of NQA practices	Post-award results
NQA-winning companies	Observation$_1$	X	Observation$_2$

Figure 4. Pretest and posttest experimental group design.

In order to test the second research question, the following format was used:

Group	Pre-award results	Adaptation of NQA practices	Post-award results
NQA-winning companies	Observation$_1$	X	Observation$_2$
Control group of non-NQA winning firms	Observation$_3$		Observation$_4$

Figure 5. Pretest and posttest experimental and control group design.

This format also conforms to John Stuart Mill's negative canon of agreement as shown in Figure 6. Where variables A and B are factors of performance, in the case of this study, and C is the treatment or the adoption of MBNQA tenets of management. Variable Z would be the performance outcomes.
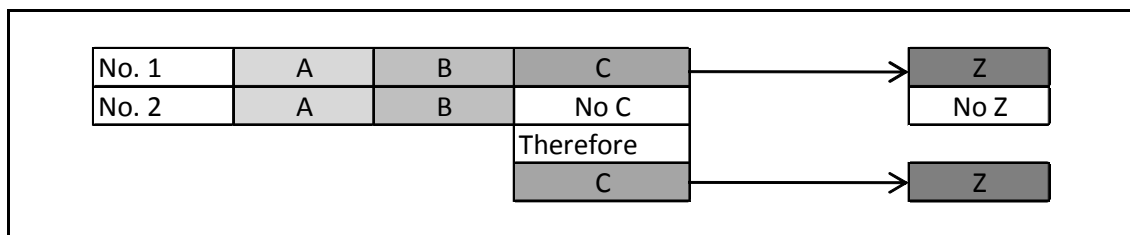
Figure 6. Mill's method of difference

From *Business Research Methods* (8th ed.), 2003, Boston: McGraw Hill, p. 164.

In order to gain a greater understanding of the relationship between firm performance and winning a NQA, this study investigated the following research questions:

What were the changes in corporate performance comparing the periods before and after an NQA?

How does a firm that won an NQA compare to its key competitors during this period under study?

The construction of the previous research questions follows the Management-Research Question Hierarchy proposed by Cooper and Schindler (2003, p. 66) which follows the following path:

1. Management dilemma. This is usually some kind of symptom of an actual business problem such as increasing employee turnover or increasing product defects.

2. Management question. This next step puts the management dilemma into question form.

3. Research question(s). This question is "the hypothesis of choice that best state the objective of the research study" (Cooper & Schindler, p.73). This must address the previous management question in order to help the firm resolve its dilemma.

4. Investigative questions. These are the actual questions that a researcher must ask in order to arrive at a conclusion. They ask for the individual pieces of information needed in the study. For purposes of this study, the investigative questions relate to the elements of shareholder value and the absence or presence of substantive performance improvement indicators.

5.   Measurement questions. For purposes in this observational study, these

questions are, "the observations researchers must record about each subject studied"

(Cooper & Schindler, p. 76). The measurement questions for this study are the

quarterly performance data points for each of the variables and each of the

companies, under study. These were identified later in this study.

6.   Management decision. To be useful and relevant to management, the study

must provide sufficient information and understanding of their original dilemma in

order to direct action to improve company performance.

Chapter III presents the statistical methods in detail, identify the study variables,

and explain the rationale for testing their relationships. The variables were resource and

asset-based and financial performance based. In brief, a test was made of the efficiency

by which a firm uses its available resources to generate sales and revenue as evidenced in

the consolidate balance sheets and the income statements. The performance metrics

relationship parallels Harrison's (1994) input-output model that is illustrated in Chapter

III. This model compares the measures of output in business performance in relation to

the measures of inputs used to derive those outputs, in this case, shareholder value by

way of profits.

The internal validation was the individual firm financial performance from before

and after winning the NQA, not on the stock price. The external validation was by

comparing these results with key competitors within the market segment to determine if

the differences can be generalized to the business segment population as a whole. As

noted by Creswell (2003), threats exist for both internal and external validation, and these

threats were addressed in Chapter III. Chapter IV presents the results of firm performance

and first compares the results of each firm before and after their winning a NQA. Next, each of the winning firms' performance was compared to their key competitors.

Definition of Terms

The key definitions used in this study are

Cost of goods sold (CGS): "Figure representing the cost of buying raw materials and producing finished goods. Depreciation is considered a part of this cost but is usually listed separately. Included in the direct costs are clear-cut factors such as direct factory labor as well as others that are less clear-cut, such as overhead" (Cost of Goods Sold, 2003).

Earnings per share (EPS): "The total profits of a company after taxation and interest, divided by the number of shares at issue. EPS will usually be higher than the dividend per share, because some earnings will be retained in the company and not distributed as dividends" (EPS, 2003).

Efficiency: The "…effective operation as measured by a comparison of production with cost (as in energy, time, and money)" (Efficiency, 2008)

Efficient-market hypothesis (EMH):

The efficient market hypothesis (EMH) holds that financial markets make efficient use of available information so that traders cannot base profitable trading strategies on available information. Such information will already be incorporated in asset prices, because when traders take advantage of profitable arbitrage opportunities, their trading changes the prices of assets, and thus public information cannot be used to outperform the market. ("Efficient Market Hypothesis," 2008)

Electronic Data Gathering, Analysis, and Retrieval system (EDGAR):

performs automated collection, validation, indexing, acceptance, and forwarding

of submissions by companies and others who are required by law to file forms

with the U.S. Securities and Exchange Commission (SEC). Its primary purpose is

to increase the efficiency and fairness of the securities market for the benefit of

investors, corporations, and the economy by accelerating the receipt, acceptance,

dissemination, and analysis of time-sensitive corporate information filed with the

agency. ("Important Information About EDGAR," 2005)

Forms 10-K and 10-Q (10-K, 10-Q): The 10-K is a form required by Federal

securities laws that "require publicly traded companies to disclose information on an

ongoing basis" (United States Securities and Commission, Exchange, 2006). This form

provides a comprehensive overview of the company's business and financial condition

and includes audited financial statements" (United States Securities and Commission,

Exchange). It contains the consolidated income statements and balance sheet for the firm.

Also of use in this study are the earnings per share and number of employees the firm

has. Form 10-Q is the quarterly reporting that leads up to the annual 10-K report. For this

study, most data was taken from the 10-Q reports to enable tracking of changes in

performance from quarter to quarter.

Generally Accepted Accounting Principles (GAAP):

Conventions, rules, and procedures that define accepted accounting practice,

including broad guidelines as well as detailed procedures. The basic doctrine was

set forth by the Accounting Principles Board of the American Institute of

Certified Public Accountants, which was superseded in 1973 by the FINANCIAL

ACCOUNTING STANDARDS BOARD (FASB), an independent self-regulatory

organization. (Generally Accepted Accounting Principles [GAAP], 2003)

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North American Industry Classification System (NAICS) codes:

The North American Industry Classification System (NAICS, pronounced Nakes)

was developed as the standard for use by Federal statistical agencies in classifying

business establishments for the collection, analysis, and publication of statistical

data related to the business economy of the U.S. NAICS was developed under the

auspices of the Office of Management and Budget (OMB), and adopted in 1997 to

replace the old Standard Industrial Classification (SIC) system. It was also

developed in cooperation with the statistical agencies of Canada and Mexico to

establish a 3-country standard that allows for a high level of comparability in

business statistics among the three countries. NAICS is the first economic

classification system to be constructed based on a single economic concept. (U.S.

Census Bureau, 2007)

Quality: The American Heritage Dictionary defines quality as an inherent or

distinguishing characteristic; a property. More specifically in a business setting would be

that quality is a condition of fitness for the intended use of a product to satisfy a

customer's needs and expectations.

Return on assets (ROA):

A measure of profitability calculated by expressing a company's net income as a percentage of total assets. Because the ROA formula reflects total revenue, total cost, and assets deployed, the ratio itself reflects a management's ability to generate income during the course of a given period, usually a year. To calculate ROA, net income is divided by total assets, and then multiplied by 100 to express the figure as a percentage. ("Return on Assets," 2006).

Return on investment (ROI):

A ratio of the profit made in a financial year as a percentage of an investment The most basic expression of ROI can be found by dividing a company's net profit (also called net earnings) by the total investment (total debt plus total equity), then multiplying by 100 to arrive at a percentage. ("Return on Investment," 2006)

Sales, general and administrative expenses (SG&A):

Grouping of expenses reported on a company's profit and loss statement between cost of goods sold and income deductions. Included are such items as salespersons' salaries and commissions, advertising and promotion, travel and entertainment, office payroll and expenses, and executives' salaries. SG&A expenses do not include such items as interest or amortization of intangible assets, which would be listed as income deductions. ("SG&A Expenses," 2003)

Shareholder value:

Theory that companies should maximize shareholder value at all times and that this aim should be a company's raison d'être. This idea gained popularity because it articulates clearly the reasons for a company's existence and ties in with the

popular concept of the stakeholder corporation, implying that shareholders

constitute a part of the stakeholders in the company. Proponents argue that

shareholder value encourages companies to take a long-term view in order to

satisfy institutional shareholders. (Shareholder value, 2005)

Standard Industrial Classifications (SIC) codes: "The Standard Industrial

Classification has been replaced by the new North American Industry Classification

System (NAICS), but several data sets are still available with SIC-based data. Both SIC

and NAICS classify establishments by their primary type of activity" (Standard Industrial

Classification (SIC) System, 2001).

Total quality management (TQM):

A philosophy and style of management that gives everyone in an organisation

responsibility for delivering quality to the customer. Total quality management

views each task in the organisation as a process that is in a customer/supplier

relationship with the next process. The aim at each stage is to define and meet the

customer's requirements in order to maximise the satisfaction of the final

consumer at the lowest possible cost. Total quality management constitutes a

challenge to organisations that have to manage the conflict between cost cutting

and the commitment of employees to continuous improvement. Achievement of

quality can be assessed by quality awards and quality standards. (TQM, 2006)

Assumptions

The key assumption of this study is that participation in a quality initiative will

create value for an organization's shareholders, which is the underlying assumption of

shareholder theory. Sundaram and Inkpen (2004) emphasized this by stating,

"Shareholder value maximization should be the preferred corporate goal not because it is law, not because it can be, as some argue, the ethical thing to do, nor because it is expedient because it is based on an observable and measurable metric" (p. 250). This study intentionally abstains from the debate of shareholder verses stakeholder valuation and supports the contention that seeking value for the shareholder is of paramount interest to a firm. Certainly, Jensen's (2002) assertion that managers "should make decisions so as to take account of the interests of all the stakeholders in a firm. Stakeholders include all individuals or groups who can substantially affect the welfare of the firm—not only the financial claimants, but also employees, customers, communities, and governmental officials…" (p. 236)—is of contextual and tangential interest, but not an immediate research concern.

Additionally, the difference in performance should be internally and externally valid. That is, there should be a measurable difference for a firm's performance before and after the competition to show an internally referenced difference. There should also be evidence that the firm out-performed comparable non-award-winning key competitor firms in creating value for its shareholders. Of primary interest is how the winning firm performed in relation to the key competitors of each winning firm. The key competitors are the limited group of relevant firms in direct competition with the NQA winning firms. The identification of the key competitors becomes known during market research. Key competitors are identified as part of the company's financial information in the various financial databases. The importance of the identification of key competitors is that in order to isolate the performance better and exclude externalities, the firm's performance was measured with external factors moderated. In other words, if winning the NQA was

beneficial for the firm, the firm's performance should have exceeded that of its key competitors. By comparing the winning firm's performance against their key competitor's performance in the same timeframe in the same market conditions also serves to remove extraneous market factors, from being a proximate cause for a change in firm's performance.

A final assumption is that the actual price of a firm's stock is not necessarily a reflection of its financial health. As far back as Fama (1965/1995) and his theory of random walks, there is a realization that a stock's price is presumed to be based on a set of rational investors with equal full knowledge of the market, that is, an efficient market is in operation. Nevertheless, the coupling of the assumption of an investor's full knowledge of a firm's condition and their rational behavior, is not always the case according to Fama because "an increase in industrial production or any other actual or anticipated change in a factor which is likely to affect the company's prospects" (Fama), will affect stock price. Of critical importance is that Fama mentions both actual and anticipated change in a firm's performance. The idea of an investor acting on an anticipated change in a company's performance leaves much room for interpretation by independent and equally rational investors. Consequently, Fama's prescribed behavior is tempered with Malkiel's (2003) assertion that "A new breed of economists emphasized psychological and behavioral elements of stock-price determination, and they came to believe that future stock prices are predictable on the basis of past stock price patterns as well as certain 'fundamental' valuation metrics" (p. 60). This study contends that the aforementioned "valuation metrics" are synonymous with the business performance metrics used in this study.

Theoretical Framework and Conceptual Model

The conceptual framework of this study is developed from an examination of current corporate performance analysis practices. While stock price is advocated by many financial practitioners to establish shareholder valuation, the underlying assumption is that EMH is valid. The central question of this study is whether winning a NQA helps the firm and verification of this by stock price has not been conclusive. Fama (1965/1995) indicates that stock prices are random in nature and will eventually reflect the true value of a firm. Stock price though is one of numerous measures of performance for a firm. ROI and economic value added for example, are equally important to ensure corporate governance especially with respect to the Sarbanes-Oxley Act of 2002 (Epstein & Hanson, 2005).

This study proposes that as a result of preparing for an winning a NQA, that internal business practices were improved which will provide sufficient reason for a firm to compete in quality competitions such as the NQA. The construct of this paper follows:
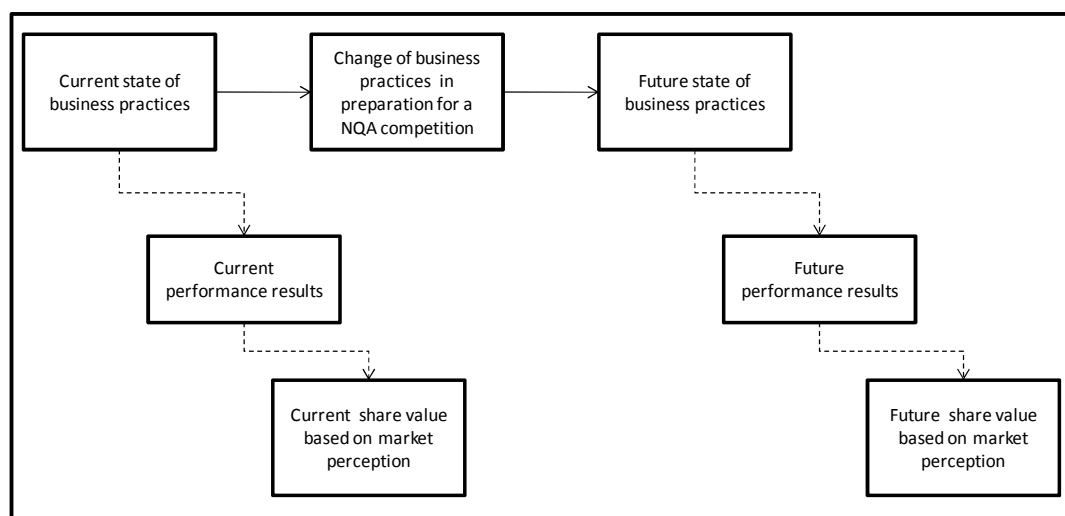
Figure 7. Conceptual framework for study.

Scope

The scope of this study is to examine publicly traded firms that won the Malcolm Baldrige National Quality Awards. Further, the number of firms was reduced to those that had at least two years of performance data available both before and after winning the award. Consequently, firms having been awarded the NQA recently were also excluded from this study. The reason for excluding companies without the sufficient number of years of performance information available is to enable a comparison of firm performance both before and after the NQA competition. Measuring the change of the NQA-winning and non-winning firm is the key component of the data analysis. Educational and health services firms were excluded from this study. The reason for the exclusion of educational and health services firms was to limit the view firm performance to those factors that contributed to a firm's financial performance. The benefits derived from an improvement in firm performance in for-profit service and manufacturing firms is different from those from the educational, and health services industries. These latter two industries having a wide and diverse body of stakeholders to serve and consequently, will not necessarily use the same valuation metrics.

Owing to the constraints previously noted, the number of firms to be tested is small and statistical sampling techniques were not used. Instead, a census of all firms meeting the previous criteria was used for this study. The firms are identified in Chapter IV, along with their performance metrics, and that of their key competitors.

Summary

With the increasing pressure of global competition on American firms, strategies and techniques must be employed to keep firms agile and competitive. Along with price

competition there exists a continuing need to maintain quality products and services. The

Malcolm Baldrige competition examines a firm's processes in a holistic and

comprehensive manner that can contribute to a firm's performance. As evidenced by the

inconsistent findings of earlier research, the mechanisms of the efficient-market

hypothesis are not always in place to reflect accurately the earning potential of a firm that

has won a NQA (Cheah, 2007). This study seeks to examine changes in firm performance

in other more direct methods of measurement of internal performance. If managers can be

provided with evidence on what changes are likely to follow from winning a NQA, then

their decision whether or not to compete in the first place can be made with greater

surety.

Chapter II

Review of Literature

Introduction to Literature Review

A review of research literature was conducted in order to determine the appropriate type of research methodology to be used. The two basic types being quantitative and qualitative, it was determined that a quantitative approach would be used (Creswell, 2003; Cooper & Schindler, 2003).

Then a review of literature in the four unique knowledge areas of this study was done. The areas of study are quality management, shareholder theory, MBNQA literature and company financial data. This provided a conceptual foundation for the research into the relationship between quality initiatives and shareholder valuation. The review of this literature showed recent research efforts, identified gaps in knowledge in the subject matter, and provided a path to creating new knowledge. References for basic research techniques included articles and textbooks on qualitative and quantitative research methods. The age of most of the research documents was less than 10 years old and most are under 5 years. The limiting of the age of the documents was done in order to take advantage of the most recent works, which themselves had benefited from previous research. Additionally, a number of older, seminal works were referenced by exception in order to provide a solid conceptual foundation. An example of this exception was the use of Fama's (1965/1995) work from the 1960s, on his efficient market hypothesis. This provided a model by which to guide understanding of the limitations of using share price as the sole reference point to evaluate firm performance.

Each of these four specific domains of knowledge were required to be examined in order to provide a conceptual understanding of quality systems and then, to measure operational outcomes for their companies. The four specific domains of knowledge follow.

First, a review was conducted of current quality management doctrine and theory. This quality management information provided an essential foundation-level understanding of quality management principles and practices.

Second, a review of current shareholder and stakeholder theory was conducted. These research documents were examined to gain an understanding and perspective on methods of shareholder valuation and methods and processes to determine that valuation. This examination was essential in order to gain an appreciation of what shareholder/stakeholder valuation is. Shareholder valuation is, for this study, the reference point from which to ascertain whether improvement had occurred in the targeted companies. The difficulty comes in determining which method to use in order to establish this valuation among varied and sometimes conflicting approaches.

The third category of literature reviewed was the MBNQA evaluation materials. The Baldrige evaluation material provides a structured framework for evaluating company performance along the seven evaluation factors used in the MBNQA. This examination was done in order to gain a greater understanding of the actual evaluative measures, with respect to the NQA criteria used and the available data from available sources. The NQA material is located on the MBNQA Program section of the National Standards and Technology Institute's web site.

The final category of literature reviewed was the historical company financial performance data and relevant anecdotal information of the firms who won a MBNQA

award. The source of this secondary data is the official company and published market records found mostly in EDGAR and the 10-Q reports posted there. This information was essential to understand the change in company performance before and after their competition. The information relating to the individual company's performance provided the necessary quantitative data to test the research hypotheses of a positive impact on company performance after winning a NQA. The overall market information was required in order to test the company data against key competitors in their respective market segments. This comparison was done in order to validate externally the changes. That is, to be able to view the changes in context to the performance of key competitors given the existing market conditions.

The literature indicated previously provides sufficient insight into the problem of insufficient evidence for the value of winning a NQA.

A Survey of Current Quality Management Systems Literature

A survey of current quality management literature is provided in order to build a foundation of understanding of the components of a quality management system. These references pertain to quality management in the for-profit business environment. The reason for the limitation to for-profit businesses is that the target NQA-winning companies in this study are all publicly owned for-profit corporations. The following documents are important to this study in their diversity and currency and written after decades of the application of these various quality management systems. The quality management systems discussed includes Total Quality Management (TQM), Six Sigma, the European Quality Foundation Award, and the MBNQA itself. Although there is a rich variety of non-business related quality management literature, such as in the health sciences field and in education,

these are not germane to this study. The uniqueness of these fields warrant them being excluded from this discussion.

Wadsworth, Stephens, and Godfrey's (2002) text provides an excellent overview of quality control techniques. Particularly relevant to this dissertation is the chapter on the history and development of quality control and quality models. By tracing the historical developments of quality, one can see a linkage from the early developmental stages of quality management into the most popular quality models including the MBNQA, ISO 9000 and the EFQM. Also apparent is the multi-national development of quality. This point is evidenced by comparing the evaluation criteria between the MBNQA model and the EFQM. The two models share many of the same evaluative criteria, as is identified later in this study. The roots of the Baldrige criteria may also by seen by examining some of the early literature on Total Quality Management efforts. The MBNQA criteria are a distillation of earlier quality management efforts and provide a balanced approached which gives weight to both the execution of a quality technique ad the performance results that follow. This later point is a key foundational concept for this study; that the application of quality improvement techniques produces identifiable performance enhancements. Not only is it necessary to design, develop and deploy intelligent quality systems, but these systems must also better the performance of the firm at the risk of their own obsolescence.

This section continues with a holistic study by of Lenka and Suar (2008) on Total Quality Management. The relevance of TQM to the rest of the literature is that TQM serves as a central framework of quality management practices, one that finds substantial agreement by academics and practitioners alike. By definition, TQM is "an integrated approach to bring continuous improvement in products and services using proper tools,

technology and training to meet customers' expectations on a continuous basis" (Lenka &

Suar, p. 57). Although there is not universal agreement of the specific tenets of TQM, most

practitioners agree that they include, "customer focus, continuous improvement, defect

prevention, performance measurement, and teamwork" (Lenka & Suar, p. 57). These

principles are so pervasive, that manifestations of these tenets can be seen various national

and international quality competition criteria, including the MBNQA, the Deming Prize

and others. Lenka and Suar went on to identify TQM by "hard" and "soft" components. The

hard skills being components such as "statistical process control, information and analysis,

process management...". The soft skills being components such as "leadership, human

resources, customer focus, management commitment…" (Lenka & Suar, p. 60). The

authors then distinguished between "back office" and "front office" functions. Saying,

"While back office operations are technology-driven, front office operations are people-

driven. These two stages are highly interrelated" (Lenka & Suar, p. 61). This

multidimensional approach to TQM gives an indication of the depth and complexity of

quality management in general. The authors concluded that, "the TQM process is best

viewed as a gestalt, and can be realized if all the core concepts as well as the peripheral

precepts work in unison (Lenka & Suar, p. 68).

     Goetsch and Davis' (2000) text covers a diversity of topics including global

competitiveness, QM and ethics, quality culture, customer satisfaction, communication and

others.

     Creech (1994) provided a background on TQM, its origins and how it affected

Japanese firms and how it improved their competitiveness. He emphasized the holistic

nature of TQM. He recognized the five pillars of TQM as

1. Product

2. Process

3. Leadership

4. Commitment, and in the center of the pillars is,

5. Organization

This later point, the centrality of the organization, is emphasized. "The organization is the framework on which the entire management system depends for efficient operations" (Creech, 1994, p. 11). Creech goes on to compare the differences in Japanese and American cultures and the profound impact that has on their respective QM programs. He states, "I don't agree that the Japanese culture has sweeping, perhaps insurmountable advantages over the American culture, as many portray it to have" (Creech, p. 42). Creech goes on to present a compelling argument for the organization of business units into small work teams to increase productivity and quality. He relayed the story of how a Boeing Aircraft plant in Texas organized production around small teams and, "As members told the story (of their transformation)… they exhibited *pride in their ownership* of the problem and their *empowerment* to find the solutions" (Creech, p. 99). Thereby indicating that given the right environment, American workers too can develop pride in workmanship.

Lagrosen and Lagrosen (2006) provided insight into quality management from several perspectives. They discussed three levels of quality management systems. The first level pertains to the tools and techniques employed by quality management practitioners. This is the shallowest level. The next level pertains to quality models and systems. The final level is the values and principles of quality management. These are the "deep-lying assumptions of the practices" (Lagrosen & Lagrosen, 2006, p. 85). For examples of tools

and techniques, the article mentioned flow-charting, Failure Mode Effects Analysis, and the seven quality tools. For quality models, the article mentioned the award model, which is discussed later, ISO 9000 and Six Sigma. The values that were mentioned were leadership commitment, customer and process orientation, and compassion.

Baglione and Zimmerer (2008) added a future dimension to the understanding of quality and its impact on business performance. They studied successful small-cap companies, those that may well be tomorrow's market leaders. Their study identified key characteristics for successful firms of the future. Not surprisingly, maintaining a quality-focus was among these characteristics. Other key characteristics were maintaining a workforce of high-quality, motivated personnel, with "unquestioned integrity and responsiveness to their every need", with superior products (Baglione & Zimmerer, p. 50). They also went on to identify characteristics that were less important for future firms. These characteristics were a reputation for innovation, firms that take greater risks than would other firms, and having a greater range of products.

Adding still further to the multi-dimensional aspect of quality, Conti (2005) discussed quality in relation to systems thinking. The nexus being that systems thinking is about relationships, and so is quality management. Specifically, quality and value apply to "relations between persons and objects or between persons" (Conti, p. 151). He goes on to state, "Since relations are the place where qualities are perceived and value is generated, on them quality management should primarily be focused" (Conti, p. 157). Conti also reiterated one recurring theme in current quality literature, that of the role of quality being to match customer expectations with their perceptions. The concept of matching a customer's expectations to their perceptions has been examined many times before.

The growth and develop of quality management, as well as its diversity, can be reflected in the pages of the Journal of the Production and Operations Management Society. Schroeder, Linderman, and Zhang (2005) wrote an article to compile the key current quality management models. They had difficulty in deciding on how to categorize articles because of the diversity of topics under the umbrella of quality management. They settled on using the seven categories of the MBNQA by which to explain the various quality models. The fact that the Journal's authors decided to use the seven MBNQA categories gives a validation as to the completeness of the NQA evaluation process.

Seth, Deshmukh, and Vrat (2005) discussed the many dimensions of service quality models available nowadays. The article reviewed 19 different models and discussed the characteristics of each. The article noted that prevalence of information technology (IT)-linked models because of the expanding application of IT to business. As this may seem to be many models to consider, the authors stated that the models could be placed into two categories. Models that were based on or similar to the gap model as prescribed by A. Parasuraman, also known as the SERVQUAL model, and all other types of models.

Martin (2007) discussed one of the key recurring themes in quality management; that of quality management's influence on organizational change. Martin subscribed to the use of the A-B-C framework of behavior change. First, an *Antecedent* event or action became known to a person or organization. This event of action then preceded a *Behavior* or action that was done with known *Consequences*. Martin went on to use the Prochaska Behavior Change Model (Prochaska, Prochaska, & Levesque, 2001). This model indicates five stages of behavior change:

1. Precontemplation

2. Contemplation

3. Preparation

4. Action, and

5.   Maintenance

Maiga and Jacobs (2005) focused their attention on the influence of management control systems on quality products. They used structural equation modeling as it "provides a method of dealing with multiple relationships simultaneously with statistical efficiency" (Maiga & Jacobs, p. 112). Three subcomponents of management control systems were used as variables; quality goals, quality feedback, and quality-related incentives. They found that "except for the impact of customer satisfaction on financial performance, the results provide support for the theoretical framework" (Maiga & Jacobs, p. 125).

The theoretical framework of quality management was extended by the work of Ruiz-Carrillo and Fernandez-Ortiz (2005). They sought to link the European Foundation for Quality Management (EFQM) model with the popular resource-based view (RBV) of management. In their paper, they first introduced the nine components of the item EFQM model. These are composed of two categories of *Enablers* and *Results*. The Enablers are Leadership, People, Policy and Strategy, Partnership and Resources and Processes. The Results are People Results, Customers Results, Society Results and Key Performance Results. The paper presented each of the nine components and qualitatively linked them with published RBV doctrine, item by item. The authors state "that the EFQM model uses the resource-based view as an implicit theoretical basis. All the criteria correspond to relevant resources and capabilities" (Ruiz-Carrillo & Fernandez-Ortiz, p. 50). This study provided insight into the linkage between the resource categories of a firm and enablers.

In another theoretical approach to quality management, Chiu and Lin (2004) sought to link service quality measurement with the Abraham Maslow's Theory of Needs. In this article, Chie and Lin examined needs in order to appreciate the critical importance of understanding the people component of quality management. They used Abraham Maslow's (Maslow, 1970) five categories of human need. These are; physiological needs, safety needs, belongingness needs, esteem needs and finally, self-actualization needs. Their study then "propose(d) a service quality scale from the theoretical approach based on the (Maslow's) theory of needs" (Maslow, 1970, p. 190). The authors identified service quality contents from these needs and called this model SQ-NEED. The association between Maslow's needs and the service quality components was done using the nominal group technique with a group of six specialists from the fields of marketing, operations management and organizational behavior. They used a survey to get data to test their hypothesis and ensure its validity. The responses back from 819 respondents substantiated their hypothesis of the linkage between the two systems.

Sila (2005) studied the issue of the setting or context in which a QM effort was undertaken. He used the TQM model and identified seven common practices in TQM. These practices are leadership, strategic planning, customer focus, information and analysis, human resource management, process management and supplier management. He examined five *contextual variables*: formal TQM implementation, ISO 9000 registration, country of origin, company size, and scope of operations. The author found "that the holistic implementation of the seven TQM practices contribute to improved performance similarly across subgroups of companies within each contextual variable (Sila, 2005, p.

207). This study examined contextual variables with respect to company size and industry type.

In order to understand the diversity of the components of quality, it helps to operationally define its tenets into value-creating actions. These value-creating actions are defined with a high-degree of precision in the form of various national and international quality competition models. Standing and Vokurka (2003) examined the five top quality competitions in the world:

1. The Malcolm Baldrige National Quality Award from the United States

2. The European Quality Award representing 16 European countries

3. The Canadian Quality Award

4. The Australian Quality Award, and

5. The Deming Prize from Japan

The importance of the group selected previously is that, according to the 1998 World Bank data, these participating countries represented 74% of the world Gross National Product. Consequently, the importance to the world economic framework cannot be overstated. The nature of their research was qualitative and compared the evaluative criteria from each of the quality competition models. They proposed a linkage between the *process* of implementing QM and the *content* of those activities that can influence a firm's performance and competitive advantage. Their propositions were substantiated, "propositions show(ed) how the award criteria support the argument for linking process and content to deliver strategic differentiation" (Standing & Vokurka, 2003, p. 945).

Whereas the previous studies focused on service applications, another application of quality management principles involves product development. Nilsson-Witell, Antoni,

and Dahlgaard (2005) examined three Swedish firms to determine the linkage of quality management processes with their product development practices. The three firms were from different industries; one firm made cleaning products, another firm made products for the aerospace industry and the last firm made industrial products. A qualitative case study research method was used. Interviews were conducted with 43 managers from the firms. The interviews were designed to ascertain: the degree of success in their product development efforts and the types of improvement programs used and quality principles practiced. The five principles of quality management identified by Dahlgaard, Kristensen, and Janji (1998) were used. These principles are

1. Management commitment

2. Focus on the customer and the employee

3. Focus on facts

4. Continuous improvement

5. Everyone's participation

The study then "provides evidence supporting the claim that the quality principles chosen for an improvement program may be vital for the success of quality initiatives" (Dahlgaard et al., p. 765).

Lagrosen and Lagrosen (2005) studied the tools of various quality models to determine their effectiveness. They used a qualitative survey they mailed to 500 Swedish quality professionals resulting in 265 usable surveys. There were several types of questions on the survey. The first section of the survey asked about the extent QM values permeated their company. "The highest response was customer orientation, followed by process orientation and participation by everybody" (Lagrosen & Lagrosen, 2005, p. 994). The next

section asked what kinds of QM models used by the company. The highest responses were ISO 9000, QS 9000, and the Swedish Quality Award model. The next set of questions dealt with the types of QM tools used by the firm. Flowcharts, FMEA and the seven quality tools, and SPC were the most frequently used tools. The last section of the survey asked about the impact of the firm's quality efforts. A correlation between these variables was done. "The strongest finding of the study is the statistical correlation between the values of quality management and the functioning of the quality management efforts of the companies" (Lagrosen & Lagrosen, 2005, p. 949).

Quality-oriented organizations require the application of specialized leadership characteristics. This premise was the focus of a study by (Lakshman, 2006) who stated that although much research has been done on leadership and management, and much research on quality management, there is insufficient knowledge of leadership in a quality-focused organization (Yukl, 2002). The study went on to identify 15 propositions about the relationship of various leadership characteristics and the firm's execution of quality programs or the firm or unit's performance. The propositions were based on the "three core principles of total quality management, namely, customer focus, teamwork and participation, and continuous improvement" (Dean & Bowen, 1994, p. 94). The outcome of the article was "the development of a theory of leadership for quality" (Lakshman, 2006, p. 57).

In calculating any performance gain through a quality management initiative, the cost of the new methodologies will affect the profitability of the firm. The cost of quality, therefore, must be understood. Stanwick and Stanwick (2003) examined this increasingly

important concept during crisis periods. They reiterated the component of the cost of quality as

1. Prevention costs including quality planning and training

2. Appraisal costs including inspections and product testing

3. Internal failure costs including scrape an rework

4. External failure cost including warranty cost and liability lawsuits

The authors went on to state that there are three component attributes to a quality management system. These attributes are technical, behavioral and cultural. The technical aspects are commonly accepted. The behavioral attributes include

1. "Focus on customer requirements;

2. Improved attitudes and aspirations about quality;

3. Better management through visibility; and

4. Budget padding" (Stanwick & Stanwick, 2003, p. 12).

The cultural attributes "Cultural attributes help develop a culture in the company that puts quality first in the minds of employees. These include quality as a way of life, and quality as an ethical value." (Stanwick & Stanwick, 2003, p. 12)

With respect to specific actions related to quality to emphasize during crisis periods, the following items are given (Stanwick & Stanwick, 2003, p. 13):

1. Training – more on-line training, assist in training events

2. Prevention – rigorously test programs to expose systemic weaknesses

3. Communication – with government authorities

4. Improvement – focus on improving processes

5. Career development – these activities foster networking and communication with others, and

6. Publications – pass along factual information that may help other on practices

LaMarsh (2005) discussed quality management's role in driving change. Specifically, the article described how a firm started using the Six Sigma model to improve its products and services and to help structure its corporate change. "Change is how organizations stay competitive and grow, and Six Sigma is how they make change happen while maintaining a clear focus on quality" (LaMarsh, p. 37).

First in the article, three different change roles were identified. These roles are sponsors, change agents, and targets. Sponsors champion improvement initiatives and are usually senior employees. Change agents are the improvement team leaders and work with the employees on actually making change happen. Targets of change are the people affected by the change. They could be either supporters or detractors of change. The detractors of change can present a formidable obstacle. In fact, "In too many organizations, the experience with change in the past teaches the targets that all changes are to be resisted" (LaMarsh, 2005, p. 38).

To mitigate resistance to change, LaMarsh (2005) suggested three strategies for change:

1. Develop a communications plan to the affected groups describing the need for change and the and how it will be done. This communications plan should come from senior management and not the change agent.

2. Develop a learning plan to ensure that all skills necessary will be taught to the workforce as needed.

3. Develop a reward plan to ensure the workforce sees a personal reason to embrace the change.

Review of Shareholder Theory and Quality-driven Performance Literature

Shareholder Theory Literature Review

The following section presents a review of shareholder theory. The purpose of this section is to understand the value creation process from the shareholder's perspective. The understanding of shareholder theory is essential, as shareholder value creation resulting from quality improvements is the central research hypothesis. However, as is seen with the various studies that follow, what constitutes shareholder value is open to discussion and interpretation.

First is an examination of value creation with a strategic view. Haksever, Chaganti, and Cook (2004) presented this view in their article. They start with the question, "For whom the value is created." They answer this question using a three dimensional approach. The dimensions are financial, nonfinancial, and time. Many articles in the past have discussed the previous question and have settled on one of two sides of the argument; profits are only meant for shareholders of the firm, while others believe that the company should benefit a broader group of stakeholders. This article bypasses the previous argument and seeks to understand "how strategic and operational decisions of managers may influence different stakeholders in different ways" (Haksever et al., p. 292). Firstly, the three definitions are differentiated. The definition of financial value is obvious and needs no further elaboration. The definition of nonfinancial value is "those that do not have a short-term financial impact" (Haksever et al., p. 295), to the firm. Time value is further sub-divided into; speed of access to benefits, time savings, and the continued benefits over

time. The article also discusses the concept of *destroying value.* The antithesis of value

creation can come about in several ways. Destroying financial value pertains to "losing

investment and future stream of income" (Haksever et al., p. 296). Destroying nonfinancial

value can involve added stress of uncertainties and bad publicity. Destroying time involves

jeopardizing long-term viability for short-term objectives. In summary, the author

concluded that value could be created and destroyed in the following ways:

One can identify five possible scenarios for the impact of managerial decisions:

1. They create value for one or more stakeholder groups with no adverse effect on

any other group;

2. They create value for one or more, but destroy value for one or more of the

others;

3. They destroy value for one or more stakeholder groups with no positive effects

on the others;

4. They destroy value for all groups; and

5. They create value for all. (Haksever et al., 2004, p. 303)

One of the earliest works on shareholder valuation can be traced to an article by

Fama (1965/1995). This is an important article in that it examined the mechanism of how

prices of stocks are determined. To begin with, there are fundamentally two methods to

predict stock prices. "These are (1) "chartist" or "technical" theories and (2) the theory of

fundamental or intrinsic value analysis" (Fama, p. 75). The chartist technique looks for

patterns of stock pricing from the past for indicators of future performance. Therefore,

there is an essential linkage between past performance patterns and the likelihood of those

patterns repeating themselves. The intrinsic value approach looks for the equilibrium price

of the stock that is dependent of the "earning potential of the security" (Fama, p. 75). This approach looks at the corporation and the context of the corporation, in total, to determine the most likely profit-earning capability of the firm. Random walks, on the other hand, "strays for the premise that the major security exchanges are good examples of 'efficient' markets" (Fama, p. 76). Further, in an efficient market the actual price of a security is a "good estimate of its intrinsic value" and "actual prices will wander randomly about their intrinsic values (Fama, p. 76). According to random walks, history cannot reliably predict future stock prices. The price level is "no more predictable than the path of a series of cumulated random numbers (Fama, p. 76). The random walks concept, along with the empirical evidence that resulted from it, indicates that stock prices do not always accurately reflect the earnings potential of a firm. Therefore, stock prices should not be overly relied upon to determine a firm's performance. This dissertation supports this premise, that the stock price is not an inherently valid indication of the performance of a firm.

Malkiel (2003) continued Fama's (1965/1995) discussion on random walks theory. He is emphatic in asserting that "a blindfolded chimpanzee throwing darts at the Wall Street Journal could select a portfolio that would do as well as the experts" (Malkiel, 2003, p. 60). Therefore, suggesting the recurring non-rationality of stock prices in relation to the value of the firm. In order to understand random walks, it is imperative to understand how the concept of "efficient" is used in this context. Efficient "financial markets that markets do not allow investors to earn above-average returns without accepting above-average risks" (Malkiel, 2003, p. 60). He went on to discuss the fickle nature of stock market prices and "found positive stock price reactions during 1998 and 1999 on corporate name changes when "dot com" was added to the corporate title" (Malkiel, 2003, p. 76).

Sundaram and Inkpen (2004) revisited the fundamental question of shareholder and stakeholder value and how they interrelate. Although stakeholder theory holders that satisfying stakeholders improves performance of the firm, "the purported relationship is largely unsupported by empirical results" (Sundaram & Inkpen, p. 353). The authors put forth the following five parts to argue for dominance of shareholder value over stakeholder value:

1. The goal of maximizing shareholder value is pro-stakeholder.

2. Maximizing shareholder value creates the appropriate incentives for managers to assume entrepreneurial risks.

3. Having more than one objective function will make governing difficult, if not impossible.

4. It is easier to make shareholders out of stakeholders than vice versa.

5. In the event of a breach of contract or trust, stakeholders, compared with shareholders, have protection (or can seek remedies) through contracts and the legal system (Sundaram & Inkpen, 2004, p. 353).

The authors also realize that the previous approach is not without its own limitations. First of all the "distributional implication" (Sundaram & Inkpen, 2004, p. 356) arises. That is, it is possible to increase shareholder value simply by reallocating resources from a stakeholder to a commodity of value for the shareholders. Another difficulty arises with "performance-contingent payments" (Sundaram & Inkpen, p. 358). These occur when considering payouts to shareholders. Certain categories of shareholders make payouts a simple matter. Others though, present complexity, such as nonconvertible debt holders. What would be the fair amount for these shareholders compared to other shareholders?

The competition between shareholders and stakeholders is examined by Hillman and Keim (2001). They found that although there is evidence to indicate that shareholder value appreciates because of better stakeholder management, they found the social issue participation is negatively associated with shareholder value. The authors devised four hypotheses to test. They use Market Value-added (MVA) for testing purposes. MVA was chosen because it is a measure that captures the relative success of firms in maximizing shareholder value through efficient allocation and management of scare resources" (Hillman & Keim, p. 129). For their calculations, MVA = market value – capital, "where market value refers to the equity market valuation of the company and capital refers to the debt and equity invested in the company" (Hillman & Keim, p. 129). According to Hillman and Keim, MVA is seen as the best single measure of the long-term company performance among the many metrics available, because it better reflected the total picture. Accounting measures, "such as Return on Assets and Return on Equity, are less useful… because they are not successful in capturing the long-term value of the company or value created for shareholders" (Hillman & Keim, p. 129). The limitations on the reliance on ROA and ROE is relevant to this dissertation in that, although they are cornerstone metrics for financial analysis, they are insufficient to determine shareholder valuation. Stakeholder management, on the other hand, was measure by several social issue participation (SIP) indicators as community relations, employee relations, environmental performance, treatment of minorities and women, and so forth. For analysis, Hillman and Keim used multiple regression primarily to test their hypotheses testing 308 firms. As mentioned earlier, there was a statistically significant relationship when testing the three hypotheses that contented a correlation between performance and shareholders management.

Nevertheless, there no evidence when testing for the SIP indicators. The authors went on to test for reverse order causality between financial performance and SIP. Again, they found no evidence of this.

A comparative study of shareholder value creation was done by Keef and Roush (2002). This article compared three types of methods for measuring shareholder return in countries on both sides of the Atlantic. The first method is Market value added (MVA), it is "the market value of a firm minus its economic book value" (Keef & Roush, p. 1). Nevertheless, MVA faces a serious problem in that it does not differentiate between money earned recently and money that was earned in the past. MVA also suffers from "the size effect" which means that the larger the firm, the larger the apparent increase in MVA. Of course, this difficulty may be overcome with the use of some standardization procedure, but it still must be considered. Total shareholder return (TSR) is the next method to identify shareholder valuation. It is "just the simple periodic rate of return in share price with necessary adjustment for cash flows to and from the shareholder" (Keef & Roush, p. 2). A key feature of TSR is that is takes dividends into account giving a truer picture of the total value realized by the shareholder. Nevertheless, it does not consider risk-adjusted opportunity costs. The final method of shareholder valuation discussed is the abnormal return (AR). The AR is "The difference between the observed total shareholder return and the opportunity cost is a true measure of the wealth created for the shareholders of the company" (Keef & Roush, p. 4). This calculation also brings into the equation the use of the Beta value for considering risk and then compares that to the change in the market value of a firm over the period of observation. It is therefore, according to the author, a more comprehensive metric.

Ramezani, Soenen, and Jung (2002) used multivariate analysis to examine

alternative to traditional metrics such as return on equity and return on investment. They

focused on the assumed relationship between growth and shareholder valuation, that is, the

relationship between growth and performance. Their survey followed company financial

performance of 2156 US companies from 1990 to 2000. To test the relationship they

compared sales growth with earnings growth. Their "empirical results indicate that

maximizing growth does not maximize corporate profitability or shareholder value"

(Ramezani et al., p. 66). Therefore suggesting that growth alone is not a valid indicator of

firm performance.

Schuster and Jameson (2003) compared four value approaches: Added Value,

Economic Value Added, Economic Profit, and Cash Value Added. They also discussed the

forward-looking and backward-looking aspect to these approaches. The former metrics are

involved at looking at financial performance from the past while the later seeks to identify

a company's current valuation.

Some key points on the comparison:

1. The Added Value technique is limited to measuring historic financial
   performance.

2. The EVA "requires the most intensive conversions so is better tailored to
   company-specific situations, that it can be used for both backward-looking and
   forward-looking assessment, and that it estimates an appropriate cost of capital,
   which is advantageous." (Schuster & Jameson, 2003, p. 51)

3. Cash Value Added "mainly targets the investment and the resulting cash flow
   using cash flow return on investment as the key measure rather than

concentrating on the profit measure. Gross cash flow cannot be regarded as comparable to the profit measures in the other approaches." (Schuster & Jameson, p. 48)

4. The Economic Profit has a strong relationship to the discounted cash flow method.

Latham (2008) studied the role of collaboration between researchers and practitioners in the performance excellence research. The article centered on the results of a conference called the 2006 Monfort Summit, hosted at the Monfort Institute, University of Northern Colorado. The conference invited a diverse group of practitioners and academics to discuss performance excellence. It focused on recipients of the MBNQA and the conference set out to address two fundamental research questions: how to sustain the performance excellence recipients have already achieved, and how to reach even higher levels of performance. For each of these questions, it went on to ask what the internal challenges were and what the external challenges to attaining these goals were. From these high-level questions, they went on to develop 112 specific management questions in order to develop actual research questions. The management questions "were organized into 11 categories: strategy, stakeholders, processes, integration, people, knowledge management, metrics, innovation, MBNQA criteria, leadership, and culture" (Latham, p. 15). Of particular interest and relevance to this study is Latham's identification of stakeholder turnover in relation to performance excellence. He stated that the Monfort group identified three specific questions:

1. Why stakeholders do not understand the benefits of performance excellence and the MBNQA process?

2. What are the most effective approaches to educate continuously stakeholders about the benefits of pursuing high performance using the MBNQA?

3. How can organizations describe the benefits and values of performance excellence and the MBNQA process to stakeholders (Latham, 2008, p. 16)?

Latham (2008) concluded, "maintaining high performance cannot be taken for granted. Rather, it must be continuously nurtured and renewed at all levels of the organization" (p. 24).

Mele and Colurcio (2006) used the qualitative case study method to examine 21 firms for their level of adoption of TQM methods in their firms. This study is of relevance in that it raises the issue of "value" and the many dimensions of value. It is possible "to determine 'customer value', a 'firm value', a 'stakeholder' value." The authors also noted, "In TQM literature we note a lack of studies analyzing the contribution of quality management to value creation and diffusion in the perspective of stakeholders" (Mele & Colurcio, p. 467). They also found that "TQM produces two main influences: the first in enterprise culture, the second in management of a firm. The innovative pushes both in the cultural and in the management directions involve the entire business system and its specific components" (p. 649). Six primary TQM principles were studied:

1. Customer orientation

2. Human resources

3. Management by process

4. Management by fact

5. Improvement

6. Learning

Of these principles, the authors found that the customer orientation and improvement principles were implemented more heavily than the other principles. They also stated that TQM also produced a raising path of innovation, excellent and value for firms. Therefore, TQM acts as an enabler for shareholder value through performance excellence.

Tuck (2005) is one of the latest authors to examine the relationship between quality awards and stock market reaction. He compared the stock prices of winners of the European Quality Award before and after their winning of the award using event study method. He used the Corrado and Schatzberg (1990) rank test for hypothesis testing. It was found "that the null hypothesis of no abnormal return cannot be rejected and therefore, it can be concluded that there is no information content in the announcement of winners of the EQA" (Tuck, p. 981). They did suggest

> further research since more research should be conducted to reveal the possible
> linkages between financial benefits and the implementation of the quality
> improvement programmes and education programmes conducted among the
> business community to increase the awareness of the potential benefits quality
> improvement programmes can bring to the company, which will eventually lead
> to a higher stock performance. (Tuck, 2005, p. 984)

Jensen (2002) discusses the issue of competition between stakeholder theory and the shareholder maximization proposition. A key dilemma that Jensen brings out is, "stakeholder theory provides no criteria for what are better or what is worse, it leaves boards of directors and executives in firms with no principled criterion for problem solving" (Jensen, p. 242). Without this "principled criterion", special interest groups

representing the stakeholders will maneuver to gain power and influence over the other parties. The importance of this article is that Jensen provides a way out of this dilemma called enlightened value maximization and enlightened stakeholder theory. Simply put, enlightened value maximization realizes that "in practice is that if we tell all participants in an organization that its sole purpose is to maximize value, we would not get maximum value for the organization" (Jensen, p. 245). The enlightened stakeholder theory is an elaboration of current stakeholder theory. It states that "that the objective function of the firm is to maximize total long-term firm market value. In short, changes in total long term market value of the firm are the scorecard by which success is measured" (Jensen, p. 246). In conclusion, Jensen points out that, having stated out the criticality of market value, the "balanced scorecard" approach, with its numerous metrics, may serve to un-focus management from its central chore of making money for the investors.

Before leaving the topic of shareholder value creation, it is necessary to examine a contrarian view of the assumed paramount importance of shareholder value. In Wagner (2000), the comments of management consultant Allan A. Kennedy. He believes that the end of shareholder value, as we know it, is at hand. The reason is that shareholder value too narrowly defines the universe of players in a firm and the lives that it touches. Firms must broaden their perspectives else, businesses will continue to have increasingly large difficulties in dealing with the disenfranchised people of the universe of stakeholders. As evidence of the 'wrongness' of the current situation, Kennedy sites the extraordinary annual salaries that are given to some CEOs. He believes that the reason for this situation is that generally, the board of directors for most major firms is populated by the CEOs of other major firms. Consequently, you have a situation where one CEO can approve an

extraordinary large compensation package for the CEO of a company, was a reasonable expectation that the favor will be returned. This is assuming, of course, that the CEO's are on each other's boards of directors. Kennedy feels that the real purpose of a company is to share wealth. For example, instead of downsizing a company to save short-term immediate costs, firms can instead grow their intellectual capital better. They can do this by emphasizing research and development and by retaining the highly skilled long-term employees who have an abundance of company and customers knowledge. Kennedy set three key actions to do this:

1. Define the real purpose of the company and how it realizes its goals

2. Reinvigorate the company's future prospect by more spending on R&D and better aligning new products with new customers and markets

3. Reconnect the firm with its local communities. In recent times, many firms have developed poor relations with their communities by negatively affecting actions in the community.

Continuing with the discussion on the alternative viewpoint of shareholder value, Goldenberg (2000) felt that shareholder value was detrimental to a firm. This is an important contrarian concept to reflect on, as the basis of this dissertation is the utility of shareholder value in its many forms, some researchers disagree. Goldberg points to other analyses that provide limitations in order to refute this claim:

1. Affected by perfect competition. Goldberg states that the shareholder value proponents subscribe to the homogeneity doctrine and this "bars meaningful difference between each industry's goods, producers and customers" (Goldenberg, 2000, p. 30).

2. Shareholder value proponents assert that profits will drive the price of a firm's stock. This assumes perfect knowledge of the market by all and immediate action. However, a firm's economic value is more than a simple multiplication of the number of shares issued by the stock price thereby discrediting a key shareholder value premise.

3. Corporations commonly disclose "'adjusted" financial data so as not to tip off the competition of key financial strategies that it may be doing. This action would consequently preclude the use of perfect knowledge assumption to drive a rationale stock price in the market. Closely aligned to this phenomenon is the realization that stock prices are driven often by external, unrelated events as the case of "The Asian Flu" in the US stock market a decade ago.

4. Another serious limitation in the use of shareholder value is that many stocks are bought and sold repeatedly, as is done by institutional trading and sell offs. This fact makes the ownership of the firm amorphous. Therefore, you often have a situation where a firm has distinct and opposing shareholders groups. One group 'in it for the long run' while the other group aims to sell as soon as it reaches its target value, no matter how it gets there. Even to the long-term detriment of the firm.

5. Interestingly, court case over the last two decades state that a firm is under no obligation to maximize stock prices. As Goldenberg says, "Why no duty to maximize shareholder value? It is infeasible to do in practice" (p. 30).

Further limitations of shareholder value were examined by Koslowski (2000). In his article, Koslowski argues that although increasing shareholder value is certainly the

goal of any company, its full benefit is not understood. He sees that increasing

shareholder value is of means for controlling the firm. In other words, "profit and

shareholder value… are not the final purpose of the firm, but an instrumental end"

(Koslowski, p. 138). Koslowski points out only one kind of firm in which the sole

responsibility is to create shareholder value. These are financial firms such as investment

banks, life insurance companies, and investment funds. The reason these types of firms

are unique, according to Koslowski, are that "shareholder value is not only the residual

measuring the performance of the firm but the product for which theses firms have come

into existence" (Koslowski, p. 140). However, Koslowski feels there has been a

corruption of the shareholder value aspect in broadening the concept from financial

institutions to industrial firms. Koslowski states, the "spillover from the financial firms to

the industrial firms has caused an inversion of the shareholder value principle from being

the control principle to being the purpose of the firm. This phenomenon has another

serious implication that is relevant to this dissertation. That is, when shareholder value is

limited in its definition, then stock appreciation takes precedence over production. This

lack of attention to production can be detrimental to the firm's long-term profit

generating capability. In fact, this serves to add the element of speculation into the value

of a firms stock, thereby precluding rationale marker pricing mechanisms. As stated,

"Since the price of the shares in the stock market does not just reflect the real value of the

firm's productivity and performance but is also subject to mere speculation, the

management has an interest in becoming involved in speculative manipulations of the

value of the firm's shares…" (Koslowski, p. 141). This assertion is an important

consideration in this dissertation.

A final point of concern that Koslowski (2000) has concerns with is the ethics involved in the shareholder valuation process. He acknowledges that although shareholder value maximization is widely accepted, "Not every pursuit and formation of profit is accepted by the law as well as ethics" (Koslowski, p. 145). This situation then creates a dilemma of the sometimes-competing entities of individual ethics and social ethics. In this context, Koslowski points to a divergence in Protestant and Catholic doctrine. The Protestants believing, "social coordination is that since the human is so much distorted by original sin he or he cannot intend the common good as." That this must be left to "the invisible hand using the individual's inevitably selfish intentions and needs for its good" (Koslowski, p. 146).

The efficient market hypothesis (EMH) has for over 30 years has provided a rationale for stock prices. It asserts that the market is a rational environment and that stock prices accurately reflect the true value of the company's shares. Consequently, there is no profit to be made in looking for "undervalued" stock, which are, in fact, properly valued. Of course, this is assuming similar levels of risk ("Efficient Market Hypothesis," 2008).

Malkiel (2005) examined the arguments both supporting and contradicting EMH. Malkiel presented some convincing comparisons between the long-term performance of the S&P 500 and professionally managed equity funds. During one 20-year period ending in 2003, for instance, the S&P 500 averaged 12.78% while the average of a group of equity funds averaged only 10.54% (Malkiel, 2005, p. 3). On the face, this data gives some strong evidence of the merit of EMH. Another interesting situation is the inconsistency of the professionally managed funds. Malkiel pointed out the radical

differences in returns for funds from two different four year periods, 1996 – 1999, and 2000 – 2003. This situation is not confined to American firms. In fact, " Over a 10-year period ending December 31, 2002, over 80% of the actively managed funds underperformed the index" (Malkiel, 2005, p. 6).

Nagorniak (2005) performed a qualitative assessment on the efficiency of the pricing of stocks in the market. The article did not support EMH and its assertion that stock prices truly reflect company performance. He believes that proper analytical techniques can find undervalued stocks where above-normal returns can be made. Nagorniak states that this can be done by combining "public data with 'private' data (proprietary ways of looking at the data and specialized sources of data" (p. 44). This point is crucial for this study. That stock prices do not necessarily reflect the true state of a company's performance and therefore, other measures should be used.

Cheah (2005) used "event study methodology… to measure the stock price effects of the announcement of quality awards" (p. 685), specifically, of firms winning the Malaysian Prime Ministers Quality Award. The finding was that there no statistically significant impact on market performance following the announcement. However, some of the difficulty in assessing the meaning of this non-significant performance may lie in the problem of "thin trading", that is, where there is non-synchronous trading of the stock. This type of trading could lead to a downward bias in estimating the stocks beta value. This bias could contribute to an inaccurate or distorted understanding of the true value of the stock in relation to firm performance, which is a contention of this study. One further finding in the study was that "service-sector companies are more prone to outperform the market index as compared to the production-sector companies" (p. 690).

Cheah (2007) continued his examination of the stock performance of MBNQA winners using long memory models commonly used in financial economics. He too acknowledges the dilemma of using stock prices to ascertain company performance resulting from winning an NQA. The dilemma assumes two components. First that investors "believe that quality leads to business excellence in terms of financial", and second, that investors would "acknowledge the benefits that these quality awards bring in terms of sustained significant abnormal returns" (p. 210). The study examined the stock performance of eight recipient companies between 1988 and 1998 and found that none of the firms (exhibit(ed) long memory at 150 and 200 trading days after winning the MBNQA" (p. 211).

Quality-driven Performance Literature

One of the earliest studies conducted to assess the impact of quality management on company performance is a 1991 U.S. General Accounting Office report. This study was conducted at the request of the Honorable Donald Ritter or the U.S. House of Representatives (GAO, 1991, p. 1). The purpose of the study was to assess the impact on company performance of firms that have adapted TQM methods. Of key importance behind the study was the fact that, "In recent years, a number of U.S. companies have found that they could not accomplish world-class quality by using traditional approaches to managing product and service quality" (GAO, p. 2). The TQM approaches, "also reflected the criteria used in the Malcolm Baldrige National Quality Award" (GAO, p. 8). The target of investigation was the 22 companies or divisions of companies that had received Baldrige site visits during 1988 and 1989. The GAO study found improved operating results in four areas: better employee relations, improved operating procedures,

greater customer satisfaction, and increase financial performance. The diversity of these dimensions reflects a holistic view of quality and performance. That is, there are many dimensions to performance improvement and they must be considered in context to accurately reflect this multidimensionality. In the area of employee satisfaction, the study found improvements with respect to job satisfaction, attitudes and behavior. These factors were measured in employee satisfaction, attendance, turnover, safety and health, and number of quality improvement suggestions generated. The results of 52 observations of these indicators were 39 increased, nine declined and four were unchanged. The GAO study then examined improved operating procedures. The measures used were reliability, timeliness of delivery, order-processing time, production errors, product lead-time, inventory turnover, quality costs, and cost savings. From 20 of the companies, 65 observations were collected. The results were that 59 showed improvement, two became worse than before and four indicated no change. Customer satisfaction was measured by using customer satisfaction surveys of the perception of product or service. Seventeen companies provided 30 observations. Of these, 21 had improved, three became worse and six were unchanged.

The final part of the GAO report dealt with financial performance of the firms. The study used ratio analysis of three factors: sales per employee, return on assets, and return on sales. Fifteen companies provided financial information for a total of 40 observations. The findings were that 34 of the 40 observations improved while the other six declined. Furthermore, market share had increase for nine of 11 reporting companies, while sales per employee increase in all 12 reporting companies.

So in summary, the report concluded:

1.   That current quality practices in American companies were not keeping them globally competitive

2.   That TQM methods offered a structured method to increase quality of products and services

3.   That the Malcolm Baldrige NQA evaluation criteria and TQM shared many of the same methods

4.   That firms benefited in four areas: better employee relations, improved operating procedures, greater customer satisfaction, and increased financial performance

Companies that adopted quality management practices experienced an overall improvement in corporate performance. In nearly all cases, companies that used total quality management practices achieved better employee relations, higher productivity, greater customer satisfaction, increased market share, and improved profitability (GAO, 1991, p. 2).

What follows are three articles from Hendricks and Singhal (1996, 1997) and Singhal and Hendricks (2001). These authors explored several aspects of quality improvement initiatives and firm performance. In all of the studies that follow, the authors examined firms that won some kind of quality award associated with TQM. Included in their study were winners of the MBNQA and other quality awards. Noting from the previous body of research that the generally accepted components of TQM systems are generally aligned with the MBNQA evaluative criteria. Consequently,

examining firms using TQM can reasonably be used as a proxy for firms using MBNQA practices.

In 1996, Hendricks and Singhal first looked at "abnormal change in the stock prices of a sample of firms on the date when information about winning a quality award was publically announced" (p. 415), specifically, the stock price was studied from three years before the winning of a quality award. They also studied whether the risks of the firm changed after the event. Another factor studied was the size of the firm. The authors hypothesized that the larger the firm, the less the change in the stock price would be since larger firms would generally have been more visible to investors before the competition in the first place. Another factor examine was the source of the quality award. That is, not all quality awards bestow the same amount of prestige as other quality awards. For testing the stock prices, they calculated the cumulative abnormal stock return prices from three years before the award until one year after winning the award. They also categorized the firms into small and large firms. These data "are suggestive of a scenario where large firms may be embarking on quality improvement programs because of their poor stock price performance" (Hendricks & Singhal, 1996, p. 434). In summary, their finding was that, "Overall the evidence indicates that the stock market reacts positively to winning quality award announcements" (Hendricks & Singhal, 1996, p. 434).

Hendricks and Singhal (1997) again looked at the impact of winning quality awards on company performance, taking a different methodological approach than in the previous example. Their paper started with a discussion of the numerous studies that showed no clear evidence that participating in a quality program either helped the firm internally or helped in the financial marketplace. Mentioned also was the U.S. General

Accounting Office (GAO) study in 1991 of the impact of TQM on financial performance. The GAO used market share, sales per employee, return on sales and return on assets to measure operating results, which this dissertation also focuses on and not on the performance of the stock price. The GAO had results that were favorable to TQM efforts and their impact on company performance. Next mentioned was a 1993 study by the accounting firm Deloitte and Touche. In that study was favorable for cost savings identified, limitations were noted:

> A common limitation of the… studies is that they do not test for the statistical significance of the improvements in performance. Additional weaknesses include, the survey nature of the data and no attempt to control for potential industry- and economy-wide influences. (Hendricks & Singhal, 1997, p. 1260)

The first hypothesis they tested was if implementing an effective TQM program would improve profitability. Profitability was measured by operating income before depreciation. The second hypothesis tested was that implementing an effective TQM program would increase revenues. Revenues were measured by net sales. The final hypothesis tested was that implementing a TQM program would reduce costs. Costs were measured by the sum of CGS and G&A expenses divided by annual sales. The study use data from 463 firms which were found by scanning on-line databases with the key terms "quality" and "award" during the time period. The firms had to have six years of data available before the winning of the award and one year after. This dissertation differed in that only the preceding 3 years were targeted as three years after the award. For data analysis, the Hendricks and Singhal (1997) identify control firms with which to compare the quality award-winning firms. These control firms were to be of the same SIC code at

least at the two-digit level with comparable sales. These would then be aligned into matched pairs with the award-winning firms for analysis.

In summary, Hendricks and Singhal's (1997) study "provide(s) strong evidence that firms that have won quality awards outperform a control sample on operating income-based measures" (p. 1271). The increase for the operating income for the test group was 48% higher than the increase for the operating income for the control group of companies. This point is particularly relevant for this dissertation in that operating income and the associated metrics are a truer reflection of the impact of a quality improvement initiative than a simple reliance on the stock price. Hendricks and Singhal (1997) also suggest that an area for further research is to consider the characteristics of the firms involved in quality initiatives as these management characteristics may influence the value of quality initiatives.

The last study by Singhal and Hendricks to be reviewed is their 2001 study in which the authors sought to examine the long-run implications of adapting TQM methods. Singhal and Hendricks used the stock price as a comparison metric between firms that did or did not win some kind of quality award during the period understudy. They picked firms to study that data was available both 4 years before and 5 years after the winning of a quality award. As with Hendricks and Singhal's (1996, 1997) previous studies, they sought out comparable firms to compare performance. Moreover, "to further control for any potential bias in the selection of control firm, three different control groups are considered: (1) an industry-matched group, (2) an industry-size-matched group, and (3) and industry-size-BM (book-to-market)-matched group" (Singhal & Hendricks, 2001, p. 363).

For determining abnormal market returns for the award-winning firms, Singhal and Hendricks (2001) choose three methods: "(1) buy-and-hold returns (BHARs), cumulative abnormal returns (CARs), and (3) mean monthly abnormal returns (MMARs)" (p. 362). The reason that they choose three methods is because there "is considerable debate in the literature about the correct methods and benchmarks for examining long-term results" (Singhal & Hendricks, 2001, p. 362).

The summary of the study was that "During the implementation period we do not find any significant difference in the stock price performance of effective TQM implementers and the various groups of matched control firms. During the post-implementation period we find that the sample of effective TQM implementers significantly outperforms the various matched control groups" (Singhal & Hendricks, 2001, p. 368).

The focus of the study again, was on the long-term results. The long-term aspect of the question of the value of quality initiatives is important. The long-term aspect is important because the market may not be an efficient interpreter of quality improvement initiatives. Singhal and Hendricks (2001) posited, "Our results indicate that the market underestimates the efficiency gains from TQM and under reacts to the information conveyed by winning quality awards" (p. 367). This is a key point and a position that taken in this dissertation. That is, that the results of a firm's stock price is not a valid indicator of the performance of a firm and as such, measures that are more direct are needed.

Sila and Ebrahimpour (2005) studied the impact of TQM on company performance. This reference was used to determine the approach taken with respect to methodology and

results. A 133-question survey measuring 27 indicators was sent to 1500 manufacturing companies in the U.S.; 220 usable surveys resulted. Structured equation modeling was used for data analysis. The "results show that especially leadership and information and analysis play a significant role in shaping the quality focus of companies" (Sila & Ebrahimpour, p. 1137). Also shown is that "TQM factors are holistic in the synergies must be created among them to achieve favorable business results" (Sila & Ebrahimpour, p. 1137). One counter-intuitive finding of the study was that "customer focus has no direct or indirect effects on business results" (Sila & Ebrahimpour, p. 1138).

Continuing on the theme of quality improvements and firm value, James P. Wilson, Mary Ann Walsh, and Kim LaScola Needy (2003) specifically addressed the impact of ISO 9000 and Baldrige Award winning on the performance of manufacturing firms. The method used to test the ISO 9000 benefits was to compile a list of ISO 9000 certified firms in eight categories according to annual sales. The authors then compared the recurring and non-recurring costs and benefits looking for a statistically significant difference in the costs and benefits. Although they found recurring benefits to be gained, large non-recurring costs necessitated prudent judgment prior to undertaking ISO 9000 certification. The method used to test the benefits of the MBNQA was to compare the stock price of the winning companies with the S&P 500 Index, an often-used approach. The results were that "the 'Baldrige Index' for the manufacturing companies outperformed the S&P 500 be a ratio of 2 to 1…" (Wilson et al., p. 8). One other particularly interesting observation was that "developing a well-established quality program that leads to winning the MBNQA takes a lot of time in comparison to the one to two years it takes to become ISO certified" (Wilson et al., p. 8). This is an important concept with respect to the cost of quality for a firm. That

is, spending too much on implementing a quality improvement program can actually be detrimental to company profits, at least in the short term.

Morris (2006) also studied the effect on firm performance of firms that became ISO 9000 certified. He studied firms in the electronics industry using variables that related to firm value including; amount of inventory, net property, plant and equipment (PP&E) , of age of PP&E and current assets. The results of his regressions used failed to support the hypothesis of increased firm financial performance (Morris, p. 232). Morris indicated though that this may have been attributed to an erroneous assertion of improved performance to begin with. He also stated the perhaps the reason for getting ISO 9000 certified has less to do with increasing financial performance than the firm having "aspirations for international sales, competitive pressures, or because of major customer requirements" (Morris, p. 233).

Lee and Hwan (2005) examined whether there were economic gains from improving service quality in the Taiwanese banking industry. The authors felt that financial ratios were not appropriate to measure economic benefits. They used qualitative surveys based on the SERVPERF model to rate the customer's perceptions. The research "employs a linear structural model to analyze he causal relationships among service quality, customer satisfaction, and profitability…" (Lee & Hwan, p. 643). This research was based on 145 usable surveys from customers and 124 from managers. The findings indicated, "service quality significantly influences customer satisfaction and customer satisfaction has directly influences purchase intentions but, customer satisfaction does not significantly influence service quality" (Lee & Hwan, p. 646).

As with any business undertaking, there are always risks and challenges associated with the action, including quality improvement initiatives. Jacob, Muda, and Tang (2004) pointed this out for the MBNQA process. They cited three major problems associated with the business decision of committing to NQA competition. The problems are:

1. The preparation process for MBNQA is expensive. Some critics suggest that the effect of this expense is that "the award can be bought" (Jacob et al., p. 898).

2. Winning the award is not singular guarantee that a firm is providing quality products and services. The authors point to the experience of Cadillac which even after winning the award, still did not receive high quality ratings by other sources such as Consumer Reports magazine and J.D. Powers.

3. Critics have charged that the winning of the MBNQA is also no guarantee of a firm's ability to compete or be more profitable.

Of key importance to this dissertation is the assertion by the authors that many previous studies on company performance of NQA winning companies failed to control for extraneous factors. This fact could raise serious questions about any alleged linkage between winning the NQA and subsequent stock performance. The study methodology consisted of making a matching pair comparison between an NQA winning company and a comparable company which was is the same three-digit SIC category. Importantly, the study found, "no significant differences between the award winners and matching sample firms across profitability indices" (Jacob et al., 2004, p. 906). The study went on to perform a multivariate test using several financial indicators like EBIT to sales, Debt to assets, capital expenses to sales. In this comparison, "the award winners were valued 11.4 percent higher than the firms in the matching samples. This indicates that the award winners are

valued higher than the otherwise comparable firms…" (Jacob et al., p. 910) In fact, the financial value indicators that were higher than the paired sample were there before the competition that may indicate those high-performing firms are the same firms that tend to compete and win the award. Nevertheless, this factor alone does not suggest a causal relationship between NQA competition and improved performance. The mixed results of Jacob's study are that business managers are faced with a dilemma whether or not to invest the time, money, and effort in preparing for a MBNQA competition.

Dean and Tomovic (2004) continued in the quest to answer the question of the value of NQA competition to a firm. They identified a key point to the competition and evaluation process. The point is that firms are evaluated on both their Baldrige approach-deployment and their business results. That is, the logic of the evaluation process itself recognizes that the two elements are not the same. That a firm can have an excellent process excellence process in place and still not succeed in business. Conversely, a firm can be successful in the marketplace and not have a well-articulated process excellence process in place. Dean and Tomovic see a serious problem with this situation, "Successful implementation of the Baldrige model is confounded with excellent business results, because excellent business results are themselves part of the model." Furthermore, they "can't ascribe any validity to the weights (referring to the scoring weights of the evaluation worksheets) assigned" (Dean & Tomovic, p. 41).

The importance of this dilemma is that the scoring system itself can preclude the possibility of using the winning firms from being a predictor of company performance in the marketplace. What is missing is the ability to establish a direct linkage between performing some internal process change under the auspices of quality improvement and

follow-on gain in the marketplace. The authors contend that this relationship can be established if access to internal company Baldrige deployment information was made available. Unfortunately, this detailed information is not readily available to most researchers. One reason for the unavailability of this information is that it is not part of the NQA evaluation process to begin with; it is not in one of the seven areas of evaluation. Other information that can be of great use in quantitative evaluation is private and not disclosed outside the company. Finally, the NQA evaluations worksheets are not disclosed as part of the announcement process. Only the names of the winners are announced. Therefore, information on how the competitors scored in each of the seven NQA evaluation areas is not available. A number of the winners though, have shared some of their quality management techniques with others to foster mutual development.

Foster (2007) examined the impact of Six Sigma programs on firm financial performance. His findings had mixed results. On such variables as free cash flow and asset turnover, he found a significant effect. However, he found no such effect on the variables of sales, return on investment or firm growth.

Martín-Castilla and Oscar (2008) added another dimension by examining performance excellence and its relationship to knowledge management (KM) and the EFQM evaluation criteria. "The EFQM model uses nine basic criteria. Five of these criteria are "enablers"; leadership, policy and strategy, people, partnership and resources, and processes. The other four criteria are; "results"; customer results, people results, society results, and key performance results" (Martín-Castilla & Oscar, p. 138). KM resides within Category 4 of the MBNQA evaluation criteria, Measurement, Analysis, and Knowledge Management, reflecting its level of importance. This article continued by

drilling down into the specifics of exactly how KM drives performance excellence. The authors did a qualitative study by examining each of the each of the nine EFQM criteria and analyzing the relationship of the criteria with aspects of KM. For example, in critiquing EFQM Criteria 2, Policy and strategy, the authors stated how, "Policy and strategy" criterion must manage the intellectual factors that contribute to the achievement of business success" (Martín-Castilla & Oscar, p. 142). The authors concluded that, "Organizational success depends on the performance of knowledge and abilities. Innovative creativity, people's motivation, allies and suppliers are key sources of competitive advantage. Organizational learning is a secure path to excellence" (Martín-Castilla & Oscar, p. 153). The assertion that organizational learning is a path to excellence drives home the proposition the KM is an element of all of the components to a quality program and an element that can be exploited as any other talent the firm has.

Han, Chen, and Ebrehimpour (2007) studied the influence of ISO 9000 and TQM and performance. The relationship between ISO 900 and TQM is important in that it illustrates the salient characteristics in common between the two different and yet but complimentary QM systems of ISO 9000 and TQM. This is an important consideration for quality planners. They used structural equation modeling and a 5-point Likert scale survey of 441 usable responses of US firms who had been ISO 9000 certified. The study of ISO 9000 and TQM brought out several key concepts of relevance to this study. Of key importance was their focus on the competitive ability of the firms involved. It "refers to the firm's ability to grow and prosper among other firms in the marketplace" (Han et al., p. 5). This is operationalized into four variables of cost, quality, delivery, and flexibility. The next construct considered was customer satisfaction. The authors

measured customer satisfaction with four indicators: "number of customer complaints, number of repeat customers, customer retention rate and level of customer satisfaction…" (Han et al., p. 6). Business performance was then considered. Two indicators were used: "profit and market share." (Han et al., p. 6). From these questions, 10 hypotheses were developed for testing. The conclusion was that "there is a significant, positive relationship between ISO 9000 registration efforts and TQM practices" (Han et al., p. 16). An outcome is that, "this study supports that ISO 9000 registration efforts do not have a direct, positive relationship with business performance" (Han et al., p. 16). A final unexpected finding was to "refute the claim that there is a direct, significant relationship between TQM practices and customer satisfaction" (Han et al., p. 16).

Lakhal, Pasin, and Limam (2005) studied company performance of Tunisia firms that implemented TQM. They focused on three research questions:

1. Which quality management practices are critical?

2. How different quality management practices are related?

3. What is the nature of the relationship between quality management practices and performance? (Lakhal et al., p. 626)

They used the following management practices to define TQM:

1. Top management commitment

2. Organization for quality

3. Employee training

4. Employee participation

5. Supplier quality management

6. Customer focus

7. Continuous support

8. Quality system improvement/information and analysis

9. Statistical quality techniques (Lakhal et al., p. 627)

The previous criteria commonly are used among writers on the subject. They next built seven hypotheses around these and sent questionnaires to 133 Tunisian companies. They placed these firms into one of three categories of performance: strong, medium, and weak. This evaluation was based on ROI, ROA, and growth of sales. The authors examined the causal relationships using path analysis, "a multivariate analytical methodology for empirically examining sets of relationships represented in the form of a linear causal model" (Lakhal et al., 2005, p. 632). Lakhal et al. concluded, the "crucial role played by top management commitment and support and clarify the relative importance and the interplay between infrastructure, core practices and organizational performance" (p. 640).

Sila and Ebrahimpour (2005) used structural equation modeling to test 23 hypotheses regarding the linkage between TQM and business performance. In setting up their study, the identified eight quality model factors:

1. Leadership

2. Strategic planning

3. Customer focus

4. Information and analysis

5. Human resource management

6. Process management

7. Supplier management, and

8. Business results

It should be noted that seven of the eight evaluation factors constitute the

MBNQA evaluation factors, which makes this study of particular interest. From the list

of eight factors, the authors developed 27 performance indicators. Next, the authors

constructed a 1-7 point Likert scale survey that was sent out to 1500 manufacturing firms.

From this, 220 usable surveys resulted. The results "show that especially leadership and

information and analysis play a significant role in shaping the quality focus of

companies" (Sila & Ebrahimpour, 2005, p. 1137). Also of significance is that "TQM

factors are holistic in that synergies must be created among them to achieve favorable

business results" (Sila & Ebrahimpour, p. 1137).

Balasubramanian, Mathur, and Thakur (2005) used an event study methodology

to determine if firms that won the MBNQA performed better than firms that used the J.D.

Power and Associates (JDPAA) program, for their performance improvement initiatives.

The analysis was done by using the least square market model and tested 34 NQA

winners and a total of 110 JDPAA winners. First, they labeled the day of the award

announcement as 0, to represent a baseline date. They proceeded to compare company

performance with the cumulative average abnormal returns using a weighted index as the

market proxy. For example, to test the JDPAA, the authors did a sign test for the day of

the award and found no statistical significance of the variance in the stock price between

that day and the following day. For the MBNQA winner, on the other hand, abnormal

returns were indicted at the 1 percent level, which was consistent with the hypothesis.

Saizarbitoria, Landín, and Fa (2006) performed a qualitative study using the

Delphi method on a Spanish companies who had implement QM. The authors asked a

panel of experts from the solicited companies their opinions of several aspects of

implementing ISO 9000. The categories were

1. Cost savings

2. Productivity

3. Quality costs

4. Stock rotation

5. Product delivery times

6. Errors and defects

7. Processing orders

8. Security

They found, "the implementation of ISO 9000, if done correctly, contributes to

unifying the workers' way of working and the criteria to be followed, with positive effects

on the operations" (Saizarbitoria et al., 2006, p. 123). However, it was further stated that,

"a direct causal relationship could not be established between the implementation of these

standards and an improvement in economic results" (Saizarbitoria et al., p. 123). Two

beneficial products though were indicted though. First, that the "increased control of

operations, contributing to an improvement in the quality of the products and services

offered" (Saizarbitoria et al., p. 123). A second benefit is "an improvement in brand

image of the company" (Saizarbitoria et al., p. 123).

Another dimension of understanding quality and performance is realizing there is

a difference between the level of quality received by a customer and the level of quality

expected by the same customer. This forms the basis for a customer survey tool known as

the SERVQUAL survey. Using this tool, Lee and Hwan (2005) studied the relationship

between profitability and customer satisfaction in the Taiwanese Banking Industry. They held that "traditional financial ratios are not appropriate for measuring the economic benefits of service quality improvement" (Lee & Hwan, p. 635). The relevance of this study is that it provides other avenues to define performance improvement. To assess service quality, they used SERVQUAL in which quality is defined as the difference between the customer's perceived quality and the customer's expected value. The authors used the following seven assessment characteristics in their study:

1. Deposit activities

2. Loan activities

3. Overdue loans

4. Foreign exchange

5. Trust activities

6. Securities activities

7. Surplus

The study developed a "model of the relationship between perceived service quality and attitudes; the model development is based on the establishment of attitude theory…" (Lee & Hwan, 2005, p. 638). The authors also "hypothesize(d) that market share is an explanatory variable for customer level satisfaction" (Lee & Hwan, p. 641). This resulted in a total of eight null hypotheses. Surveys based on SERVQUAL and SERVPERF were used and resulted in 145 usable questionnaires. The study concluded, "that the performance-based scale developed SERVPERF model and the customer satisfaction on profitability model are confirmed to accurately represent the Taiwanese Banking industry.

Taking a qualitative approach to evaluating firm performance, Easton and Jarrell (1998) performed an event study on firms by interviewing senior executives from the firms. They used nonparametric statistics to test their hypotheses that firms who employee TQM performed better as measured by internal performance metrics than by performance in the stock market. The metrics used were net income, operating income, sales, and inventory. The tests however, did not validate the hypotheses. The article was relevant to this study in that the authors discussed their challenges to getting the right metrics to validate performance. They noted that much of the data needed is internal, company operations-type data and consequently not available to the typical researcher. A particular challenge to their study was the differing approaches to TQM used by the various firms. Not all of the firms used the same quality improvement components under the broad category of TQM. The MBNQA process however, does not suffer from this problem since the operational definitions involved are all precisely defined in the NQA documentation, which follows later in this study. To determine the change in performance, Easton and Jarrell used the 5 years following the implementation of the firm's TQM program and compared that with a proxy performance level based on three other comparable firms that did not implement TQM. "The impact on performance is then measure by the excess unexpected performance, the difference between the unexpected performance of the event firm and the unexpected performance of its control portfolio" (Easton & Jarrell, p. 258). Also of particular use in this study was the way Easton and Jarrell considered stock prices. "First, this study does not focus on the effect of information events ('announcements') on the capital market. While we examine stock

returns, we use them for a different purpose – as a comparatively 'clean' overall performance measure" (Easton & Jarrell, p. 261).

Przasnyski and Tai (2002) looked at the stock price of a number of firms and the reaction of the stock price on the day of the announcement of winning of an NQA. This study focused on the stock market price of MBNQA winning companies, that is, publically traded companies. This article is important to this dissertation in that it seeks to determine actual and not speculated shareholder value following the NQA competition. Przasnyski and Tai examined the professed stock market gains that were published by the NIST which showed that from 1988-1995, NQA winning companies appreciated three times more that the Standard and Poor's (S&P) 500 index. However, the authors assert this calculation is flawed in that it is "calculated without adjusting for market and industry factors and were not annualized" (Przasnyski & Tai, p. 393). This is a serious methodical error and one that this dissertation sought to avoid. This was done by examining NQA winning company's performance in context to the performance of its key competitors. This mitigates the "raising tide" phenomenon, which is the effect that happens when one company is performing "above average" when in fact; it is only average among its peers. Przasnyski and Tai also performed an unique technique to help validate differences between NQA winning and non-winning firms. They conducted a matched pair analysis with a comparably sized firm in the same industry. Ironically, the findings indicated, "that the spectacular returns of the stocks of winning companies claimed by earlier studies were due to market and industry factors, i.e. due to a booming stock market and prosperous industries" (Przasnyski & Tai, p. 399).

Wisner and Eakins (1994) did an earlier study on the effect of quality on firm performance. In this study, Wisner and Eakins found that the companies who competed in the NQA were also high performing companies by other means of evaluation. For instance, Globe Metallurgical Inc., which won a NQA, also received a Shingo Prize for Manufacturing Excellence and the European ISO 9000 Quality Certification. Another NQA winner, Federal Express, had won over 195 awards for their quality efforts during the period under observation. However, the qualitative nature of this study precluded the testing of this anecdotal evidence to determine a more compelling causal relationship. One question raised by the study "is whether the Baldrige Consortium identifies product quality leaders adequately among the applicants" (Wisner & Eakins, p. 26). It is not apparent how germane this matter is in the competition process but it appeared to be important to the authors.

Using a canonical correlation approach to finding the value of competing in the NQA program, Evans and Jack (2003) developed 20 hypotheses. They made a distinction between endogenous and exogenous factors. The endogenous were internally oriented, and these Baldrige factors were human resources, supplier and partner results, and organizational effectiveness. The exogenous factors were externally oriented and these Baldrige evaluation factors were customer-focused results and financial and market results. The first 10 hypotheses were testing the linkage between the endogenous variables. The remaining 10 hypotheses were testing the linkage between the endogenous variables and the exogenous results. The conclusion of the study found, "empirical results support long-standing beliefs and anecdotal evidence by practitioners about the relationships between endogenous and exogenous results for business performance, and

lend credibility to causal hypotheses that improving internal management practices leads to improvement in external results" (Evans & Jack, p. 18). Some key findings of the study include:

1. Employee satisfaction does lead to higher process performance,

2. Customer satisfaction is a dependent variate of product quality, service quality and work system improvement, and

3. Financial performance is "correlated significantly as a dependent variate with productivity, market performance, work system improvement and product quality" (Evans & Jack, 2003, p. 21).

The final study in this section provides a multi-dimensional approach to asserting the value of firm performance by looking at the integration of profitability, productivity and performance (PPP). Selladurai (2002) proposed the PPP model to integrate TQM methodology with that of Business Process Reengineering (BPR). To lead this integration is the blending of several key input and output variables of performance that this study also uses to determine performance. These variables include; revenue, net profits, and market share.

Financial Analysis Methodologies Literature Review

The final portion of this section pertains to financial analysis methodologies that were pertinent to this dissertation. The focus was a review of literature pertaining to the actual financial metrics with which to establish shareholder valuation and company performance. There is a rich body of knowledge available for this task.

Palepu, Healy, and Bernard (2004) provided several valuation techniques for discussion. One approach is based on the assertion, "Finance theory holds that the value

of any financial claim is simply the present value of the cash payoffs that its claimholders receive" (Palepu et al., p. 7-2). This holds that the shareholders equity value can be calculated by summing the present value (PV) of future cash flows from their investment. Another method of valuation interest is based on price multiples. It has an advantage of not requiring multi-year forecasts about factors, such as the cost of capital and profitability. Its fundamental underlying premise is that by comparing a firm with comparable firms, an accurate portrayal of the targeted firm's performance will result. That is, "the analyst relies on the market to undertake the difficult task of considering the short- and long-term prospects for growth and profitability and their implications for the values of the comparable firms" (Palepu et al., p. 7-6). By lessening the complexity of the underlying assumptions about a firm, a less problematic analysis can be made. Nevertheless, this approach does have one complex step however. This is the selection of the comparable firm with which to compare the target firm. The firms must be similar to the greatest extent possible along parameters such as the kind of industry, and the size of the firm and the market.

Vance (2003) provides further details on financial analysis practices. Of particular relevance is a section in Chapter II on cautions about using financial ratios. Ratio analysis has been a common tool for analysis for many aspects of financial performance. However, Vance provides three cautions in the use of financial ratios. Ratios, alone, are not sufficient to understand a company's past performance or to forecast future performance. They must be used in the context of (1) other companies in the industry, (2) the prior performance of the company, and (3) whether the ratios, taken together, tell a consistent story (Vance, p. 47).

Additionally, when reading financial ratios, a time lag is quite common between the onset of a causal factor and the apparent outcome of that causal factor. Indeed, the element of a time lag can be an intervening variable in the relationship a researcher is trying to establish. In conclusion, when undertaking financial ratio analysis, a holistic approach should be considered. That is, to gain a sufficient understanding a company by using financial ratios, it is necessary that all three general categories be used; operating performance, financial performance and risk performance.

Continuing on the theme of uses and limitations of financial analysis techniques, Helfert (2003), in Chapter III entitled Assessment of Business Performance, Helfert states, "Before beginning any task, therefore, the analyst must define the following elements:

1. The viewpoint taken

2. The objectives of the analysis, and

3. The potential standards of comparison" (Helfert, 2003, p. 108).

Armed with this cautionary note, a researcher will need to understand that any financial metric, any financial ratio, in and of itself, is meaningless without some criteria to measure against. Another limitation of any financial analysis, "is based on past data and conditions from which it might be difficult to extrapolate future expectations" (Helfert, 2003, p. 108). A critical concern in financial analyses is the impact of the method of taking accounting adjustments on the financial analysis. Firms can change their accounting practices and this in turn can skew a financial trend without a researcher's knowledge.

To begin a financial analysis, Helfert (2003) states that one must focus on the

three most important stakeholders; the managers, the owners (investors) and the lenders. This will provide a guideline for the analyst in limiting the financial analysis to the critical financial metrics that each category of stakeholder represents. A summary of the types of stakeholder-focused performance data follows:

Management	Owners	Lenders
Operational analysis	Investment return	Liquidity
Resource management	Disposition of Earnings	Financial Leverage
Profitability	Market Performance	Debt Service

Technical analysis tutorial (2006) provides a method for the detailed analysis of stock prices with emphasis of prices over time. This study provides detailed exposition on the tools used by market technical analysts in determining stock price projections.

Harper (2006) presents extensive information on reading financial statements. It starts with the basics of the 10-K Annual Report that is the cornerstone financial report for publically traded firms. This report is required annually by the Securities and Exchange Commission (SEC). Of particular interest is the section entitled, "What Cash Flow Measure is Best?" This discussion highlights the complexity of how to evaluate a company's financial performance. For every cash flow measuring technique mentioned, there are negative implications in using that technique as opposed to one of the other techniques.

One of the key aspects of financial analysis is the change over a period as opposed to a point in time. The difficulty becomes one of ensuring that an accurate picture of a company's performance is measured while environmental market and industry indicators change over the period of observation. Koop (2006) provides several chapters that provide in-depth information relevant to this study principally relating to changes in performance

over period of time. The first component Koop used is the discussion on regression with time lagged explanatory variables. The reason for the importance of a time lag is that after winning a NQA, benefits may not be apparent until sometime in the future, which may be consistent with other winning firms. If this were the case, firms cannot expect to see performance gains until the end of the lag time.

Janssen's (2006) monograph provides fundamental financial analysis information. This was key to understanding the underlying company financial analysis process. Of particular importance to this study is the concept of intrinsic value. Intrinsic value reflects, "the primary assumption of fundamental analysis is that the price of the stock market does not fully reflect a stock's 'real' value" (Janssen, p. 4). The difference between these two values is the intrinsic value of the stock. Another concept from fundamental analysis is that, in time, a stock price will reflect the fundamental of the firm. However, the length of time before this occurs may be in a matter of days or months.

Harper's (2006) monograph contains detailed techniques for analyzing financial statements that was crucial to understanding the key financial metrics and analytical approaches used to examine the health of a company. This information was useful for analyzing the 10-Q reports from EDGAR.

Review of General Research and Statistical Techniques Literature

The purpose of this section is to review relevant research methods used in this study. The following references pertain not to any specific knowledge domain in quality or performance management, but pertain to research in general. These documents guided the methodological framework of this study.

General Research Literature

Cooper and Schindler (2003) were of particular value in that Chapter 6 discussed research design strategies. Two sections of particular note pertained to secondary data analysis and causation. The authors described three basis causal relationships. These are:

1. Symmetric. This is where two variables change but we assumed no relationship in the changes.

2. Reciprocal. This relationship occurs and it is assumed that there is a relationship between the variables.

3. Asymmetrical. This relationship exists where one independent variable is responsible for the change.

The text went on to describe causation and ex post facto research design. Caution was recommended in the assertion that one event causes another event in the absence of quantitative data points. Some cautionary strategies to avoid a premature declaration of an association are

1. "We would like to see some evidence of the time order of events" (Cooper & Schindler, 2003, p. 169). This is to say, did the event of the independent variable indeed happen before the proposed reaction by the dependent variable? Is there evidence to the contrary? Were there any other intervening events that would cause the reaction?

2. "We cannot use assignment of subjects in ex post facto research as we did in experimentation" (Cooper & Schindler, 2003, p. 169). This emphasized that random assignment of subjects in experimental research ensure the complete randomization of the events. In ex post facto studies, we do not have that

luxury. We must contend with the actual subjects as they occurred in their natural setting and not one induced artificially. Nevertheless, "we can gather information about potential confounding factors and use these data to make cross-classification comparisons…" (Cooper & Schindler, 2003, p. 169), in order to validate our relationship.

In conclusion, three things must be done in order to prevent an erroneous determination of an unfounded relationship in an ex post facto study:

1. Measure the level of covariation among the variables,

2. Validate the time order (sequencing) of the event in the independent and dependent variables, and

3. Look for other extraneous factors which may serve to confound the results

Creswell (2003) provides an examination of the key research approaches including qualitative, quantitative and mixed methods research. This book is relevant is that it provides clear pathways for each of the research approaches. The sections of the book on quantitative methods serve as the basis for the research format of this study. The sections covered topics including; purpose statement, research questions and hypotheses, and limitations and significance.

Harrison (1994) examined methods for evaluating organizations. He posited three critical facets of diagnosing organizations, these are

1. Processes. This pertains to the development of roles and relationships between individuals who will examine an organization and their relationship with the members of the organization. Only after this point will critical information about the firm is forthcoming.

2.   Interpretation. Now that the basic information about the firm has been gathered, its interpretation is the next step. Critically important it is, "To provide useful findings and recommendations, practitioners must assure that their results are important and relevant to clients" (Harrison, 1994, p. 16).

3.   Methods. The methods employed by the researcher must be appropriate for the task. "To provide valid results, practitioners should employ the most rigorous methods possible with the practical constraints imposed by the nature of the assignment" (Harrison, 1994, p. 22).

Also of relevance to this study was Harrison's discussion on the open systems model for organizations. This model showed that an organization represents inputs that produce outputs. This process however, is governed by a mixture of several elements to include:

1.   Goals and strategies

2.   Behavior and processes

3.   Technology

4.   Culture, and

5.   Structure

Therefore, any business process should be thought of as part of a holistic system and not in isolation. This study was cognizant of this fact in that it sought to evaluate the firms under study by way of several key metrics rather than limiting oneself to one or two. This continues the theme that Cooper and Schindler (2003) espouse, which is a multifaceted approached to organizational analyses.

Jarusch and Hardy (1991) explored the many ways in which researchers examine historical data. This becomes a challenge because with the passage of time, the more limited the sources of data may become. A particularly relevant chapter discussed the types of questions that may be addressed when many variables are present. The authors gave some key questions in order to help decide how to scope (limit) the path of research. These questions are:

1. Can the values of two or more variables be used to predict the probable values of another variable?

2. Does a particular independent variable improve the accuracy of the predictions of a dependent variable beyond the level reached by one or more or the other independent variables? This provides an extension of Cooper and Schindler's (2003) caution about testing causality from several perspectives in order to better ascertain validity.

3. Are independent and dependant variables causally related after the effects of one or more of the other variables statistically controlled?

4. Is the relationship between a set of independent variables and a dependent variable different for distinct groupings or cases? (Jarusch & Hardy, 1991, p. 144).

Katzer, Cook, and Crouch (1998) discussed the application of research techniques in social sciences. Of particular interest to this study is the chapter on measurement concepts. The authors discussed the concepts of "noise" (or random error) in the measurement process. They defined noise as developing an erroneous understanding of the phenomenon under study because of a flawed measurement technique. Contributing to this

noise are factors such as an ill-defined "operational definition" of the process under study. The person doing the measuring may also jeopardize the accuracy of measurement because of careless techniques or lack of understanding of the measurement process. Measurement reliability is also a consideration. That is, "a measurement is reliable to the extent it is trustworthy and dependable" (Katzer et al., p. 98). Reliable measurements are ones that are repeatable and stable over a period. A final factor that plays heavily in measurement is the concept of validity. I measurement is valid "to the extent that is measure what one want it to measure and not something else" (Katzer et al., p. 101).

Creswell's (2007) text provides a presentation on the various methods of qualitative study. This is pertinent to this dissertation in that his description of a case study as "the study of an issue through one or more cases within a bounded system (i.e., a setting, a context)" (Creswell, 2007, p. 73) gives context to this study also. Creswell goes on to explain a collective case study as one in which "the one issue or concern is again selected, but the inquirer selects multiple case studies to illustrate the issue" (Creswell, 2007, p. 74). Cooper and Schindler (2003) and Harrison (1994) provide supportive advice on this aspect of context.

In performing data analysis, Creswell (2007) also provides a construct of a Data Analysis Spiral. This is a model to explain the conversion of raw data into meaningful information for the researcher. The spiral ascends from the collection of raw data into the production of insightful information for the researcher's use. This study uses the following data analysis spiral as a framework for data collection and analysis. The steps in the spiral are

1. "Data collection

2. Data managing

3. Reading and memoing of the data

4. Describing, Classifying and Interpreting

5. Representing and visualizing" (Creswell, 2007, p. 151)

Statistical Research Techniques Literature

Davis (1996) provided a basic text for the overall approach for the statistical methods employed for this study. This text outlined the basics of the planning process for analysis, and covered the statistical methods as *t*-tests and regressions. Of particular relevance was the appendix entitled "A Practitioner's Guide to Secondary Business Information Sources". This covered specific topics on methods to research information on individual companies, statistical sources and the use of industrial classification coding. All these techniques were used as part of this study.

Monk's (1991) text provides illustrations for using Minitab® Statistical Software for statistical analysis. MINITAB was used as the primary statistical calculation tool for this study. Microsoft Excel was used for basic data collection, categorization, and graphical display purposes. However, MINITAB was used for other statistical techniques including descriptive statistics, parametric tests (Monk, p. 138), *t*-tests, and Mann-Whitney tests (Monk, p. 141) and Wilcoxon test (Monk, p. 161), as MINITAB provides an enriched statistical presentation package.

Doane and Seward (2007) provided an exhaustive text on statistical techniques to include multiple regression techniques and nonparametric techniques using MINITAB. Nonparametrics, or distribution free metrics were used in this study when the available data on firm performance displayed a non-normal distribution. Exploratory data analysis,

relying heavily on graphical representations, was used at the initial testing stages of this process.

Miles' (1994) text on qualitative analysis provides detailed examples on cross-case displays (p. 173). This tool is useful for presenting categorical data that is helpful in the ordering of the firms under study while displaying categorical information in the same chart. This is an aid during the early, exploratory data analysis phase in order to understand the categorical distribution of the NQA-winning firms.

A Critique of MBNQA Process Literature

The first part of this section presents the MBNQA evaluation criteria from the NIST site. Following that is a discussion on the evaluation process from other researchers. The purpose for this information is to gain an understanding of what the criteria are and how the evaluations are made.

Literature from the Malcolm Baldrige National Quality Program Site

The cornerstone document for evaluation is the Business and Nonprofit Criteria for Performance Excellence (Baldrige National Quality Program, 2008). This document contains detailed descriptions of the seven evaluation categories and the details on how to evaluate each of the sections within the seven categories. The categories are presented in Table 4 along with the key components of each category:

Table 4

Baldrige Evaluation Criteria
<div align="center">Category Titles and Focus Questions</div>

Category 1 Leadership

1.1 Senior Leadership: How do your senior leaders lead?

   a. Vision and values

   b. Communication and organizational performance

1.2 Governance and Social Responsibilities: How do you govern and address your

social responsibilities?

   a. Organizational governance

   b. Legal and ethical behavior

Category 2 Strategic Planning

2.1 Strategy Development: How do you develop your strategy?

   a. Strategy development process

   b. Strategic objectives

2.2 Strategy Deployment: How do you deploy your strategy?

   a. Action plan development and deployment

   b. Performance projection

Category 3 Customer and Market Focus

3.1 Customer and Market Knowledge: How do you obtain and use customer and

market knowledge?

   a. Customer and market knowledge

Category Titles and Focus Questions

3.2 Customer Relationships and Satisfaction: How do you build relationships and grow customer satisfaction and loyalty?

    a. Customer relationship building

    b. Customer satisfaction determination

Category 4 Measurement, Analysis, and Knowledge Management

4.1 Measurement, Analysis, and Improvement of Organizational Performance: How do you measure, analyze, and then improve organizational performance?

    a. Performance measurement

    b. Performance analysis, review, and improvement

4.2 Management of Information, Information Technology, and Knowledge:

    a. How do you manage your information, information technology, and organizational knowledge?

    b. Management of Information Resources

    c. Data, Information, and Knowledge Management

Category 5 Workforce Focus

5.1 Workforce Engagement: How do you engage your workforce to achieve organizational and personal success?

    a. Workforce enrichment

    b. Workforce and leader development

    c. Assessment of workforce engagement

Category Titles and Focus Questions

5.2 Workforce Environment: How do you build an effective and supportive

workforce environment?

a. Workforce capability and capacity

b. Workforce climate

Category 6 Process Management

6.1 Work Systems Design: How do you design your work systems?

a. Core competencies

b. Work process design

c. Emergency readiness

6.2 Work Process Management and Improvement: How do you manage and

improve your key organizational work processes?

a. Work process management

b. Work process improvement

Category 7 Results

7.1 Product and Service Outcomes: What are your product and service performance

results?

a. Product and service results

The MBNQA evaluation process then assigns the weights to each of the seven

categories of evaluation as seen in Table 5. The Results category has, by far, the greatest

amount of points awarded of all the NQA evaluation categories. The Results category

evaluates if there were demonstrable benefits delivered to the firm from each of the categories of the competition.

Although not part of the scoring, the evaluation process also contains an Organizational Profile section that contains the following questions. These establish the organizational environment under which the firm operates.

Table 5

Scoring System for Baldrige Criteria

Category and Section Titles	Section Points	Category Points
Category 1 Leadership		120
1.1 Senior Leadership	70	
1.2 Governance and Social Responsibilities	50	
Category 2 Strategic Planning		85
2.1 Strategy Development	40	
2.2 Strategy Deployment	45	
Category 3 Customer and Market Focus		85
3.1 Customer and Market Knowledge	40	
3.2 Customer Relationships and Satisfaction	45	
Category 4 Measurement, Analysis, and Knowledge Management		90

Category and Section Titles	Section Points	Category Points
4.1 Measurement, Analysis, and Improvement of	45	
Organizational Performance	45	
4.2 Management of Information, Information		
Technology, and Knowledge		
Category 5 Workforce Focus		85
5.1 Workforce Engagement	45	
5.2 Workforce Environment	40	
Category 6 Process Management		85
6.1 Work Systems Design	35	
6.2 Work Process Management and Improvement	50	
Category 7 Results		450
7.1 Product and Service Outcomes	100	
7.2 Customer-Focused Outcomes	70	
7.3 Financial and Market Outcomes	70	
7.4 Workforce-Focused Outcomes	70	
7.5 Process Effectiveness Outcomes	70	
7.6 Leadership Outcomes	70	

Table 6

Organizational Profile Questions

P.1 Organizational Description: What are your key organizational characteristics?

a. Organizational Environment

b. Organizational Relationships

P.2 Organizational Challenges: What are your key organizational challenges?

a. Competitive Environment

b. Strategic Context

c. Performance Improvement System

Literature about the MBNQA Evaluation Process

The preceding paragraph presented literature from the MBNQA web site including

the examination criteria and evaluation point allocation. This section examines literature

from sources other than the NIST MBNQA library. This section examines literature that

other researchers have written about the NQA program and its evaluation process.

Latham and Vinyard (2006) provide a detailed discussion on the techniques for

preparation for each of the seven areas of evaluation. Of key importance to the process is

the level of commitment and involvement by management. Latham and Vinyard take a

unique approach to the change process, or "journey" as they refer to the company's

transformation process in preparation of a NQA competition. They use a Diagnosis –

Design – Transformation framework to structure their process. This provides an actionable

three-step approach for the journey. During the Diagnosis phase, firms will use the various

Baldrige resources to evaluate their current business processes and performance results.

During the Design phase, firms will creatively redesign their business processes that have identified performance gaps or waste in their business processes. Finally, the firm's leadership will carry out the transformation of their affected business processes to enable them to undergo the scrutiny of a NQA examination. This is where the previously mentioned level of management commitment was tested.

Also unique is Latham and Vinyard's discussion of the systems approach in the quest for performance excellence. In this application of the systems approach, three integrated elements are identified; strategic leadership, execution excellence and organizational learning. The systems approach is a holistic and self-perpetuating cycle for implementing performance excellence. Latham and Vinyard also presented a business process maturity model using four progressively advanced dimensions or levels. The four maturity levels are:

Approach – "how the process addresses the item requirements – the method(s) used" (Latham & Vinyard, 2006, p. 107)

Deployment – "the extent to which the approach is applied to the appropriate areas and activities in the organization" (Latham & Vinyard, 2006, p. 107)

Learning – "sharing refinements and innovation with other relevant work units and processes in your organization" (Latham & Vinyard, 2006, p. 107), and

Integration and Alignment – "the plans, processes, results, analysis, learning, and actions are harmonized across processes and work units to support organization-wide goals (integrated)" (Latham & Vinyard, 2006, p. 107)

Hutton (2000) took a unique approach to commenting on MBNQA. Hutton sought to reflect on the use of NQA as a tool for pressing organizational change that is assessment-

based rather than compliance-based. The difference in this context being that companies that take an assessment-based approach to NQA do not intend to compete in the award process. These companies want to use the evaluation criteria to structure their change initiatives. Hutton stated the differences succinctly, "compliance audits are excellent tools for achieving and maintaining a desired status quo – typically a stable, documented quality assurance system. Assessments are more effective as tools for driving change" (Hutton, p. 603). Hutton saw the assessment-based approach as a continuous process with the Assessment process leading to the Planning process, which led to the Implementation process that finally ended with the Monitoring process. At this point, the process begins again.

Other key points about the assessment-based approach were:

1. Leaders must by fully engaged from the beginning, providing approvals along the way is not sufficient

2. The assessment must serve the unique needs of the organization; there is no one way for all firms.

3. Identify the "vital few" areas for assessment, do not try to employ universally.

A final word about the execution of an assessment-based approach is that it should be in a positive and engaging atmosphere; an atmosphere in which everyone involved feels as if he is fully engaged. Indeed, Hutton states, "In fact it is easy to accomplish, especially for internal assessors, since there are so many opportunities for learning, for effective teamwork, and for having a positive impact on the organization" (Hutton, 2000, p. 605).

DeBaylo (1999) did a qualitative study to examine the effectiveness of the Baldrige process. This is not pertaining to the performance of the competing companies,

but to the NQA process as its practitioners implement it within their companies. He found 10 reasons for the program's effectiveness:

1. Assessment and improvements drive business results.

2. Criteria that encourage concepts and values

3. Customized improvement models

4. Pervasive use of self-assessment. Of key importance, here is the holistic nature of the self-assessments. The entire company must become involved.

5. Recognition drives participation. Companies may recognize their employee's achievements internally, not counting on being a winner in their NQA category at the national level.

6. Assessment is linked to business strategy. This is especially effective if management is involved in the assessment.

7. Senior management involved. This can be effective when a senior manager of the company that is about to undertake a NQA initiative consults with a senior manager from another company that has experience with NQA.

8. Accelerated learning. One of the biggest benefits in participating in the NQA is the amount of organizational learning that occurs on performance enhancing techniques.

9. Criteria evolve and improve. The Baldrige evaluation criterion has evolved over the years with changes to include a greater emphasis on business results, identification of stakeholder needs and away from the concentration on the manufacturing segment.

10. One size does not fit all. The Baldrige evaluation process has spun off into

varied directions including many state quality award programs that use similar evaluative criteria. Additionally, many companies take the standard Baldrige criteria and modify it for their own self-assessment efforts with no intent to compete for the NQA.

Oger and Platt (2002) performed a qualitative comparison between the Baldrige criteria and the criteria use for the EFQM award and noted some considerable differences. Specifically:

1. EFQM emphasizes tactical criteria, while NQA emphasizes strategic criteria

2. EFQM places more emphasis on customers, employees and society's needs than NQA. This is done mostly in that EFQM places more emphasis on the perception of the measure than the performance of the measure.

3. Baldrige weights business results higher than EFQM

4. The EFQM requires a more detailed assessment process than NQA because of its emphasis on tactical criteria

5. Although difficult to quantify, the cultural differences between the US and Europe tend to orient EFQM towards long-term relationships.

As a final method of comparison between the two models, the authors compared both the EFQM and MBNQA with the Balanced Scorecard (BSC) criteria. The BSC formulated by Kaplan and Norton (1996) presented four categories for measurement for firms. These categories are financial results, processes and innovation, customer focus and learning and growth. The key differences noted while using the BSC criteria is that the NQA places a heavier emphasis on financial results while the EFQM places a heavier emphasis on customers and employees.

Khoo and Tan (2003) performed another example of a cross-cultural examination of the Baldrige criteria. The authors did a qualitative examination of the evaluation criteria between the MBNQA, and two quality management award programs from Japan, the Deming Prize and the Japanese Quality Award. In the study, the authors compared and contrasted each of the individual evaluation criteria. In summary, the MBNQA "includes in its framework the importance of fostering a culture of entrepreneurial challenges and of harnessing new technologies, as well as employing diversity to create competitiveness and business success" (p. 21). Khoo and Tan went on to state, "The comparison demonstrated how socio-cultural attributes affect quality management practices and workplace performance" (p. 21). That is, the MBNQA and the Deming and JQA models reflect the cultural environment from which they came. Success in performance management therefore, must reflect the society in which the effort is undertaken.

Prybutok and Cutshall (2004) performed a qualitative study on the Baldrige examination criteria through a survey of members of the Dallas, Texas section of the ASQ. The members were asked to rate each of the Baldrige criteria against a list of qualitative questions using Likert-type scale. A factor analysis was then performed to determine the linkages. The implication of the study is that the Baldrige criteria are found to relevant to senior leadership's aspirations of performance excellence.

While the previous references viewed the Baldrige program from an internal perspective, Link and Scott (2006) examined how the NQA program affected the national economy. This being a strategic view, the issues addressed were quite different from those examined so far. The authors first sought to quantify the social costs of the NQA

program itself. They did this by getting the budget for the program under the National

Institute of Standards and Technology. The target for their work was companies that were

associated with the American Society for Quality, at the time of the study, 23 of these

companies had performed Baldrige self-assessments. These self-assessments are a way

for a company to get started in the Baldrige process. Perhaps the firms will not even enter

the actual NQA competition but the self-assessment is an excellent tool to assess ones

firm strengths and weaknesses with respect to the seven Baldrige criteria areas. There

used qualitative surveys to the ASQ-member companies and asked how much effort went

into the Baldrige work and how much benefit they got out of the effort. What they found

was the companies stated that they had benefited greatly in relation to the amount of

effort spent for the assessment. The authors used the economic benefit gained by the

ASQ members and divided that value by the "proportion taken by the ASQ members in

the 50 represented industrial sectors" (Link & Scott, p. 97). Armed with this information,

the calculated that the "ratio of the economy-wide benefits to social costs is 207:1" (Link

& Scott, p. 97). The relevance of this study is the method of calculating a cost-benefit

ratio gives weight to the value of the Baldrige process in that it is not overly burdensome

to implement.

Conclusion for Literature Review

This literature review presented an overview from four areas of study: quality

management, shareholder valuation, the MBNQA and company financial performance

information. It sought to integrate these knowledge areas into a logical flow from the

creation of product and service quality, to shareholder value creation. The MBNQA was

used as the subject of investigation to determine whether firms that increased their level

of quality, would increase shareholder value. Before presenting those unique areas,

research literature and statistical sources were surveyed in order to determine the best

research approach to use and the appropriate statistical tools for testing of the hypotheses.

In the knowledge area of quality management doctrine and theory, Peters and

Waterman (1983) started attracted a lot of interest in the area of performance excellence

and put excellence into business perspective of competitive survivability. Juran and

Godfrey (1999) provided a virtual encyclopedia of information on quality systems.

Wadsworth et al. (2002); Lenka and Suar (2008); Goetsch and Davis (2000); Tsai, Pan,

and Chiang (2004); Schroeder et al. (2005); Martin (2007); Van der Stede, Chow, and

Lin (2006); and Lagrosen and Lagrosen (2006) provided insight into quality systems

theory and applications. Creech (1994) provided an international dimension be examining

TQM results in Japan from which we can see a lineage to the MBNQA dimensions of

strategic management. Yavas, Janda, and Marcoulides (2004) compared the perceptions

of quality between American and Turkish managers. Continuing with the international

comparison, Ruiz-Carrillo and Fernandez-Ortiz (2005) examined performance and firms

that won the European Foundation for Quality Management (EFQM) award while

Standing and Vokurka (2003) compared the top six national quality competitions in the

world. Mellat-Parast and Digman (2007) examined the concept of strategic alliances and

quality performance. Baglione and Zimmerer (2008) added a future dimension by

studying small-cap companies and quality performance, while Conti (2005) introduced us

to systems thinking and quality management. Seth et al. (2005) introduced us to service

quality models in IT applications by way of the foundational work of A. Parasuraman,

and his SERVQUAL model. Likewise, Chiu and Lin (2004) sought to link service quality

measurement with the Abraham Maslow's *Theory of Needs*. In a unique application, Maiga and Jacobs (2005) linked quality management systems to management control systems. Sila (2005) examined quality performance and contextual variables that influence outcomes.

Current shareholder and stakeholder theory was examined in order to provide a reference point of value to shareholders of quality initiatives. Following on to shareholder theory is the efficient market hypothesis. This study seeks to link performance to other internally-based and resource-based performance metrics instead of stock prices.

Haksever et al. (2004) started this section with an examination of the multiple dimensions of value creation; financial, nonfinancial and time. This was in line with Mele and Colurcio (2006) multi-dimensional examination of value creation. Fama (1965/1995) wrote on the "random walk" theory of stock prices starting in the mid-1960s and the discussion continues to this day. This leading to a central question – Is the stock market efficient at setting stock prices based on a firms actual and potential worth? Malkiel (2003) continued Fama's discussion with his "blindfolded chimpanzee throwing darts" analogy for stock prices. Sundaram and Inkpen (2004) sought to relate shareholder and stakeholder value, while Hillman and Keim (2001) talked of an actual competition between shareholders and stakeholders. Keef and Roush (2002) and Schuster and Jameson (2003) did comparative studies of shareholder value approaches with the clear finding that there in no one superior method, but, advantages and disadvantages to the various means. Of particular relevance to this study is Ramezani et al.'s (2002) use of metrics such as return on equity and return on investment. Gilmour and Radford (2007) considered organizational development (OD) a way to create shareholder value. Finally

Latham (2008) examined collaboration between researchers and practitioners in the performance excellence research.

The next type of literature reviewed was MBNQA evaluation materials. This is done in order to understand the evaluation mechanisms of what makes a NQA winning company. That is, what exactly are the Baldrige examiners evaluating as they perform their work. The point is especially important for this study. The firm's winning an NQA is evidence that the examiners determined the company to be performing in a superior manner with respect to the Baldrige strategic management performance model. There should be other artifacts that substantiate this superior performance. Those artifacts are what this study is looking for.

The primary source of material from this section was from the Baldrige National Quality Program website. This site provides all the materials that a firm needs to get started in the NQA process. It has introductory pamphlets used for general informational purposes. Self-assessment forms to be used be firms to examine their current state of performance based on their employees viewpoint. There are two version of the self-assessment form; one for employees and one for supervisors. Important to note is that these self-assessment forms also use the same seven evaluation categories as the NQA examiners use when they evaluate a firm during competition. The application for the NQA competition is located on the web site. The evaluation worksheets are on the web site. These worksheets are used by the examiners as they prepare to perform an on-site examination for a NQA competitor. Firms preparing to compete in NQA can use these evaluation worksheets to help guide their preparation for the competition.

The final source of literature reviewed was the historical company performance

data. This information was obtained from various on-line sites using the Nova

Southeastern University library looking under the category of company information. 10-

K reports were useful to determine, from year to year, company financial performance.

Chapter III

Methodology

This study uses financial metrics to show changes in performance of firms that have won the MBNQA. It compares the firm's performance before and after winning the MBNQA and compares its performance with key competitors. The departure of this study from previous studies, however, is that this study focuses on internal measures of performance and not the external measure of stock price.

This chapter introduces the research and data analysis techniques used. It is quantitative in nature and relies on secondary data to provide substantive evidence of events regarding the performance of the companies under study. Appropriate analysis techniques were chosen to facilitate a comparison between those firms that won a MBNQA and key competitors. This includes pictorial display of the data, descriptive statistical measures, and also some inferential statistical tools. The purpose of this study is to determine the effects on company performance of firms that won a Malcolm Baldrige NQA.

Several statistical tests are shown as follows, which illustrate the quantitative methods used. The population under examination is firm performance tracked both before and after NQA competition and award. Secondly, the performance of the winning firms was compared with their key competitors. The population under examination is firm performance tracked both before and after NQA competition and award. The research assumption is that by winning a NQA, there is evidence to support an assertion that a firm became more efficient and effective in the marketplace.

Research Questions and Hypotheses

This section provides the research questions and the related hypotheses. The statistical tests associated with these hypotheses follows later in this chapter.

Research Questions

There are two research questions to be addressed and the hypotheses were derived from these.

Research Question 1

What were the changes in corporate performance comparing the periods before and after an NQA?

Research Question 2

How does a firm that won an NQA compare with its key competitors during this period under study?

This question is essential to understand the winning firm's performance in context to the market conditions that existed at that time of the study. A challenge in determining shareholder valuation is to differentiate the performance of a firm from the "rising tide" phenomenon. That is, a firm that performs well when all of its competitors perform equally well is not increasing shareholder value at an exceptional rate, only a normal rate. A more direct signal of exceptional shareholder value creation is a firm that increases its value while it key competitors do not perform as well. The EMH indicates that the market will generate signals equally to investors and, in time, the investors will react in an appropriate manner.

H_01:   There is no difference in ROA for firms before and after winning the

NQA.

H_11:   There is a statistically significant improvement in the ROA for firms following the winning of a NQA.

H_02:   There is no difference in the EPS for firms before and after winning the NQA.

H_12:   There is a statistically significant improvement in the EPS for firms following the winning of a NQA.

H_03:   There is no difference in the current ratio for firms before and after winning the NQA.

H_13:   There is a statistically significant improvement in the current ratio for firms following the winning of a NQA.

H_04:   There is no difference in ROA for NQA-winning firms and comparable firms of key competitors.

H_14:   There is a statistically significant difference in ROA for NQA-winning firms and comparable firms of key competitors.

H_05:   There is no difference in EPS for NQA-winning firms and comparable firms of key competitors.

H_15:   There is a statistically significant difference in EPS for NQA-winning firms and comparable firms of key competitors.

H_06:   There is no difference in the current ratio for NQA-winning firms and comparable firms of key competitors.

H_16:   There is a statistically significant difference in the current ratio for NQA-winning firms and comparable firms of key competitors.

Research Method and Design Appropriateness

Creswell's (2003) quantitative research framework is used for this study using empirical observation and measurement. This approach, "employs strategies of inquiry such as experiments and surveys, and collects data on predetermined instruments that yield statistical data" (p. 18). The survey portion was the examination of archived official company records of business performance of the targeted firms. The statistical techniques used to determine significance was discussed later in Chapter III of this study.

As Federer (1991) stated, "It is useful to differentiate between empirical research and analytical research**.** The former deals with investigations involving measurement; the latter deals with laws, axioms, postulates, and definitions in the field of inquiry." He further stated "…in experimental physics, biology, social sciences, and business, much of the research is empirical in that it involves measurements and observations on various characteristics" (Federer, p. 67).

By way of comparison, qualitative techniques were considered for this study. Some of the most compelling reasons to perform qualitative analysis however, were absent. For example, Miles (1994) points out that discovering underlying content of phenomenon and "preserving the flow, see(ing) precisely which event led to which consequences" (p. 1), are absent from the research questions.

Theoretical Model

The model for this study is to compare the measures of output in business performance in relation to the measures of inputs used to derive those outputs, in this case, shareholder value by way of profits.

Harrison (1994) uses the open systems model in diagnosing organizations. This model is a representation of value-adding activities performing in order to create a product or service. It starts with inputs that are all types of labor and non-labor resources owned by the organization. By way internal procedures, it converts these resource inputs into a finished product or service. These internal business processes though, are supported by four other factors to support production. These four factors are; technology, goals and strategy, culture, and structure (Harrison, p. 28). As comprehensive as this process is, it is not in set in isolation but is contained within a contextual environment external to the organization.

This study aligns the logic of the open systems model with Generally Accepted Accounting Principles [GAAP] (2003) and associated financial reporting requirements of the U.S. Securities and Exchange Commission.

The following flow chart is based on this structure, that is, following the shareholder value-creation stream from resources to profits.
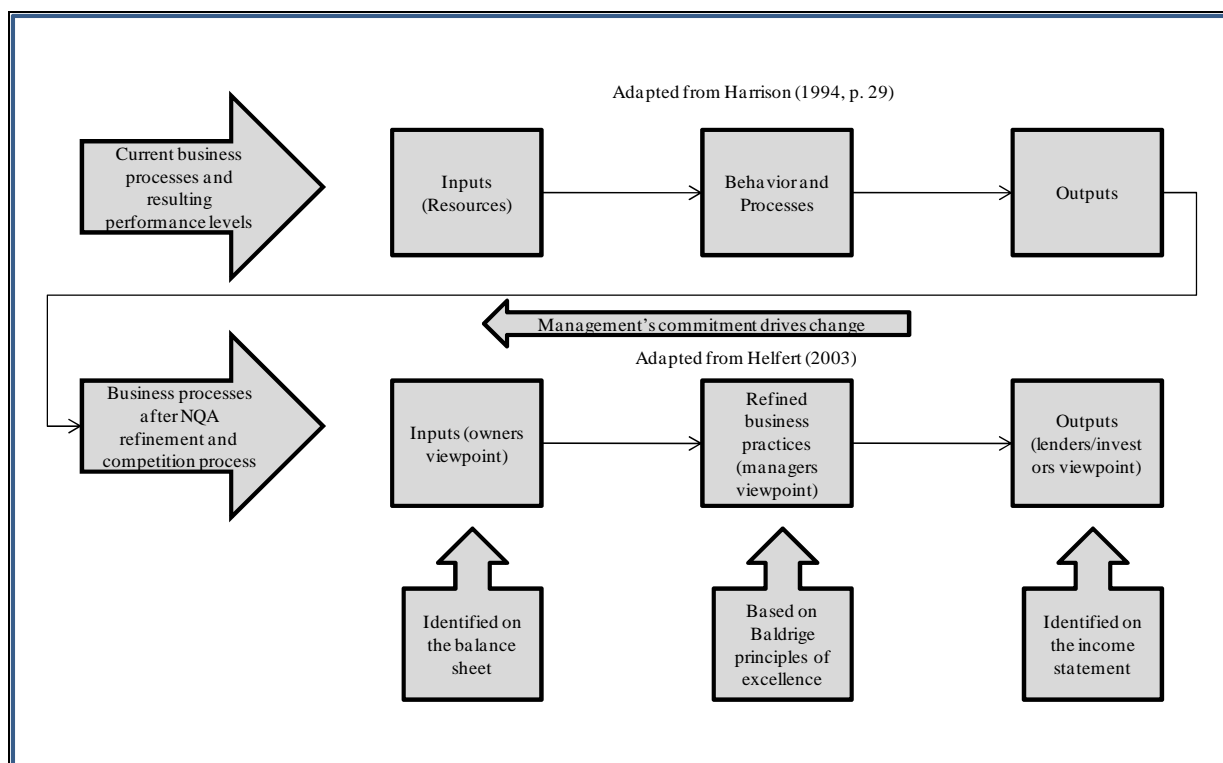
Figure 8. Model of the study variables logic.

Definition of Variables

The goal of this study is to determine if there is evidence that an organization is more efficient following its preparation for, and its subsequent winning of a NQA using accounting data to indicate improved efficiency. Efficiency in this context is the measure of effective production relative to the expenditure of resources (Efficiency, 2008). In the context of this study, efficiency is the productivity of using the assets of the company as represented on the balance sheet, with the sales and income performance as shown on the income statement. The measures of production in this study represent assets (resources), those factors converts into profit. The results of the consumption of the factors of production were those factors, which occurs because of that consumption. The reason for the selection of these data points is that they are an essential part of the company's annual

10-K filing that represents the company's final audited financial report of operations for the year. This is required by the U.S. Securities and Exchange Commission ("Form 10-K," 2006). These variables also represent key indicators from both the balance sheet and the income statement.

The following are the variables used for this study:

1. Return on assets (ROA). This is a measure of how effectively a firm converts assets, which appear on the balance sheet, to income. It is calculated by dividing the net income by the assets. ROA is, "a basic measure of the efficiency with which a company allocates and manages its resources" (Higgins, 2007, p. 39). The rationale for selecting this variable is that it integrates a key metric from the balance sheet, assets, with a key metric from the income statement, net income. The testing of ROA in this study extends the work of Martinez-Costa and Martinez-Lorente (2007) and Heras, Casadesus, and Dick (2002). Both of these studies used t-tests in a similar manner to this study. That is, they used t-tests to analyze company ROA before and after firms were awarded ISO 9000 certification, a process similar in nature to the NQA evaluation process. The goal too in their studies was to establish evidence for shareholder value of quality initiatives. A final justification for using ROA is that it enables cross-sectional and intertemporal comparisons of firm performance (Healy et al., 1992). This enables the comparisons, for instance, of large firms with small firms because the metric does not use an absolute value, such as sales, but is ratio of two performance metrics.

2. Earnings Per Share (EPS). The rationale for selecting this factor was that the "EPS of common stock is a way to measure profitability from the point of view of

the common shareholder" (Vance, 2003, p. 34). The EPS tells the shareholders, "how much earning power and how much dividend income would you be getting for each share you buy?" (Williams, Haka, Bettner, & Carcello, 2006, p. 560). In this way, EPS serves as a key measure of shareholder valuation. It is important enough in fact, that "often is the basis for setting specific corporate objectives and goals as part of strategic planning" (Helfert, 2003, p. 132). There are two basic kinds of EPS, Basic and Diluted. The number of shares of common stock provide the basis for calculating the undiluted EPS. Many firms issue preferred stock however, which can be converted to common stock and "the conversion of this preferred stock would increase the number of common share outstanding and might dilute (reduce) earnings per share" (Williams et al., p. 563). While the conversion is not always done, the diluted EPS tells the shareholder what could have happened to their EPS had the conversion been done (Williams et al.). With this fact in mind, the diluted EPS value is used for all EPS calculations.

Another consideration in using EPS is whether or not to include extraordinary items in the calculation. Extraordinary items are, "…transactions and events that are unusual in nature and occur infrequently…" (Williams et al., 2006, p. 577). For purposes of this study, extraordinary items were included in the EPS calculations.

The use of ROA and EPS follows the work of (Chow-Cua, Goh, & Wan, 2003) where that sought to establish the value to shareholders of ISO 9000 certification. These variables, ROA and EPS, are also among the financial performance indicators for strategic business performance as noted by Beattie and

Sohal (1999). Consequently, they are of high importance to shareholders for both near-term and long-term considerations.

3. Current ratio. The current ratio is a measure of a firm's liquidity. It is calculated by dividing the current assets by the current liabilities. The rationale for selecting this variable for analysis is that the current ratio is important from the investor's viewpoint as it indicates the ability of the firm to operate on operating income and not rely on outside financing (Higgins, 2007, p. 51). This variable was chosen to act as a counterbalance to ROA. That is, this metric provides shareholders with information to ensure that a firm does not incur increased risks to its financial liquidity by undermining its current ratio, in its quest to increase ROA. Morin and Jarrel (2001) indicated this concern as well when they stated "value can be created for equity holders by increasing financial leverage (debt) up to a point" (p. 414). The current ratio then acts as a measure of the risk a company incurs in balancing it asset base with its liabilities. In fact, this component is so important to financial performance that often, it is the overstatement of assets and, or the understatement of liabilities that are found in financial fraud cases. Mulford and Comiskey (2002) stated, "an overstatement of assets or understatement of liabilities can be directly linked to an increase in earnings. As earnings are increased, so are retained earnings, leading to a direct increment to shareholders' equity" (p. 239).

Data Collection

Sample and Population

Sample. Sampling techniques were not used in this study, as the entire population of NQA winners is examined. As the entire population of NQA is small to begin with,

there is no need to use sampling techniques. Nor would there be any of the stated advantages of performing sampling such as cost, time or accuracy (Sanders & Smidt, 2000).

Population.

Target population. The population under examination is a set of firms whose performance tracked both before and after NQA competition and award.

Inclusion criteria. Only those firms satisfying both the criteria given as follows are included in the study.

Firms operating in a business environment. Others firms in educations or health service categories were not included for the study.

Firms that are publicly traded. Privately-held firms were not used and as this study required credible, high-quality financial performance for study variables.

Data Collection Process for NQA Winners

A multi-stepped process was used for choosing the NQA winners. First, the MBNQA website was examined to identify the winners for all years from the inception of the program in 1988 ("1988-2007 Award Recipients' Contacts and Profiles," 2008). From the list of all winners, those that were in the education or health services categories were eliminated, as the focus of this study is performance in a business environment and not the education or health services fields. Next, only those firms that are publically-traded, were considered because of the need for published financial performance data. Credible financial data on publically-traded firms is available on numerous commercial databases such as Value Line Datafile. The U.S. Security and Exchange Commission's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) database also provides financial data

on publically-traded U.S. business ("SEC Filings & Forms [EDGAR]," n.d.). From this smaller list of businesses, only those firms that had sufficient number of years of data available both before and after the year of their NQA award-date were considered. Data from 1994 is available, and consequently firms winning an NQA prior to 1996 were eliminated from this study. The number of years chosen was at least 2 years before and 2 years after their award date, plus the year of award itself, for a total period of study of 5 years. Using the quarterly 10-Q reports provides 20 data points for each of the three variables for each of the NQA-winning firms under study. This established a baseline of 10 quarterly data points before and during the first half of the award year, and 10 data points during the later part of the award year and after, to address research question 1. This interval gives a sufficient time to moderate seasonal variations and is considered a long-term horizon and not short or medium term (Groebner, Shannon, Fry, & Smith, 2005, p. 615). In this manner, a 5-year period is sufficiently long to compare business performance before and after the NQA award date. Research question 2 however, is only concerned with testing the NQA-winning firm with its competitors, from the middle of year of award through two years (business cycles) thereafter. This is a total of 10 quarterly data points for the three variables.

Key Competitors of NQA Winners

The statistical approach used in this study is to take the performance of the study variables and compare it to a comparable portfolio of firms to see if evidence existed of a difference in performance between the two. The rationale for doing this comparison is twofold. First, it is to externally validate the NQA-winning firms against the market segment as a whole. A risk to excluding these external validation points is that a NQA-

winning firm's performance may have increased after winning but, the improvement may have been due to an overall improvement of performance in that market sector. The second reason is to mitigate the effects of non-obvious factors that influenced the performance outcomes, factors that were not included in this study.

The method of selecting the key competitors was by first identifying the primary Standard Industrial Classification (SIC) classification codes of the NQA winners as shown in the EDGAR record. The SIC codes represent the classification of the kind business performed by companies. The total market sales within that SIC were then calculated to determine the significant and non-significant competitors. The percentage of total sales for all listed firms was sorted in descending order with the company with the highest market share heading the list. For the purposes of this study, the collection of key competitors were those companies whose market share exceeded 3% of the total sales of the SIC and collectively constituted a majority of the market. This eliminated many non-significant competitors whose market share was sometimes a fraction of 1%. Market share data were shown in Chapter IV.

Sources of Data

This study uses only publically available secondary data for the analyses. Consequently, there are no issues of informed consent of the participants. The financial data came from the EDGAR database from the U.S. Securities and Exchange Commission and from the Fundamentals Quarterly file on the COMPUSTAT North American database, which is available through the Wharton Research Data Services (WRDS) website. Then, individual queries were constructed based on the four digit SIC code for the selected NQA winning firms. The time period selected was for a total of 5

years of quarterly data. This includes two full years of performance data before the award year, 2 full years after their award, and the year of the award itself. The queries were constructed selecting for the following data elements in the Fundamentals Quarterly data file:

Table 7

Elements of Data Queries in COMPUSTAT

Company Performance Data Element	COMPUSTAT Code
Current assets	ACTQ
Total assets	ATQ
Earnings per share, diluted, including extraordinary items	EPSFIQ
Current liabilities	LCTQ
Total liabilities	LTQ
Net income	N IQ
Net Sales	SALEQ

Data Analysis

Statistical Approach

The following statistical procedures focus on answering the two central research questions. First, did companies perform better after winning a NQA than before, thereby increasing shareholder value? Second, did NQA-winning companies perform better than key competitors in their market sector? The null hypothesis in both cases is that, 1) there is no difference in company performance before and after winning a NQA, and 2) there is no difference between NQA-winning and their key competitors. That is, the null hypothesis in both cases "says two samples have been drawn from equivalent

populations. According to the null hypothesis, any observed difference between samples is regarded as a chance occurrence resulting from sampling error alone" (Levin & Fox, 2000, p. 199). This is classical approach to hypothesis testing where, "decision making rests totally on an analysis of available sampling data. A hypothesis is establish; it is rejected or fails to be rejected, based on the sample data collected (Cooper & Schindler, 2003, p. 521). This type of hypothesis testing then extends into business applications as in the case of making comparisons of performance data between an existing product and performance data from a new product. The null hypothesis in these cases being that the means of the performance data of the old product and the new product are the same, while the alternative hypothesis, is that the new product is different, normally superior (Groebner et al., 2005, p. 306). The research hypothesis of this study is that the application of NQA techniques in business will result in greater value for shareholders.

Time-series analysis was considered for use in this study but found to be inappropriate to answer the research questions. Typical applications for time-series analysis include:

1. Looking at output over a period of time

2. Determining whether a process is stable or unstable, over time

3. Forecasting future performance based on historic data (Doane & Seward, 2007)

These are not considerations of the research questions. Further, for this study it cannot be assumed "that the historical pattern will continue in the future" (Groebner et al., 2005, p. 614), especially since the firms under study had won an NQA, which may have led to a significant change in performance.

Finally, this data for this study do not exhibit the "characteristic dependency among data points, that is, a person's score at any one time is probably related to that person's score on the same variable at any other time" (Rovine & von Eye, 1991, p. 151). The results of individual quarterly performance is not part of the research questions rather, the compiled performance for the entire 5-year period for research question 1 and for a 2.5 year period for research question 2.

A two-step approach was used for the analysis in Chapter IV. First of all the company performance data was collected from EDGAR for the NQA-winning and their key competitors based on their four-digit SIC code. Next, the raw data was examined to determine if normality of data distribution exists. This is essential as this is the guideline for choosing the type of analysis test procedures to be used to test various hypotheses. These tools are generally classified as parametric and nonparametric tests. Application of any parametric test procedure is valid only when the fundamental assumption of normality of the data is satisfied. Nonparametric test procedures can be used for even non-normal data. Hence if normality of the data is proved, then the following listed parametric techniques were used. If there is a non-normal distribution of data, if it is highly skewed for example (Groebner et al., 2005; Levin & Fox, 2000), then nonparametric techniques were used as outlined later in this chapter. Non-normality was indicated if the assumption of normal distribution is violated as shown by the residuals and was plotted in a probability plot (Doane & Seward, 2007, p. 524).

All the inferential test procedures used in this study were conducted at the 0.05 (5%) level of significance as. In other words, we set the maximum probability of committing type I error of rejecting the null hypothesis when it is actually true as only

5%. For implementing this, for any test procedure if the p value of the test is less than 0.05, we reject the null hypothesis and if it is more than 0.05 we do not reject the null hypothesis.

This alpha is considered of sufficient power level to reject false hypotheses and represents a balance of the alpha and beta risks (Bowerman & O'Connell, 2003; Doane & Seward, 2007). Additionally, since the sign of the difference in performance in not important, only that there is a difference or not, then the population size used in this study is sufficient, at the alpha of .05, to detect a statistically significant difference at the 95% confidence level (Taylor, 1990).

Testing for Normality

The first step is to perform the initial analyses on the variables to determine if they are normally distributed. If these series display a normal distribution and parametric testing is appropriate, *t*-tests were done to compare the means of the variables both before and after the award of an NQA, in order to answer the first research question. Then, *t*-tests were used to compare the performance of NQA winning firms against their key competitors. This answered the second research question. The rationale for using *t*-test is that the sample size is less than 30 and the *t*-test compares population means which in turn, answers the research questions (Doane & Seward, 2007; Lind, Marchal & Wathen, 2008).

If the series are non-normal the following indicated nonparametric tests were used. The first step was to display a graphic of the residuals to get a visual orientation of the nature of the distribution. Next, a normality test was run in order to produce a probability plot in order to examine the linearity of the residuals (Doane & Seward, 2007,

p. 525). The normality tests were performed using the MINITAB 15 Normality Test

function. This procedure produced a probability plot that is a graphical display of the data

points on the x axis and the cumulative percentage of all data points shown on the y axis.

The data points on the probability plot form a straight line, or closely clustering around it

if the data are normal. Additionally, "the normal probability plot supports the assumption

of normally distributed residuals if the plotted points are fairly close to a straight line

drawn from the lower left to the upper right of the graph" (Lind et al., 2008, p. 533).

Significant deviation from this pattern indicates non-normal data. The plot shows that the,

"reference line forms an estimate of the cumulative distribution function for the

population from which the data are drawn" ("Normality Test," 2007). These probability

plots were included in Chapter IV. The *p*-values are also displayed on the probability

plots. The *p*-values were the deciding factors on whether to use parametric or

nonparametric tests during the next step.

The shape and symmetry of the data was examined using the skewness and

kurtosis measures. The skewness is a measure of the symmetry of the data and data with

normal symmetry should approximate zero. A skewness factor of greater than zero

indicates a positive skew with more data points above the median. A skewness of less

than zero indicates a negative skew with more data points below the median. Similarly,

the kurtosis is a measure of the peak of the data, and it too, for normal data, should

approximate zero. A positive kurtosis measure indicates a data set that has a relatively

high peak in the middle. Whereas a kurtosis below zero indicates a relatively flat data set

("NIST/SEMATECH e-Handbook of Statistical Methods," 2006).

To confirm the observation made through probability plot, we use a statistical test

procedure to test the normality of the data. The null hypothesis for this was H_0: The data follows normal distribution & the alternate hypothesis is H_1: The data does not follow normal distribution. This test is used because, "the probability plot has the attraction of revealing discrepancies between the sample and the hypothesized distribution, and it is usually easy to spot outliers" (Doane & Seward, 2007, p. 685). The test procedure is known as Anderson-Darling test and is a popular test procedure for testing the normality of the data. This test procedure gives a graphical presentation along with test statistic value and the p value. This *p*-value indicates whether the null hypothesis is rejected or not rejected. Since we are using 5% level of significance if this p value is less than 0.05 we reject null hypothesis otherwise we do not reject it. In other words, if the p value of the test is less than 0.05 it means that the data does not follow normal distribution and if it is more than 0.05, then we can safely conclude that it follows normal distribution at 5% level of significance.

Parametric Testing

Dependent and independent *t*-tests were used for parametric testing if possible, as nonparametric tests are "less powerful and less sensitive that those obtained using parametric methods. Thus stronger support must be established before we can reject a null hypothesis" (Sanders & Smidt, 2000, p. 597). In addition, parametric testing "will generally require less data in order to demonstrate the significance of an effect of some given size" (Monk, 1991, p. 145). With the limited number of data points in this study, the effort to use parametric testing is justified. Should the normality testing indicate a normal distribution of the data, then *t*-tests were used as indicated in Figure 9.

If parametric testing is called for, dependent samples *t*-test, also known as within-

subjects *t*-tests, were used to answer research question 1 while independent samples *t*-tests, also known as between subjects *t*-tests, were used for research question 2. The rationale for the use of t-tests is that they specifically address the research questions in this study. The two research questions are, "characterized by a measurement followed by an intervention of some kind and then another measurement" (Lind et al., 2008, p. 374). In the case of research question 1, an initial measurement was made of company performance pre-NQA award of the three variables. Then, after the intervention of company transformation based on adapting NQA management philosophy, a second measurement of the three variables was made to determine if there is a significant difference (improvement) in performance thereby enhancing shareholder value. Dependent *t*-tests were used for research question 1 in that dependent sample testing is preferable to independent samples testing in that they "reduce the variation in the sampling distribution" (Lind et al., p. 374). The null hypothesis for this test is that the, "differences come from a normal distribution with mean zero" (Monk, 1991, p. 160). For research question 2, the winning company's post-award performance was tested against a portfolio of their key competitors over the same period. The rationale for using this type of comparison is that two different groups are being tested for their differences. Specifically, "Each subject experiences only one of the level of the independent variable and so contributes just one score to the analysis" (Monk, p. 157). Again, tests for all three variables were made.

Nonparametric Testing

Nonparametric tests were used if normality of data is not demonstrated. Nonparametric testing also has several other advantages. They can be used with interval

data measurement (Levin & Fox, 2000, p. 266), and used with small sample sizes (Sanders & Smidt, 2000, p. 597). They also are appropriate where data demonstrates other characteristics such as; the presence of extreme outliers (scores greater than three standard deviations from the group mean) or "when the range of scores in one group is much larger than the other group, say more than twice" (Monk, 1991, p. 145).

The nonparametric tests chosen were the Wilcoxon matched-pairs signed rank test and the Mann-Whitney *U* test. The Wilcoxon test is appropriate for, "related samples and are unwilling or unable (due to data-level limitations) to use the paired-sample *t*-test. It is useful when the two related samples have a measurement scale that allows us to determine not only whether the pairs of observations differ, but also the magnitude of any difference" (Groebner et al., 2005, p. 680). It is also useful where parametrics are inappropriate because of the lack of normally distributed data, the Wilcoxon test is "appropriate without assuming that the sampled populations have the shapes of any particular probability distributions" (Bowerman & O'Connell, 2003, p. 748). The Wilcoxon test is known as a sign test in that it is, "based on the sign difference between two related observations" (Lind et al., 2008, p. 547). Therefore, this test fulfills the requirements for being able to answer research question 1.

The Mann-Whitney test is appropriate for testing population means when using a *t*-test are not appropriate. It is, "a nonparametric test to compare two populations, utilizing only the ranks of the data from two independent samples" (Doane & Seward, 2007, p. 706). Specifically, "The assumption for the *t*-distribution is that the two populations are normally distributed" (Groebner et al., p. 675). The previously mentioned normality tests determined the matter of normality.

Figure 9 shows the testing protocol. A normality test was performed first and then either the nonparametric or *t*-tests was used.
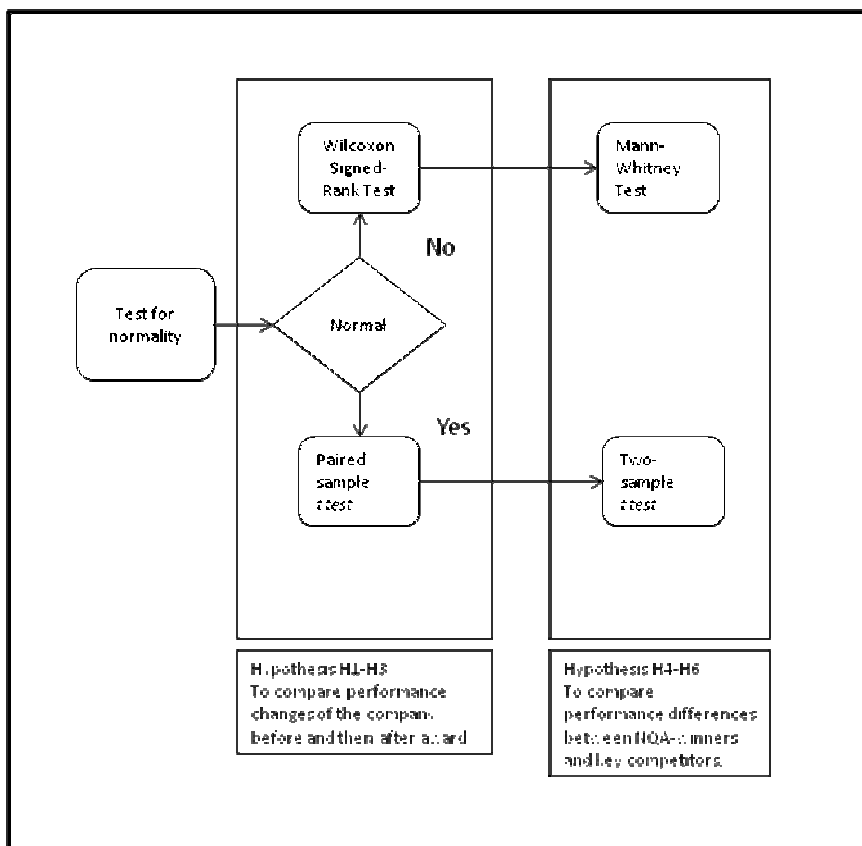
Figure 9. Data testing sequence.

Validity and Reliability

Sharpe and Koperwas (2003) identified two dimensions of validity, internal and external. Internal validity is the assurance that alternative explanations may be ruled out, and that the proposed explanation is indeed, valid (Sharpe & Koperwas, p. 228). External validity, on the other hand, is the ability to generalize the explanation to applications outside the immediate use. That is, the ability of a practitioner to apply the concept outside the field of endeavor of the original testing, for instance, into a real world setting.

Internal validity was assured in this study by using the most direct metric available to measure firm performance (Sharpe & Koperwas, p. 228). H1 through H3 addressed this perspective. That is, the actual financial performance results that are auditable and reported to the U.S. Securities and Exchange Commission. Short of intentional fraud in the reporting of these measures, these are the most direct and reliable measure of firm performance available.

To assure a higher degree of external validity, H4 through H6 compared performance between the NQA-winning firms and their key competitors. This serves to provide an outside application of the results into the context of the applicable market segment. That is, to ensure the generalizibility of the construct. The second set of hypotheses are concerned with the interaction of the experimental treatment with other factors and the "ability to generalize to (and across) times, settings, or persons" (Cooper & Schindler, 2003, p. 434). This would address questions that shareholders of firms that have not initiated Baldrige management practices may have as to the value of those initiatives.

In addition to the proactive approach to validity described previously, caution was used regarding the threats to validity outlined by Creswell (2003). Internal threats are associated with "procedures, treatments, or experiences of the participants" (p. 171) that threaten the conclusions drawn by the researcher. As secondary data are used, the latter two threats are not germane. However, the first internal threat, that of a procedural threat, is possible. To mitigate this threat, the statistical techniques used are all fundamental, sound and well established statistical techniques, widely used and described.

With respect to external threats to validity, Creswell (2003) stated that, "these are when experimenters draw incorrect inferences from other persons or settings" (p. 171). This threat is possible but, any comparisons between companies are being made within the confines of the market segment as defined by the applicable SIC code and within the same time period of study.

One final consideration on the issue of validity is construct validity as described by Katzer et al. (1998). That is, "that concept (under study) is being measured and not something else" (p. 102). As stated previously, since the metrics are the foundational financial and operating performance measures of a business, there is no more direct measure that the ones being used. As stated earlier in this study, these are the central measure of efficiency of how the firm used its assets (resources) to generate net income and consequently, profit.

The reliability of a study can be affected by "noise, or random error, in measurement," it is also "repeatable and stable" (Katzer et al., 1998, p. 98). Further, reliability is the trustworthiness and dependability of the data. Cooper and Schindler (2003) stated additionally that reliability is "the degree to which a measurement is free of random or unstable error" (p. 236). They also stated that reliability has three components; stability, equivalence, and internal consistency. Stability is the ability to get consistent results from measurement. Equivalence is concerned with "variation at one point in time among observers and samples of items" (Schindler, p. 238).

Summary

This chapter outlined the statistical approach to be used for this study. It specified the types of statistical tests and gave a justification for their use. The method of

population selection was identified and the sources of the data itself. It was also noted

that because of a small size of the population, that statistical sampling techniques were

not used for the analyses in Chapter IV. All of the NQA-winning firms were studied and

then their performance was compared to a portfolio of their key competitors. The source

of this data was the firm's 10-K/10-Q financial reports located on the U.S. Securities and

Exchange Commission's EDGAR database

Chapter IV uses the statistical techniques illustrated in this chapter to gather and

analyze their performance data in a two-step approach. First the data was examined to

determine if it displays normal distribution. If it does, then the parametric techniques

described previously are used. If it appears to display non-normal distribution, then the

previously mentioned nonparametric techniques are used.

Chapter IV

Analysis and Presentation of Findings

Introduction

This chapter provides the results of the research techniques described in Chapter

III. The chapter starts with the Data Review section that reviews the data variables used

in the study, and provides an introduction of the firms selected for study. This section

then explains the method of data collection including the specific techniques used to

gather data from the on-line sources. The Descriptive Statistics section provides an

overview of the selected firms under study and displays the descriptive statistics

associated with those selected firms. Following next is the Results of the Hypotheses

Testing for both research questions. These sections provide the results of the statistical

tests used for this study. The portfolios of key competitor firms identified were examined

in comparison with the NQA-winning firms. This section includes the display of the

analytical results in graphical form. Next, the Results section provides a detailed listing

of the results of the previous analysis into a comprehensive listing of the results of

hypothesis test. This analysis provides data to test the quasi-experimental non-equivalent

control group design of this quantitative study that is based on Creswell (2003). Finally,

the Summary section provides a reiteration of key points and findings in this chapter.

Data Review

There were two research questions addressed in this study. The first research

question was; do firms that have won a MBNQA show an improvement in their operating

efficiency and profit-making ability thereby enhancing shareholder value? The second

research question was; do firms that won a MBNQA show a performance improvement

over and about a portfolio of their key competitors within their market sector?

Variables

The variables used in this study often are used to evaluate a company's operating and financial performance. Financial evaluations often begin with an examination of a firm's income statement and balance sheet. From the information contained in these documents, three performance variables chose for evaluation were ROA, EPS and the current ratio. These metrics are of significance for both the firm and the firm's investors. The U.S. Securities and Exchange Commission require also the first two metrics for reporting purposes for publically traded firms, while the third is calculated using numbers from the balance sheet. The variables chosen represent factors of production that a firm can use to produce profit and are included on the company's balance sheet or income statement. As such, these variables are widely known and used by investors and management alike as key indicators of business performance.

Selection of MBNQA-winning Firms

The selection criterion for targeted firms to examine during this study was that they were publically traded firms that had at least two years of data available both before and after NQA award year. This factor eliminated many of the organizations that have won a NQA because these were a small business, an educational institution, or a hospital. This screening then left firms that were listed as either Manufacturing or Service in the MBNQA list of winners. Several winning firms were excluded for various reasons. In some cases, other firms acquired them, in another case, the winning company was owned by a foreign parent company. In yet another case, the winning firm's core business was dissimilar from the parent company as in the case of Caterpillar Financial Services. In

some cases, only a segment of the firm competed and if the segment was not a significant

part of the firm, it was excluded too. One firm, STMicroelectronics, Inc., what won an

NQA in 1999, is foreign owned and was excluded. Another firm, Boeing Corp., has won

twice and the data is used from the later date of 2003 and not the 1998 award date.

Caterpillar Financial Services won the MBNQA in 2003 but was not studied as it is a

division of the Caterpillar firm and separate asset, liability, and EPS is not available. In

addition to this fact, as financial services are not part of the core business of equipment

manufacturing, it is considered disparate in nature from the parent company. The

following table is a list of the companies targeted for study that met all of the previous

criteria.

Table 8

List of Manufacturing and Service Firms That Won the MBNQA

Year	Category	Name
2003	Service	Boeing Aerospace Support
2002	Manufacturing	Motorola Commercial, Government & Industrial Solutions Sector
1998	Manufacturing	Solar Turbines Incorporated
1997	Manufacturing	3M Dental Products Division
1997	Service	Merrill Lynch Credit Corporation
1997	Manufacturing	Solectron Corporation

Note. From 1988-2007 Award Recipients' Contacts and Profiles, 2008.

Data Sources

After the selection of the firms was made, the EDGAR database on the SEC site

was used as the date source for company information to include its primary SIC code. By

reviewing EDGAR, it was also ensured that the firm has a sufficient number of 10-Q

reports to be included in this study. After this review in EDGAR, the Fundamentals

Quarterly file on the COMPUSTAT North American database was used. This is available

through the Wharton Research Data Services website. In this site, a query was built by

filtering for the SIC code of every NQA-winning firm under study and a 5-year period.

The 5-year period included the year of award and the preceding and succeeding two

years. This constitutes 20 quarterly data points for analyzing research question 1 and 10

quarterly data points for analyzing research question 2, for all three variables. The

COMPUSTAT database contains records that are both currently active and inactive, that

is, companies that have gone out of business or been acquired by some other firm. These

records are annotated as Active and Inactive in the database. Both Active and Inactive

firms were used in this study. Therefore, not all firms included in this study are currently

active. The performance of these currently Inactive though, is relevant to answer the

research questions so the data from these Inactive firms used in this study.

The previous review produced a list of all SEC listed firms that did business

whose primary SIC was the same as the NQA-winning company. The list was then sorted

by total annual sales to represent the largest to the smallest firms in that SIC. A

cumulative percentage was calculated to account for the majority of the total annual sales

for each SIC. Key competitors were considered those who held at least 3% of the market

share of sales for the SIC for the 5-year period. The remaining companies having less

than 3% of the market share were not used as they were considered not of material

significance for this comparison of key competitors. Many of these smaller companies

represented less than 1% of the total annual sales in that SIC and therefore, had little

overall impact to the market segment as a whole.

<div align="center">*Performance Data and Descriptive Statistics*</div>

Summary Data Tables

The first part of this section shows the summary data tables as derived from EDGAR and COMPUSTAT. These tables show the within-company performance data for the 5-year study period. Following this section are tables of company performance for key competitors within each of the SIC codes of the NQA-winning companies. Appendix A shows the results for each of the selected NQA-winning companies from COMPUSTAT North America based on the SIC codes for the targeted 5-year period. Additional columns were added to the COMPUSTAT data in order to calculate the ROA and the current ratio, which were not directly available from the 10-Q forms.

The tables in Appendix B show the results of the normality tests performed on all three variables for the NQA-winning firms. These tests were done using the MINITAB Normality Test feature. Of key importance is the *p*-value for each variable. If the *p*-value was below the alpha of .05, then nonparametric hypothesis testing was performed on the variable, otherwise, the parametric equivalent test was performed.

The tables in Appendix B show the key competitor firms within the 4 digit SIC code. Together with the NQA-winning firms, these firms generated the majority of the net sales for that SIC code for the given 5-year period and each held at least 3% of the market.

Descriptive Statistics

The following section contains the descriptive statistics for each of the NQA-winning firms. The source data files are contained in Appendix A. The purpose of this

section is not to draw any conclusions or perform hypothesis testing, but to display the nature and range of the financial performance data in order to gain an initial level of understanding of this datum. The descriptive statistics routines contained in this study were calculated using the MINITAB 15 Descriptive Statistics function.

In each of the descriptive statistics tables that follow, the three study variables—ROA, EPS, and Current Ratio—are located in the first column on the left. The Award column, immediately following, contains a 0 for the 10 quarterly periods of performance before the NQA award, and a 1 in the Award column for the 10 quarterly periods following the award. Again, the first two quarters of the year of award are included in the pre-award calculations while the later two quarters are included in the post-award calculations. The N column represents the number of data points while the Mean, Standard Error of the Mean, Standard Deviation, and the Minimum columns are self-explanatory. The Coefficient of Variation (CV) function on the other hand, was included in the descriptive statistics routine as it provides additional insight as to the level of variation in a process. It is used to "compare dispersion in data sets with dissimilar units of measurement or… dissimilar means" (Doane & Seward, 2007, p.133). The CV is the standard deviation expressed as a percent of the mean. The CV is relevant to a shareholder in that it is an indicator of the level of variation in a performance indicator. The level of variation can be an indicator of a large range of movement in performance for all firms in the market but it can also be an indicator that the firm under study is experiencing a wide range of performance during the study period.

Following each of the descriptive statistics tables are graphical representations of the data provided to give extra insight on the performance. The graphical techniques

chosen were boxplots, on the left, and histograms, on the right of each figure that follows. The importance and practicality of these graphical displays is evident by examining the first set of graphs showing the ROA for Boeing Co. during the study period. The box on the left of the boxplot shows the variation of data points pre-award while the box on the right side of the boxplot panel shows the variation of data points post-award. Knowing that the box portion of the boxplot contains 50% of the data points, it is readily apparent that Boeing Co. has less variation on ROA following their NQA award. This information is displayed in greater detail in the adjoining histogram on the right side of the page.

The graphical routines were run using the MINITAB 15 Boxplot and Histogram functions, respectively.

Year of MBNQA Award: 2003   Company: Boeing Co.   SIC: 3721

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	Award	N	N*	Mean	SE Mean	StDev	CoefVar	Minimum
ROA	0	10	0	0.00583	0.00503	0.01591	273.14	-0.02683
	1	10	0	0.01051	0.00171	0.00539	51.29	0.00345
EPS	0	10	0	0.313	0.283	0.895	286.01	-1.540
	1	10	0	0.722	0.116	0.367	50.88	0.230
Current Ratio	0	10	0	0.8692	0.0176	0.0557	6.41	0.7911
	1	10	0	0.8017	0.0235	0.0743	9.27	0.7247
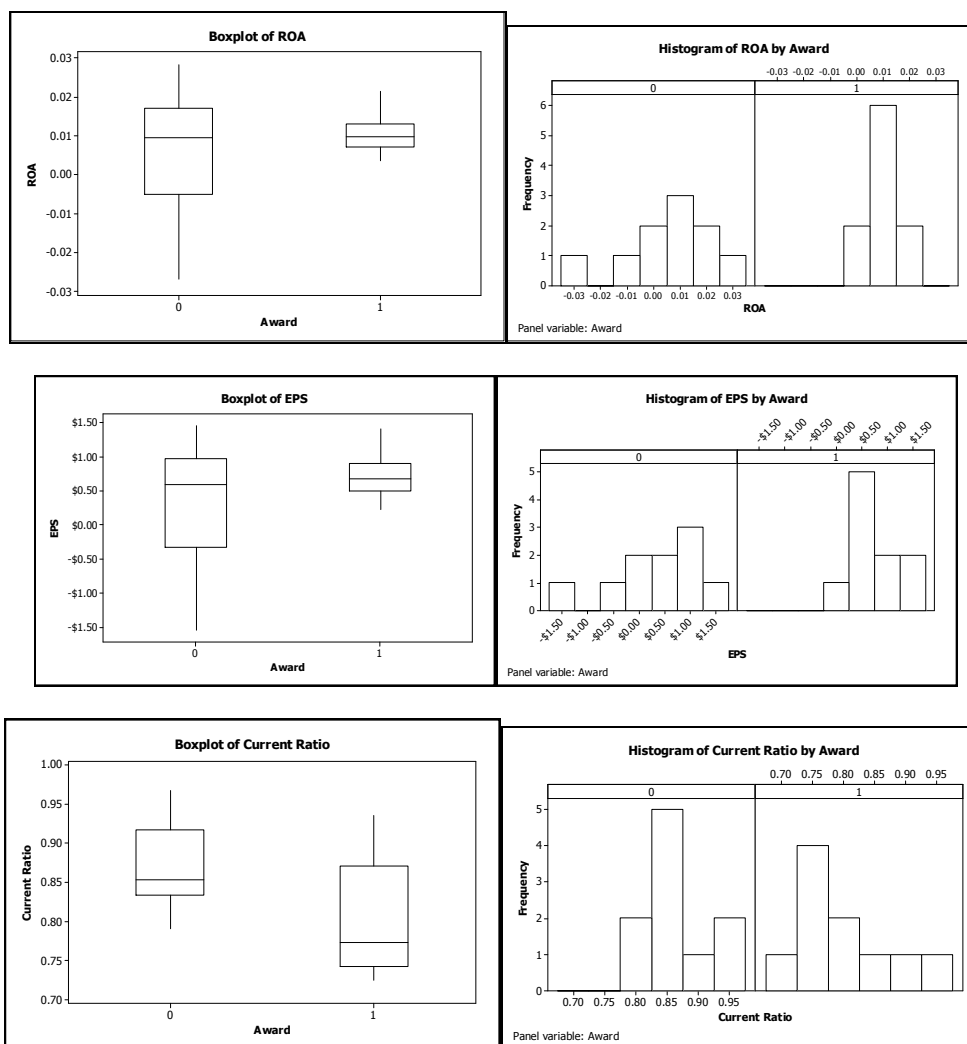
Boxplot of ROA

Histogram of ROA by Award

Panel variable: Award

Boxplot of EPS

Histogram of EPS by Award

Panel variable: Award

Boxplot of Current Ratio

Histogram of Current Ratio by Award

Panel variable: Award

Year of MBNQA Award: 2002   Company: Motorola Inc.   SIC: 3663

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	Award	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	-0.01723	0.00886	0.02801	-162.63	-0.07695	0.01202
	1	0.00853	0.00266	0.00842	98.71	-0.00631	0.02095
EPS	0	-0.203	0.148	0.468	-230.66	-1.020	0.590
	1	0.1120	0.0352	0.1113	99.41	-0.0900	0.2600
Current Ratio	0	1.4934	0.0635	0.2007	13.44	1.2232	1.7683
	1	1.9050	0.0338	0.1069	5.61	1.7418	2.0759
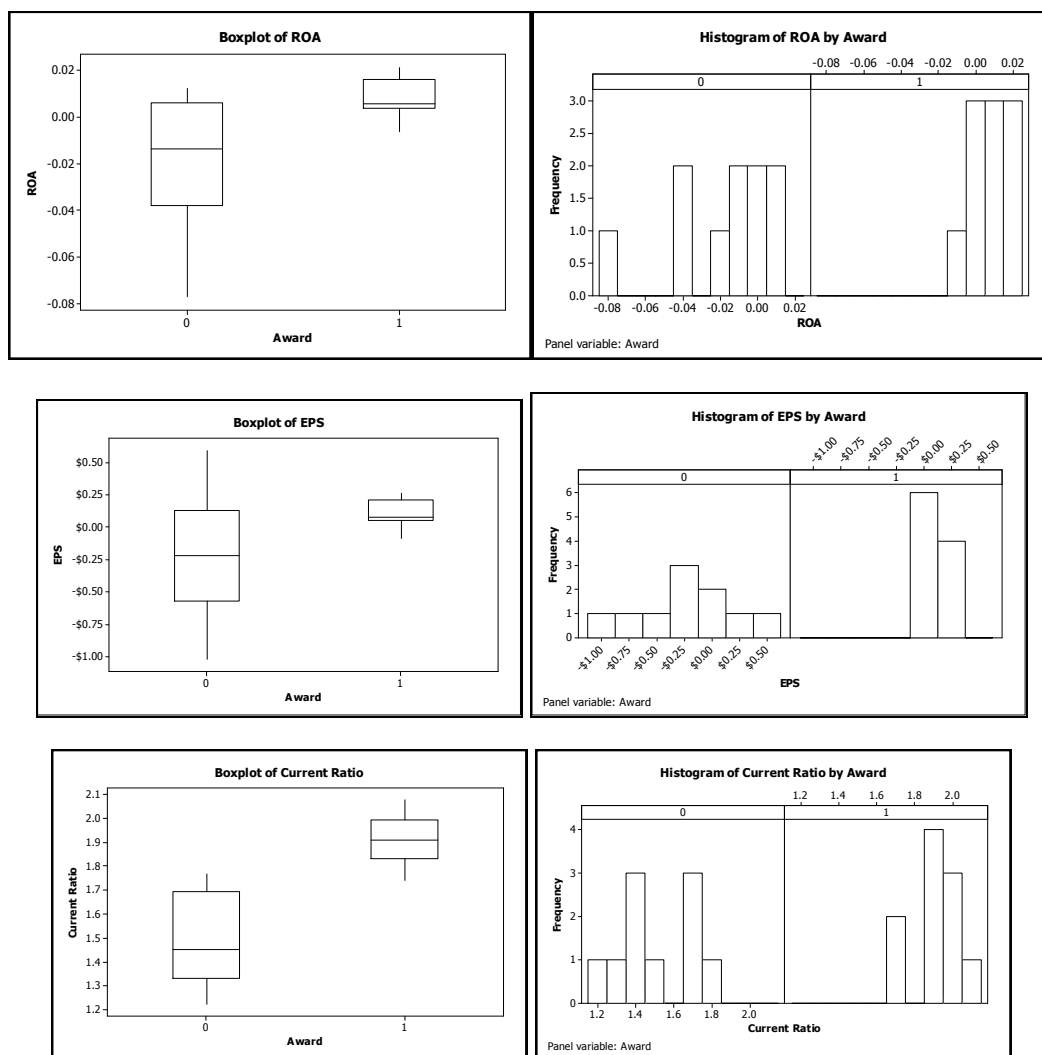
Boxplot of ROA; Histogram of ROA by Award; Boxplot of EPS; Histogram of EPS by Award; Boxplot of Current Ratio; Histogram of Current Ratio by Award

Year of MBNQA Award: 1998   Company: Solar Turbine (Caterpillar) SIC: 3531

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	Award	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.019289	0.000590	0.001865	9.67	0.016668	0.021729
	1	0.009904	0.000587	0.001858	18.76	0.007759	0.013368
EPS	0	1.586	0.140	0.442	27.86	1.010	2.260
	1	0.7390	0.0385	0.1217	16.47	0.5700	0.9200
Current Ratio	0	1.4086	0.0420	0.1329	9.43	1.2092	1.5595
	1	1.4987	0.0178	0.0564	3.76	1.4348	1.5916

Boxplot of ROA

Histogram of ROA by Award

Boxplot of EPS

Histogram of EPS by Award

Boxplot of Current Ratio

Histogram of Current Ratio by Award
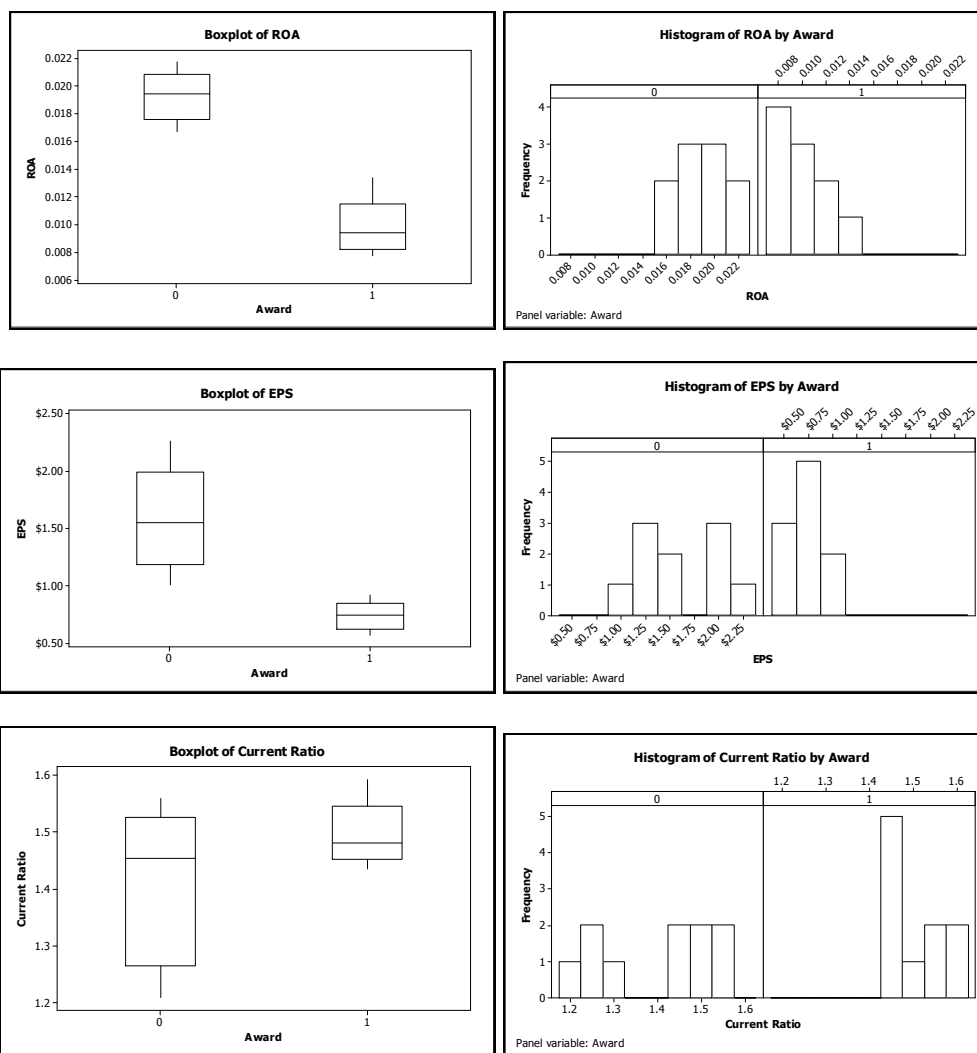
Year of MBNQA Award: 1997   Company: Xerox Business Services   SIC: 3577

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	Award	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.00419	0.00525	0.01661	396.62	-0.04209	0.01588
	1	0.00898	0.00404	0.01277	142.23	-0.02457	0.02045
EPS	0	0.10	1.17	3.71	3638.02	-10.36	1.95
	1	0.518	0.339	1.073	207.18	-2.190	1.790
Current Ratio	0	1.5149	0.0209	0.0660	4.36	1.4049	1.5929
	1	1.5120	0.0383	0.1212	8.01	1.3699	1.7293

Boxplot of ROA

Histogram of ROA by Award

Boxplot of EPS

Histogram of EPS by Award

Boxplot of Current Ratio

Histogram of Current Ratio by Award
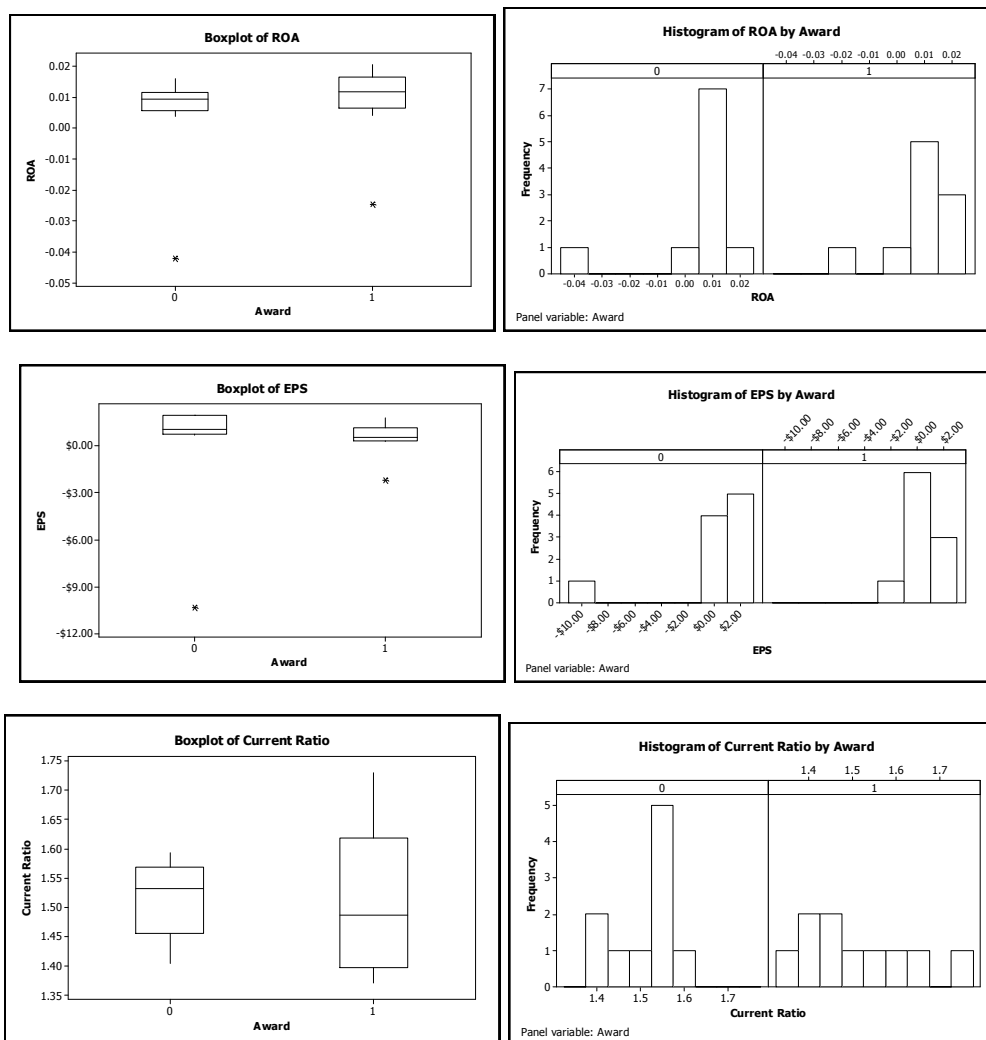
Year of MBNQA Award: 1997   Company: 3M Co.SIC: 2670

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	Award	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.02412	0.00353	0.01118	46.34	-0.00684	0.03084
	1	0.03100	0.00483	0.01528	49.29	0.01275	0.06907
EPS	0	0.782	0.115	0.363	46.48	-0.240	0.990
	1	1.033	0.152	0.480	46.44	0.440	2.210
Current Ratio	0	1.8076	0.0511	0.1615	8.93	1.6189	2.0604
	1	1.5806	0.0466	0.1474	9.33	1.4405	1.9015

Boxplot of ROA

Histogram of ROA by Award

Boxplot of EPS

Histogram of EPS by Award

Boxplot of Current Ratio

Histogram of Current Ratio by Award
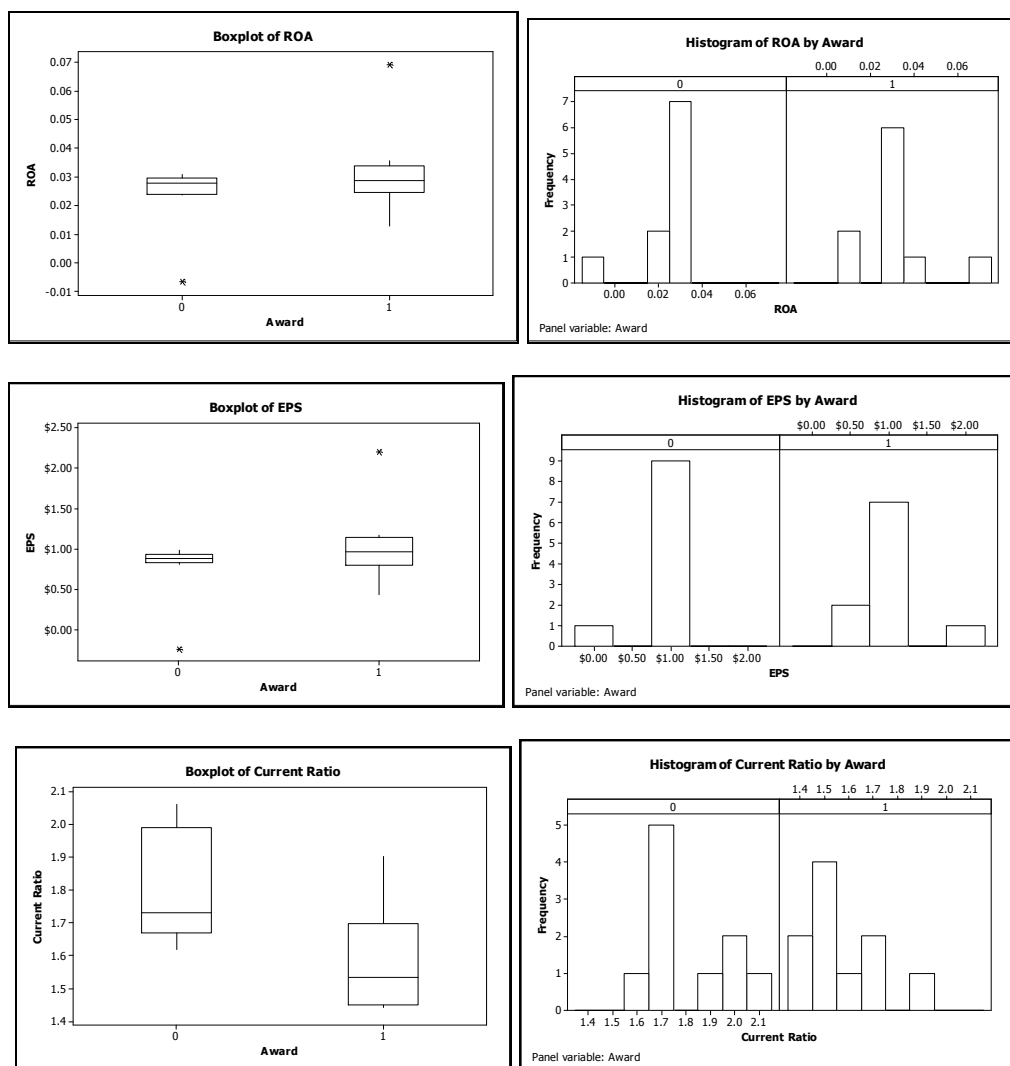
Year of MBNQA Award: 1997   Company: Solectron Corp.   SIC: 3672

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	Award	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.022583	0.000671	0.002121	9.39	0.019387	0.026537
	1	0.024115	0.000745	0.002235	9.27	0.021408	0.028016
EPS	0	0.5350	0.0323	0.1021	19.09	0.3800	0.7100
	1	0.3956	0.0274	0.0822	20.77	0.2800	0.5600
Current Ratio	0	-2.556	0.144	0.455	-17.79	-3.194	-1.886
	1	-2.656	0.153	0.459	-17.28	-3.588	-2.011

Boxplot of ROA — Histogram of ROA by Award
Boxplot of EPS — Histogram of EPS by Award
Boxplot of Current Ratio — Histogram of Current Ratio by Award
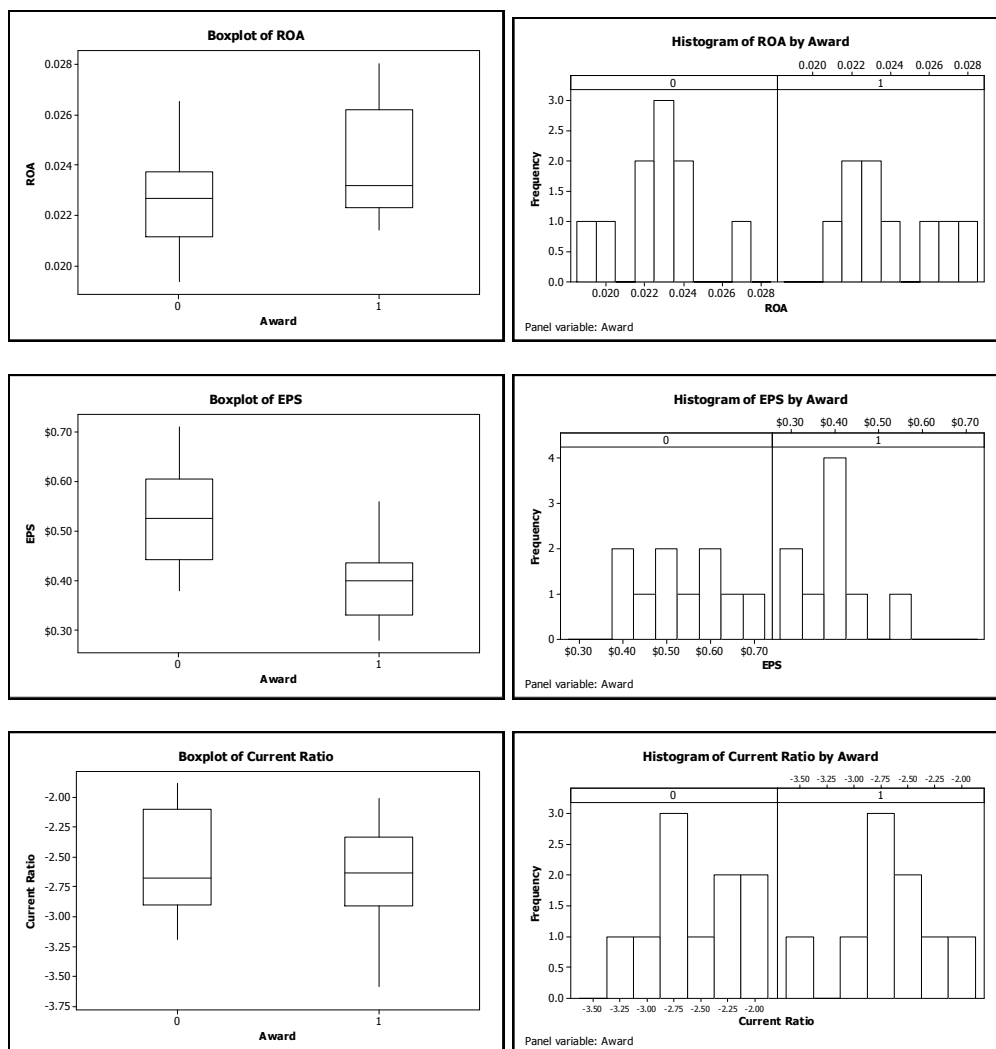
Year of MBNQA Award: 1997   Company: Merrill Lynch SIC: 6211

Descriptive Statistics: ROA, EPS

Variable	Award	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.001787	0.000085	0.000270	15.13	0.001286	0.002115
	1	0.001543	0.000250	0.000790	51.22	-0.000461	0.002417
EPS	0	1.715	0.143	0.453	26.44	1.080	2.320
	1	1.160	0.194	0.613	52.84	-0.420	1.820

Review of the Statistical Techniques

Normality tests. The following section contains the normality tests that were run on each of the data files in Appendix A. Normality tests were run for each of the three variables, for each of the MBNQA-winning firms to produce the following information. The purpose of running these normality tests was to determine whether to use parametric or nonparametric hypothesis testing procedures.

The Normality Test function in MINITAB 15 was used in each case. This produced the p-value for each of the variables to determine whether the data displayed normal or non-normal distribution. The results of this determination were then used to use either parametric or nonparametric hypothesis testing procedures in order to produce the correct hypothesis test.

Each of the graphs that follow contains all three test variables in one graphic. Each of the plots within the graphic is laid out in the same way with the variable metric value on the x-axis and the percentage of the total on the y-axis.

Year of MBNQA Award: 2003   Company: Boeing Co.   SIC: 3721

Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	0.008170
StDev	0.01181
N	20
AD	0.672
P-Value	0.067

EPS	
Mean	0.5175
StDev	0.6983
N	20
AD	0.775
P-Value	0.036

Current Ratio	
Mean	0.8355
StDev	0.07270
N	20
AD	0.225
P-Value	0.793

Year of MBNQA Award: 2002   Company: Motorola Inc.   SIC: 3663

Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	-0.004350
StDev	0.02408
N	20
AD	1.299
P-Value	<0.005

EPS	
Mean	-0.0455
StDev	0.3686
N	20
AD	0.896
P-Value	0.018

Current Ratio	
Mean	1.699
StDev	0.2628
N	20
AD	0.568
P-Value	0.122

Year of MBNQA Award: 1998   Company: Solar Turbine (Caterpillar) SIC: 3531

Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	0.01460
StDev	0.005144
N	20
AD	0.834
P-Value	0.026

EPS	
Mean	1.163
StDev	0.5369
N	20
AD	0.899
P-Value	0.018

Current Ratio	
Mean	1.454
StDev	0.1096
N	20
AD	0.987
P-Value	0.010

Year of MBNQA Award: 1997   Company: Xerox Business Services SIC: 3577

Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	0.006583
StDev	0.01463
N	20
AD	2.622
P-Value	<0.005

EPS	
Mean	0.31
StDev	2.667
N	20
AD	3.590
P-Value	<0.005

Current Ratio	
Mean	1.513
StDev	0.09497
N	20
AD	0.254
P-Value	0.695

Year of MBNQA Award: 1997   Company: 3M Co.SIC: 2670

Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	0.02756
StDev	0.01350
N	20
AD	1.902
P-Value	<0.005

EPS	
Mean	0.9075
StDev	0.4338
N	20
AD	1.928
P-Value	<0.005

Current Ratio	
Mean	1.694
StDev	0.1903
N	20
AD	0.467
P-Value	0.225

Year of MBNQA Award: 1997   Company: Solectron Corp.   SIC: 3672

Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	0.02331
StDev	0.002255
N	19
AD	0.433
P-Value	0.272

EPS	
Mean	0.4689
StDev	0.1155
N	19
AD	0.254
P-Value	0.693

Current Ratio	
Mean	-2.604
StDev	0.4468
N	19
AD	0.180
P-Value	0.902

Year of MBNQA Award: 1997   Company: Merrill Lynch SIC: 6211

Summary of results of the normality tests. The following table contains a

summary of normality tests. The decision factor of normality for this study was the *p*-

value level. If the *p*-value exceeded the alpha of .05, then the null hypothesis of a normal

data distribution was not rejected. The cells of the summary table that are colored

indicated statistical significance, while the cells that contain no background color are not

statistically significant, at the .05 alpha level.

Table 9

Summary of Normality Tests For Research Question 1

Company	Award Year	SIC	ROA Normality test P-value	EPS Normality test P-value	Current Ratio Normality test P-value	
Boeing Co.	2003	3721	0.067	0.036	0.793*	
Motorola Inc.	2002	3663	0.005	0.018*	0.122*	
Solar Turbine (Caterpillar)	1998	3531	0.026	0.018*	0.01*	*
Xerox Business Services	1997	3577	0.005	0.005*	0.695*	
3M Co.	1997	2670	0.005	0.005	0.225*	
Solectron	1997	3672	0.272	0.693	0.902	
Merrill Lynch	1997	6211	0.005	0.038	*	

Note. Current ratio data is not available for Merrill Lynch as there is no current asset or current liability data for any of the selected SIC 6211 firms shown in EDGAR. Consequently, the current ratio could not be calculated.

*Statistically significant at the .05 level

    As indicated in the Table 9, 12 of the 21 tests demonstrated a non-normal distribution of the data thereby calling for the use of nonparametric hypothesis tests. Of particular interest is the level of significance shown by six of the data points, being at the .005 level, indicating a very high degree of probability of non-normal data being present. On the other side of the significance level are four data points indicating strong evidence that normal data is present. These are the EPS and current ratio for Solectron, and the current ratio for Boeing Co. and Xerox Business Services. The fact that the high levels of

normality and non-normality are indicated is a strong indication that the normality testing

procedure is justified and that the use of the two different approaches is appropriate.

Based on the data shown in the Table 9, the Table 10 shows the hypothesis testing

strategy to be used.

Table 10

Statistical Test Decision Results for Research Question 1

Company	Award Year	SIC	ROA Test Used	EPS Test Used	Current Ratio Test Used
Boeing Co.	2003	3721	Paired t test	Wilcoxon	Paired t test
Motorola Inc.	2002	3663	Wilcoxon	Wilcoxon	Paired t test
Solar Turbine (Caterpillar)	1998	3531	Wilcoxon	Wilcoxon	Wilcoxon
Xerox Business Services	1997	3577	Wilcoxon	Wilcoxon	Paired t test
3M Co.	1997	2670	Wilcoxon	Wilcoxon	Paired t test
Solectron	1997	3672	Paired t test	Paired t test	Paired t test
Merrill Lynch	1997	6211	Wilcoxon	Wilcoxon	

Note. Current ratio data not available from EDGAR for SIC 6211 firms.

Results of Hypothesis Testing

Depending on whether the previous results indicated normal or non-normal

distribution, either paired sample *t*-tests or Wilcoxon Signed Rank tests were used. The

hypothesis test results for each of the MBNQA-winning firms follows. All tests were

performed using MINITAB 15. A summary table follows showing the company, test used

and significance level for each of the three variables tested. Of key importance is the *p*-

value indicated for each test. If the *p*-value is below the alpha of .05, then was a

statistically significant change in the mean value for that variable from the 10 quarterly periods before the winning of an NQA, to the 10 quarterly periods after. These results are summarized at the end of this section.

Year of MBNQA Award: 2003   Company: Boeing Co.   SIC: 3721

Paired T-Test and CI: ROA, ROA_2

Paired T for ROA - ROA_2

	N	Mean	StDev	SE Mean
ROA	10	0.00583	0.01591	0.00503
ROA_2	10	0.01051	0.00539	0.00171
Difference	10	-0.00469	0.01720	0.00544

95% CI for mean difference: (-0.01699, 0.00762)

T-Test of mean difference = 0 (vs not = 0): T-Value = -0.86 P-Value = 0.411

Wilcoxon Signed Rank Test: EPS

Test of median = 0.000000 versus median not = 0.000000

	N	N for Wilcoxon Test	Statistic	P	Estimated Median
C9	10	10	17.0	0.308	-0.3950

Paired T-Test and CI: Current Ratio, Current Ratio_2

Paired T for Current Ratio - Current Ratio_2

	N	Mean	StDev	SE Mean
Current Ratio	10	0.8692	0.0557	0.0176
Current Ratio_2	10	0.8017	0.0743	0.0235
Difference	10	0.0675	0.0792	0.0250

95% CI for mean difference: (0.0109, 0.1241)

T-Test of mean difference = 0 (vs not = 0): T-Value = 2.70 P-Value = 0.024

Year of MBNQA Award: 2002   Company: Motorola Inc.   SIC: 3663

Wilcoxon Signed Rank Test: ROA test

Test of median = 0.000000 versus median not = 0.000000

N for   Wilcoxon   Estimated

N   Test   Statistic   P   Median

ROA test 10   10   7.0 0.041   -0.02265

Wilcoxon Signed Rank Test: EPS test

Test of median = 0.000000 versus median not = 0.000000

N for   Wilcoxon   Estimated

N   Test   Statistic   P   Median

EPS test 10   10   13.0 0.154   -0.2900

Paired T-Test and CI: Current Ratio, Current Ratio_2

Paired T for Current Ratio - Current Ratio_2

N   Mean   StDev SE Mean

Current Ratio   10   1.4934 0.2007   0.0635

Current Ratio_2 10   1.9050 0.1069   0.0338

Difference   10 -0.4116 0.1465   0.0463

95% CI for mean difference: (-0.5164, -0.3068)

T-Test of mean difference = 0 (vs not = 0): T-Value = -8.89 P-Value = 0.000

Year of MBNQA Award: 1998   Company: Solar Turbine (Caterpillar) SIC: 3531

Wilcoxon Signed Rank Test: ROA test

Test of median = 0.000000 versus median not = 0.000000

N for   Wilcoxon   Estimated

N   Test   Statistic   P   Median

ROA test 10   10   55.0 0.006   0.009565

Wilcoxon Signed Rank Test: EPS test

Test of median = 0.000000 versus median not = 0.000000

	N	N for Test	Wilcoxon Statistic	P	Estimated Median
EPS test	10	10	55.0	0.006	0.8350

Wilcoxon Signed Rank Test: Current ratio test

Test of median = 0.000000 versus median not = 0.000000

	N	N for Test	Wilcoxon Statistic	P	Estimated Median
Current ratio test	10	10	13.0	0.154	-0.07842

Year of MBNQA Award: 1997   Company: Xerox Business Services   SIC: 3577

Wilcoxon Signed Rank Test: ROA test

Test of median = 0.000000 versus median not = 0.000000

	N	N for Test	Wilcoxon Statistic	P	Estimated Median
ROA test	10	10	11.0	0.103	-0.004540

Wilcoxon Signed Rank Test: EPS test

Test of median = 0.000000 versus median not = 0.000000

	N	N for Test	Wilcoxon Statistic	P	Estimated Median
EPS test	10	10	37.0	0.359	0.3900

Paired T-Test and CI: Current Ratio, Current Ratio_2

Paired T for Current Ratio - Current Ratio_2

	N	Mean	StDev	SE Mean
Current Ratio	10	1.5149	0.0660	0.0209
Current Ratio_2	10	1.5120	0.1212	0.0383
Difference	10	0.0029	0.1326	0.0419

95% CI for mean difference: (-0.0920, 0.0978)

T-Test of mean difference = 0 (vs not = 0): T-Value = 0.07 P-Value = 0.946

Year of MBNQA Award: 1997   Company: 3M Co.SIC: 2670

Wilcoxon Signed Rank Test: ROA test

Test of median = 0.000000 versus median not = 0.000000

	N	N for Wilcoxon Test	Wilcoxon Statistic	P	Estimated Median
ROA test	10	10	16.0	0.262	-0.003717

Wilcoxon Signed Rank Test: EPS test

Test of median = 0.000000 versus median not = 0.000000

	N	N for Wilcoxon Test	Wilcoxon Statistic	P	Estimated Median
EPS test	10	10	15.0	0.221	-0.1500

Paired T-Test and CI: Current Ratio, Current Ratio_2

Paired T for Current Ratio - Current Ratio_2

	N	Mean	StDev	SE Mean
Current Ratio	10	1.8076	0.1615	0.0511
Current Ratio_2	10	1.5806	0.1474	0.0466
Difference	10	0.2270	0.1553	0.0491

95% CI for mean difference: (0.1159, 0.3382)

T-Test of mean difference = 0 (vs not = 0): T-Value = 4.62 P-Value = 0.001

Year of MBNQA Award: 1997   Company: Solectron Corp.   SIC: 3672

Paired T-Test and CI: ROA, ROA_2

Paired T for ROA - ROA_2

	N	Mean	StDev	SE Mean
ROA	9	0.022541	0.002245	0.000748
ROA_2	9	0.024115	0.002235	0.000745
Difference	9	-0.00157	0.00410	0.00137

95% CI for mean difference: (-0.00473, 0.00158)

T-Test of mean difference = 0 (vs not = 0): T-Value = -1.15 P-Value = 0.283

Paired T-Test and CI: EPS, EPS_2

Paired T for EPS - EPS_2

	N	Mean	StDev	SE Mean
EPS	9	0.5156	0.0865	0.0288
EPS_2	9	0.3956	0.0822	0.0274
Difference	9	0.1200	0.1371	0.0457

95% CI for mean difference: (0.0146, 0.2254)

T-Test of mean difference = 0 (vs not = 0): T-Value = 2.63 P-Value = 0.030

Paired T-Test and CI: Current Ratio, Current Ratio_2

Paired T for Current Ratio - Current Ratio_2

	N	Mean	StDev	SE Mean
Current Ratio	9	-2.549	0.482	0.161
Current Ratio_2	9	-2.656	0.459	0.153
Difference	9	0.107	0.595	0.198

95% CI for mean difference: (-0.350, 0.564)

T-Test of mean difference = 0 (vs not = 0): T-Value = 0.54 P-Value = 0.603

Year of MBNQA Award: 1997   Company: Merrill Lynch SIC: 6211

Wilcoxon Signed Rank Test: ROA test

Test of median = 0.000000 versus median not = 0.000000

	N for	Wilcoxon		Estimated
	N	Test Statistic	P	Median
ROA test	10	10	31.0 0.760	0.00005538

Wilcoxon Signed Rank Test: EPS test

Test of median = 0.000000 versus median not = 0.000000

	N for	Wilcoxon		Estimated
	N	Test Statistic	P	Median
EPS test	10	10	48.0 0.041	0.4150

Test of Hypothesis 1

$H_0 1$:   There is no difference in ROA for firms before and after winning the

NQA.

$H_1 1$:   There is a statistically significant improvement in the ROA for firms

following the winning of a NQA.

Table 11

Results of Test of Hypothesis 1

Company	Award Year	SIC	ROA Significance test P-value	
Boeing Co.	2003	3721	0.411	
Motorola Inc.	2002	3663	0.041	*
Solar Turbine (Caterpillar)	1998	3531	0.006	*
Xerox Business Services	1997	3577	0.103	
3M Co.	1997	2670	0.262	
Solectron	1997	3672	0.283	
Merrill Lynch	1997	6211	0.76	

* Statistically significant at the .05 level

Test of Hypothesis 2

$H_0 2$:   There is no difference in the current ratio for firms before and after

winning the NQA.

$H_1 2$:   There is a statistically significant improvement in the current ratio for

firms following the winning of a NQA.

Table 12

Results of Hypothesis Test 2

Company	Award Year	SIC	Current ratio Significance test P-value
Boeing Co.	2003	3721	0.024 *
Motorola Inc.	2002	3663	0.000 *
Solar Turbine (Caterpillar)	1998	3531	0.154
Xerox Business Services	1997	3577	0.946
3M Co.	1997	2670	0.001 *
Solectron	1997	3672	0.603
Merrill Lynch	1997	6211	

Note. Current ratio data not available from EDGAR for SIC 6211 firms.

* Statistically significant at the .05 level

Test of Hypothesis 3

H$_0$3: There is no difference in the EPS for firms before and after winning the NQA.

H$_1$3: There is a statistically significant improvement in the EPS for firms following the winning of a NQA.

Table 13

Results of Hypothesis Test 3

Company	Award Year	SIC	EPS Significance test P-value
Boeing Co.	2003	3721	0.308
Motorola Inc.	2002	3663	0.154
Solar Turbine (Caterpillar)	1998	3531	0.006*
Xerox Business Services	1997	3577	0.359
3M Co.	1997	2670	0.221
Solectron	1997	3672	0.03*
Merrill Lynch	1997	6211	0.041*

*Statistically significant at the .05 level

Statistical techniques applied to the key competitor firms. The following section contains data to answer research question 2, which constitutes Hypotheses 4 – 6. Appendix B contains the raw performance data for each of the key competitors and the NQA-winning firms. The comparison was to test the difference in the 10 quarterly periods starting from the middle of the NQA-award year and the next two years. Again, all three research variables of ROA, EPS and current ratio were analyzed. Immediately following are the descriptive statistics of the firms and no conclusions are appropriate. The purpose is to show the data range of the competitors within each of the SIC and the hypothesis testing follows later.

Year of MBNQA Award: 2003   Company: Boeing Co.   SIC: 3721

Descriptive Statistics: ROA, EPS, CR

Variable	NQA	N	N*	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	24	0	0.00147	0.00197	0.00966	658.00	-0.02839	0.01616
	1	10	0	0.01051	0.00171	0.00539	51.29	0.00345	0.02134
EPS	0	24	0	0.205	0.113	0.555	271.49	-1.200	0.910
	1	10	0	0.722	0.116	0.367	50.88	0.230	1.400
CR	0	24	0	1.1327	0.0414	0.2029	17.91	0.6353	1.3237
	1	10	0	0.8017	0.0235	0.0743	9.27	0.7247	0.9355
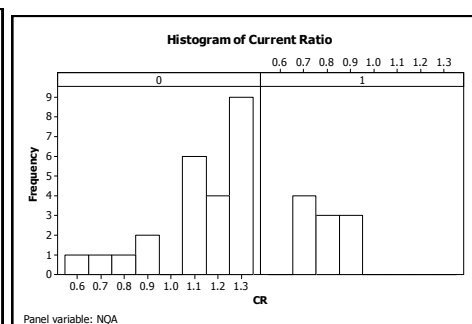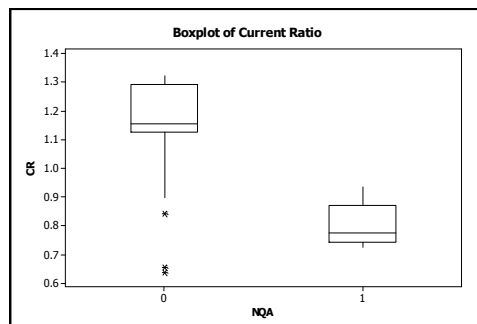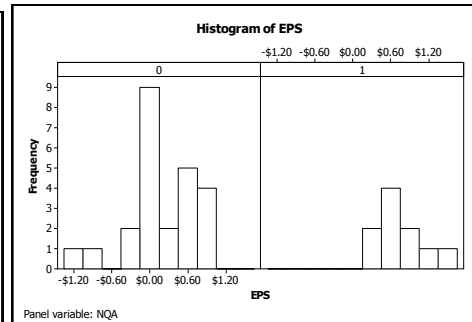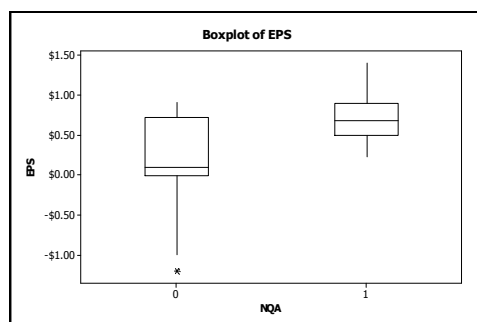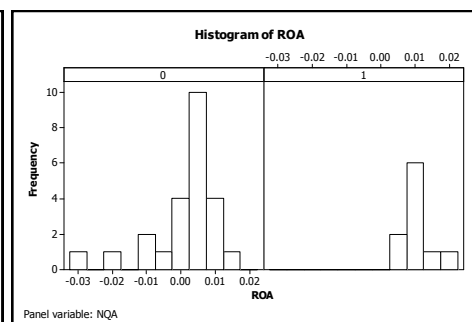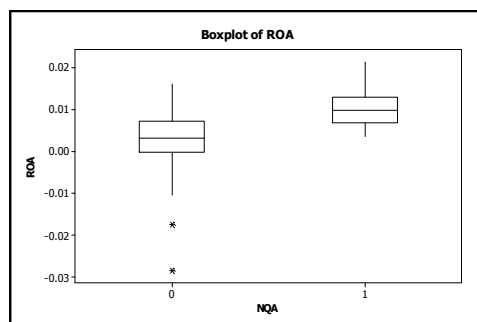
Year of MBNQA Award: 2002   Company: Motorola Inc.   SIC: 3663

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	NQA	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	-0.0067	0.0120	0.0802	-1197.78	-0.4454	0.0564
	1	0.00853	0.00266	0.00842	98.71	-0.00631	0.02095
EPS	0	-0.071	0.147	0.909	-1284.08	-5.000	0.670
	1	0.1120	0.0352	0.1113	99.41	-0.0900	0.2600
Current Ratio	0	1.9343	0.0720	0.4831	24.98	1.1196	2.9950
	1	1.9050	0.0338	0.1069	5.61	1.7418	2.0759
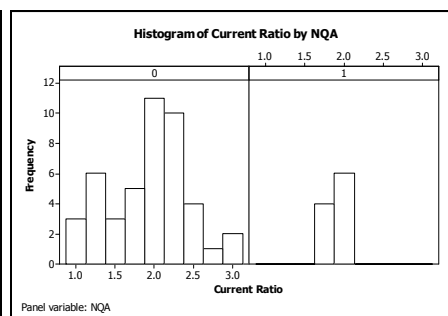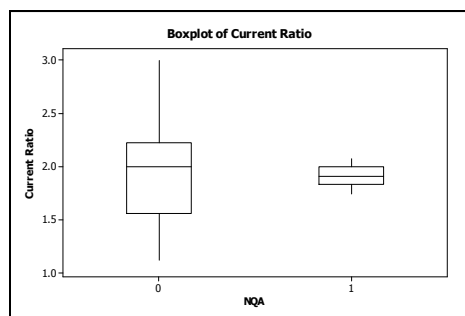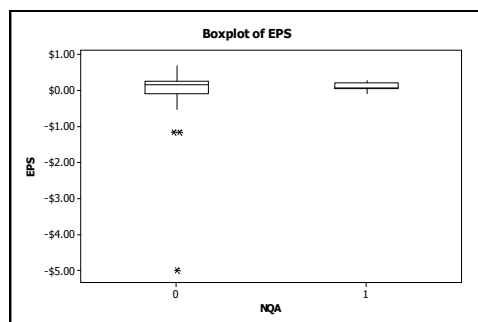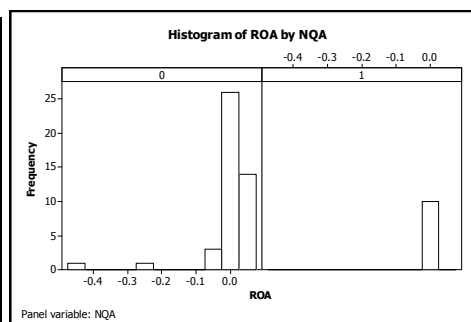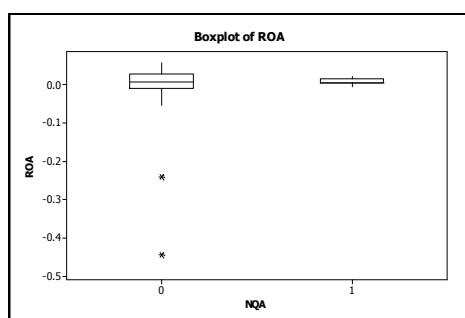
Year of MBNQA Award: 1998   Company: Solar Turbine (Caterpillar) SIC: 3531

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	NQA	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.01002	0.00277	0.01174	117.14	-0.00350	0.03977
	1	0.009904	0.000587	0.001858	18.76	0.007759	0.013368
EPS	0	0.662	0.196	0.830	125.44	-0.200	3.040
	1	0.7390	0.0385	0.1217	16.47	0.5700	0.9200
Current Ratio	0	1.8267	0.0937	0.3974	21.76	1.3442	2.4469
	1	1.4987	0.0178	0.0564	3.76	1.4348	1.5916
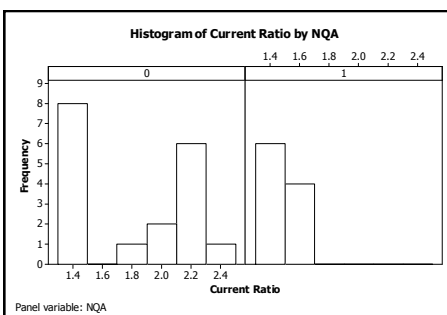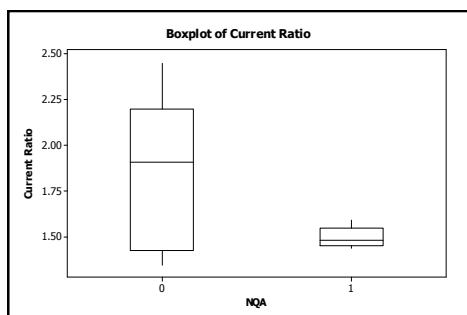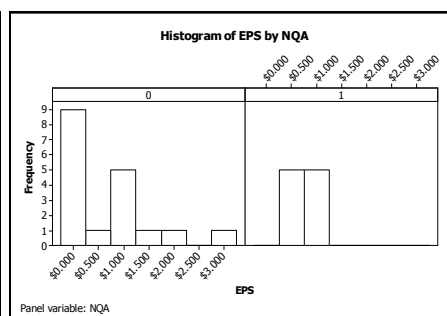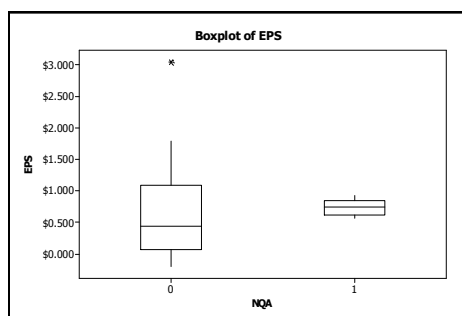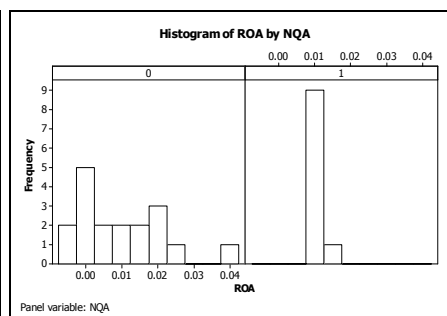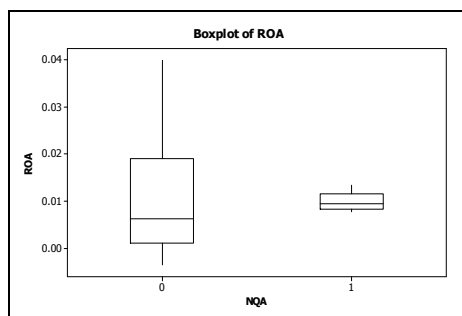
Results for: 3577 All

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	NQA	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.02906	0.00419	0.01874	64.49	0.00575	0.05856
	1	0.00898	0.00404	0.01277	142.23	-0.02457	0.02045
EPS	0	0.5990	0.0838	0.3746	62.53	0.1500	1.3000
	1	0.518	0.339	1.073	207.18	-2.190	1.790
Current Ratio	0	1.5564	0.0187	0.0835	5.36	1.3546	1.6954
	1	1.5120	0.0383	0.1212	8.01	1.3699	1.7293
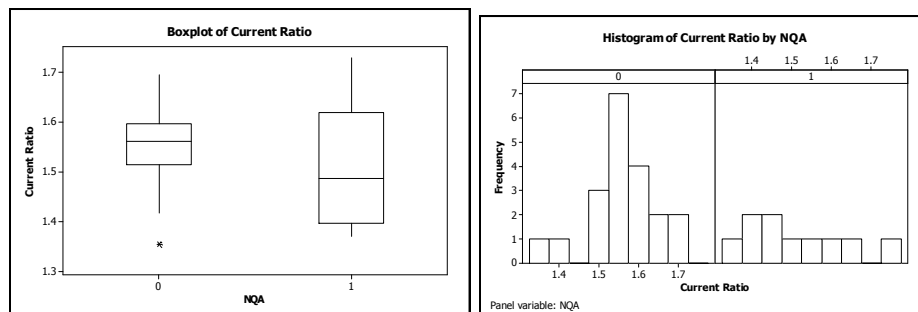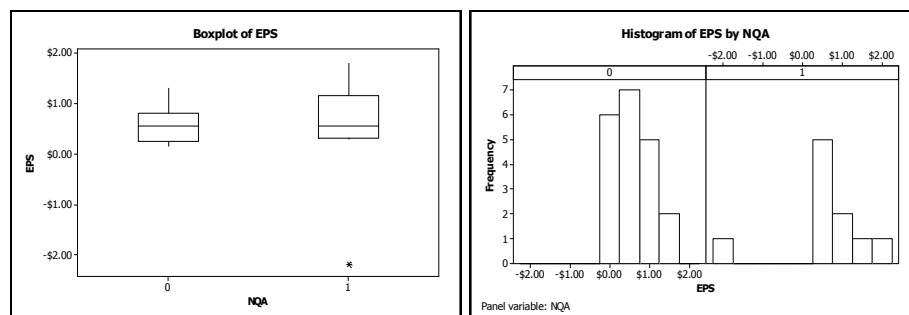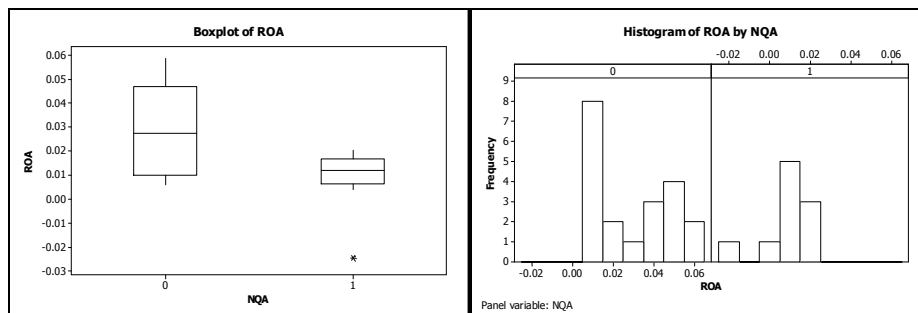
Year of MBNQA Award: 1997   Company: 3M Co.SIC: 2670

Results for: SIC 2670

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	NQA	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.02190	0.00376	0.02223	101.50	-0.01347	0.12478
	1	0.03100	0.00483	0.01528	49.29	0.01275	0.06907
EPS	0	0.840	0.226	1.354	161.23	-0.850	7.590
	1	1.033	0.152	0.480	46.44	0.440	2.210
Current Ratio	0	1.5215	0.0816	0.4826	31.72	0.6832	2.3042
	1	1.5806	0.0466	0.1474	9.33	1.4405	1.9015
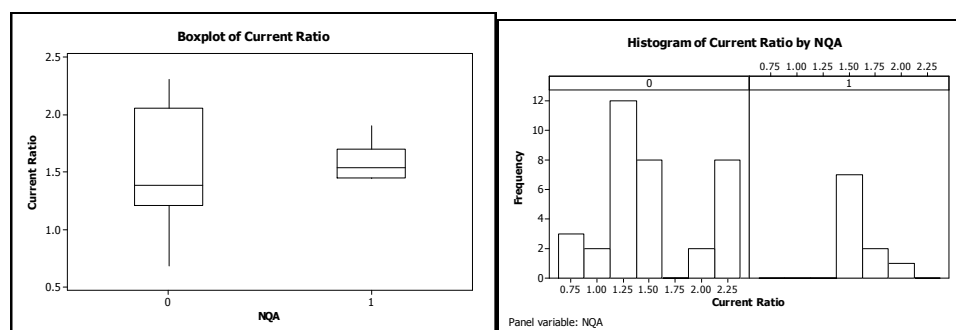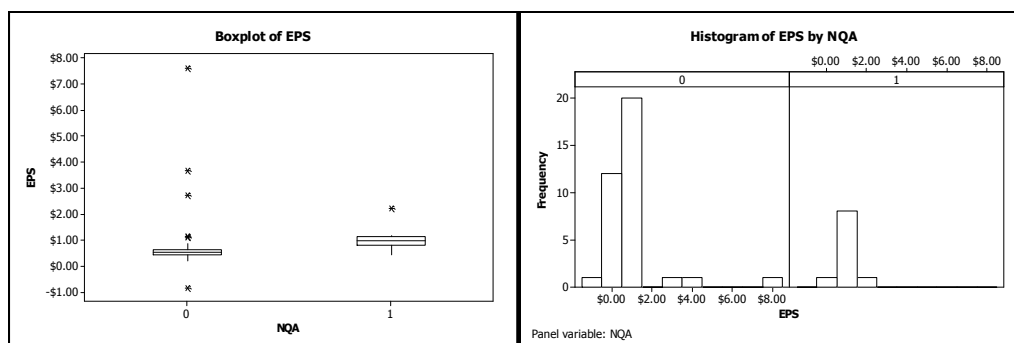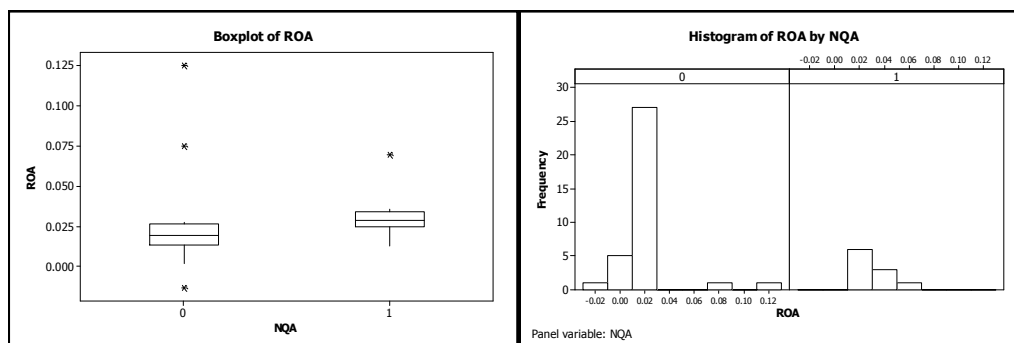
Year of MBNQA Award: 1997   Company: Solectron Corp.   SIC: 3672

Results for: SIC 3672

Descriptive Statistics: ROA, EPS, Current Ratio

Variable	NQA	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.01822	0.00355	0.02456	134.83	-0.08079	0.05585
	1	0.024000	0.000676	0.002138	8.91	0.021408	0.028016
EPS	0	0.264	0.115	0.794	300.57	-4.540	0.930
	1	0.4270	0.0399	0.1261	29.52	0.2800	0.7100
Current Ratio	0	1.951	0.116	0.804	41.20	1.199	4.959
	1	2.653	0.137	0.433	16.32	2.011	3.588

Boxplot of Current Ratio

Histogram of Current Ratio by NQA
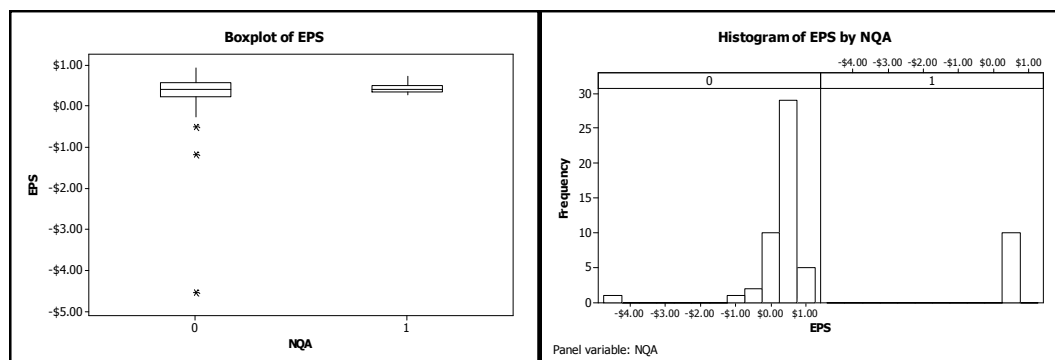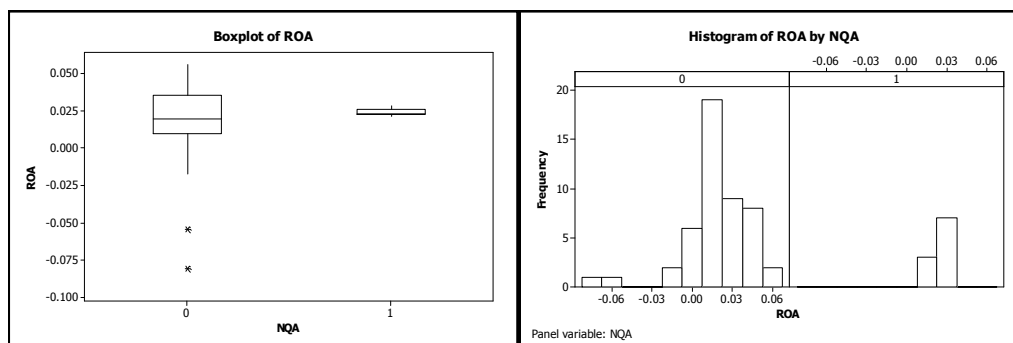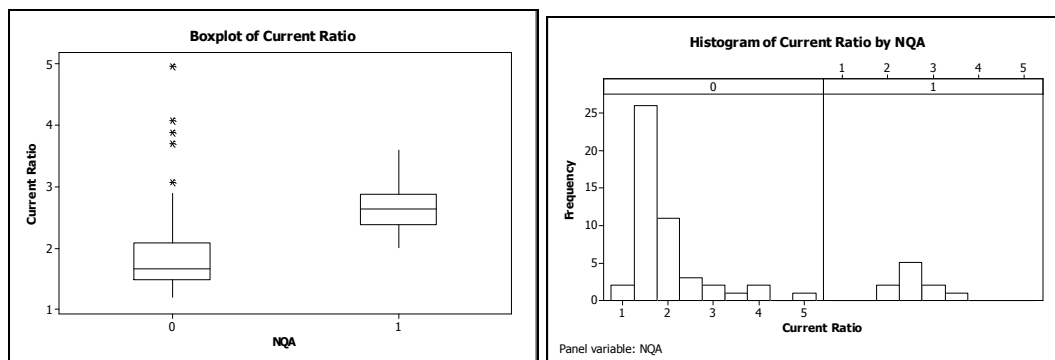
Year of MBNQA Award: 1997   Company: Merrill Lynch SIC: 6211

Results for: SIC 6211

Descriptive Statistics: ROA, EPS

Variable	NQA	Mean	SE Mean	StDev	CoefVar	Minimum	Maximum
ROA	0	0.001741	0.000122	0.001062	61.03	-0.001365	0.004450
	1	0.001543	0.000250	0.000790	51.22	-0.000461	0.002417
EPS	0	1.1856	0.0744	0.5903	49.80	-0.0900	2.8400
	1	1.160	0.194	0.613	52.84	-0.420	1.820

Boxplot of ROA

Histogram of ROA by NQA

Boxplot of EPS

Histogram of EPS by NQA
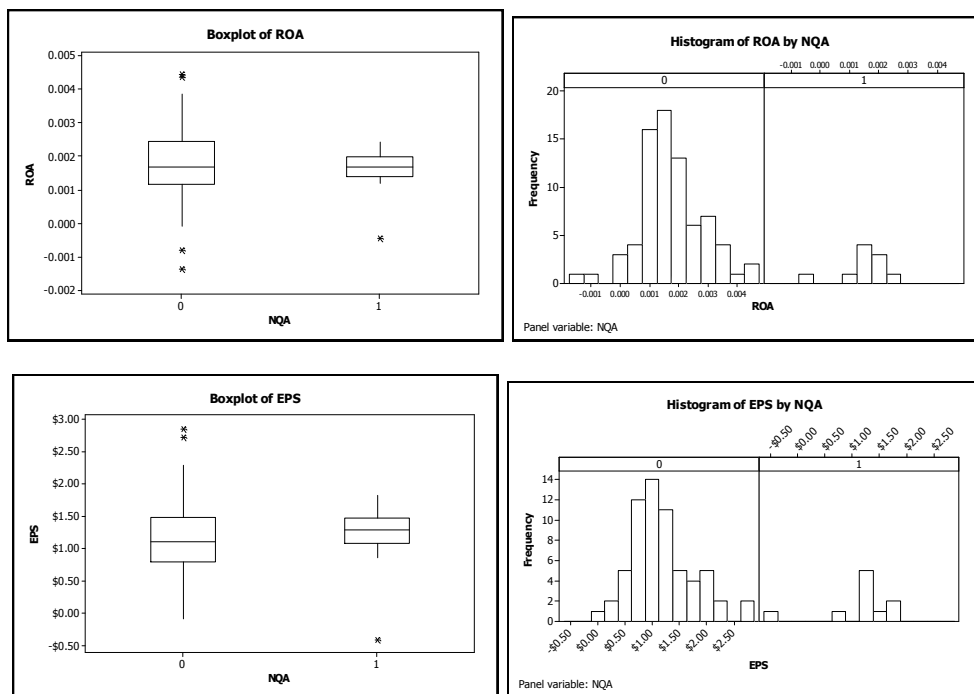
The following section contains the results of the Normality Tests for each of the three research variables for the firms in each of the SIC groups. The purpose of this procedure is to determine whether to use parametric or nonparametric hypothesis tests in order to answer research question 2, pertaining to research Hypotheses 4 – 6.

The Normality Test function in MINITAB 15 was used. This procedure produced the p-value for each of the variables to determine whether the data displayed normal or non-normal distribution. The results of this determination were used as the basis for either parametric or nonparametric hypothesis testing procedures in order to produce the hypotheses test results contained in the next section.

Each of the graphs that follow contains all three test variables in one graphic. Each of the plots within the graphic is laid out in the same way with the variable metric value on the x-axis and the percentage of the total on the y-axis. A summary of the normality tests follows at the end of this section.

Year of MBNQA Award: 2003   Company: Boeing Co.   SIC: 3721

SIC 3721 Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	0.005826
StDev	0.01591
N	10
AD	0.237
P-Value	0.711

EPS	
Mean	0.313
StDev	0.8952
N	10
AD	0.344
P-Value	0.408

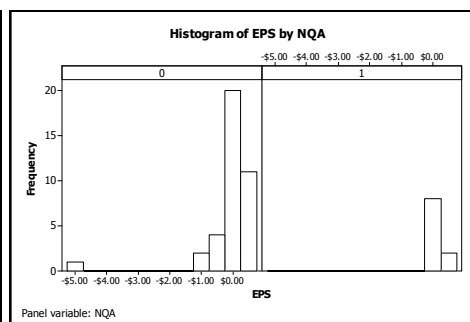| Current Ratio	
Mean	0.8692
StDev	0.05571
N	10
AD	0.370
P-Value	0.352

Year of MBNQA Award: 2002   Company: Motorola Inc.   SIC: 3663

Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	-0.01723
StDev	0.02801
N	10
AD	0.403
P-Value	0.289

EPS	
Mean	-0.203
StDev	0.4682
N	10
AD	0.125
P-Value	0.977

Current Ratio	
Mean	1.493
StDev	0.2007
N	10
AD	0.446
P-Value	0.221

Year of MBNQA Award: 1998   Company: Solar Turbine (Caterpillar) SIC: 3531

Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	0.009978
StDev	0.009374
N	28
AD	0.554
P-Value	0.139

EPS	
Mean	0.6893
StDev	0.6634
N	28
AD	1.016
P-Value	0.009

Current Ratio	
Mean	1.710
StDev	0.3552
N	28
AD	2.502
P-Value	<0.005

Year of MBNQA Award: 1997   Company: Xerox Business Services SIC: 3577

Year of MBNQA Award: 1997   Company: 3M Co.SIC: 2670
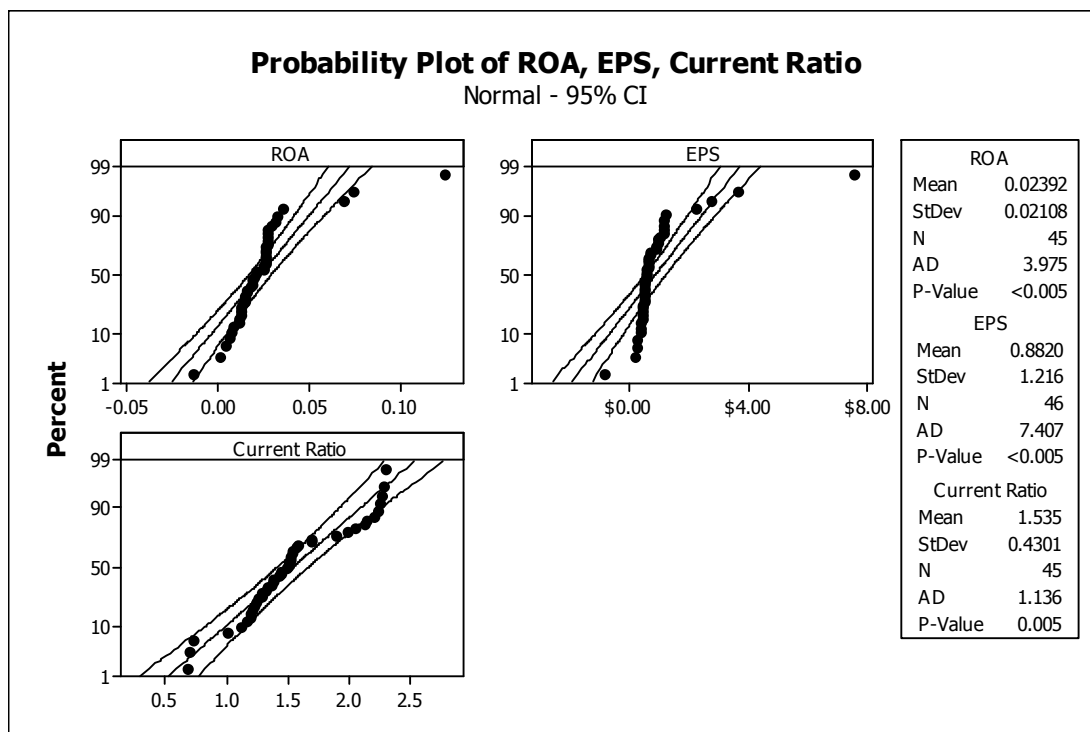
Year of MBNQA Award: 1997   Company: Solectron Corp.   SIC: 3672
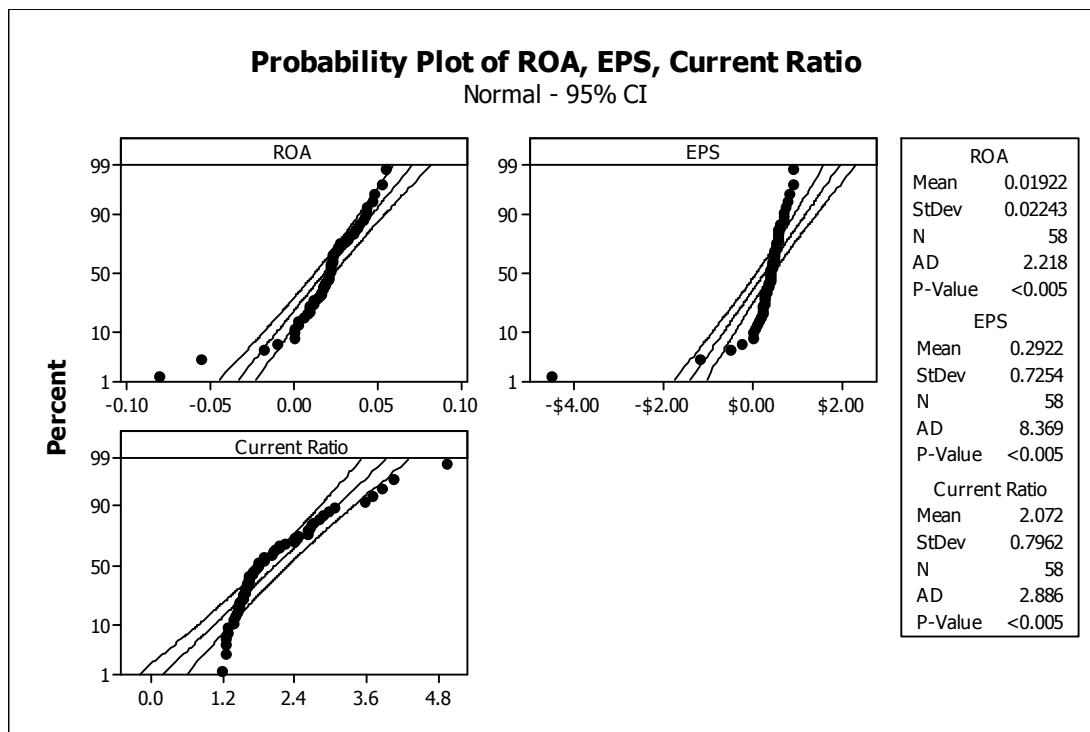
Probability Plot of ROA, EPS, Current Ratio
Normal - 95% CI

ROA	
Mean	0.01922
StDev	0.02243
N	58
AD	2.218
P-Value	<0.005
EPS	
Mean	0.2922
StDev	0.7254
N	58
AD	8.369
P-Value	<0.005
Current Ratio	
Mean	2.072
StDev	0.7962
N	58
AD	2.886
P-Value	<0.005

Year of MBNQA Award: 1997   Company: Merrill Lynch SIC: 6211

Probability Plot of ROA, EPS
Normal - 95% CI

ROA	
Mean	0.001718
StDev	0.001033
N	86
AD	0.994
P-Value	0.012
EPS	
Mean	1.182
StDev	0.5892
N	73
AD	0.652
P-Value	0.085
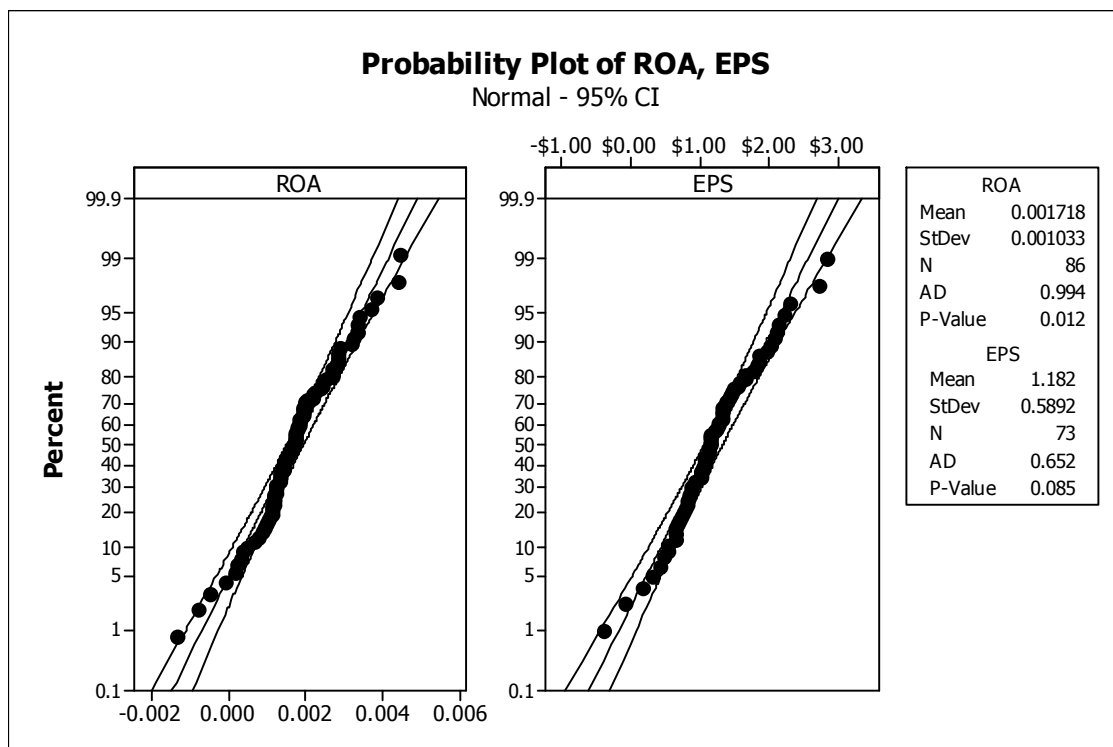
Summary of Results of the Normality Tests for SICs

The following table contains a summary of normality tests. The decision factor of normality for this study was the *p*-value level. If the *p*-value exceeded the alpha of .05, then the null hypothesis of a normal data distribution was not rejected. The cells of the summary table that are colored indicated statistical significance, while the cells that contain no background color are not statistically significant, at the .05 alpha level.

Table 14

Results of Normality Tests for Research Question 2

					io est
2002	3663	0.289	0.977	0.221	
1998	3531	0.139	0.009*	0.005* *	*
1997	3577	0.005*	0.005*	* 0.78	
1997	2670	0.005*	0.005*	* 0.005* *	
1997	3672	0.005*	0.005*	* 0.005* *	*
1997	6211	0.012	0.085		

* Statistically significant at the .05 level

Based on the data shown in Table 14, Table 15 shows the hypothesis testing strategy to

be used for the SIC groups.

Table 15

Statistical Test Decision Results for Research Question 2

Award Year	SIC	ROA Test Used	ROA Test Used	Current Ratio Test Used
2003	3721	2 sample t test	2 sample t test	2 sample t test
2002	3663	2 sample t test	2 sample t test	2 sample t test
1998	3531	2 sample t test	Mann-Whitney test	Mann-Whitney test
1997	3577	Mann-Whitney test	Mann-Whitney test	2 sample t test
1997	2670	Mann-Whitney test	Mann-Whitney test	Mann-Whitney test
1997	3672	Mann-Whitney test	Mann-Whitney test	Mann-Whitney test
1997	6211	Mann-Whitney test	2 sample t test	Mann-Whitney test

Results of Hypothesis Testing

Depending on whether the previous results indicated normal or non-normal distribution, either two sample *t*-tests or Mann-Whitney tests were used. The hypothesis test results for each of the MBNQA-winning firms follows. All tests were performed using MINITAB 15. A summary table follows showing the company, test used and significance level for each of the three variables tested. Of key importance is the *p*-value indicated for each test. If the *p*-value is below the alpha of .05, then was a statistically significant change in the mean value for that variable from the 10 quarterly periods before the winning of an NQA, to the 10 quarterly periods after. In the tests that follow, the variable NQA can have two values, 0 or 1, where 0 is a dummy variable to represent non-NQA-winning firms within the SIC during the study period. The value of 1 for the variable NQA represents the NQA-winning companies during the study period. The N value in the following tables are the number of firms being tested. Whereas the *n* value is a constant of 10 quarterly periods for the NQA-winning firms, the *n* value for the non-NQA-winning firms varies depending on the number of key competitors within the SIC for the study period. These results are summarized at the end of this section.

Year of MBNQA Award: 2003   Company: Boeing Co.   SIC: 3721

Results for: SIC 3721

Two-Sample T-Test and CI: ROA, NQA

```
Two-sample T for ROA

NQA   N      Mean     StDev   SE Mean

0    24   0.00147   0.00966   0.0020

1    10   0.01051   0.00539   0.0017

Difference = mu (0) - mu (1)

Estimate for difference:  -0.00905

95% CI for difference:  (-0.01438, -0.00371)

T-Test of difference = 0 (vs not =): T-Value = -3.47  P-Value = 0.002  DF = 28
```


Boxplot of ROA
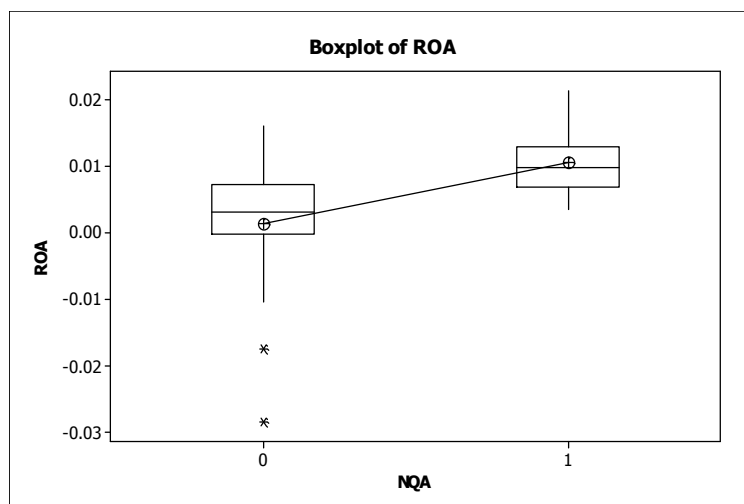
Two-Sample T-Test and CI: EPS, NQA

```
Two-sample T for EPS

NQA   N   Mean  StDev  SE Mean

0    24  0.205  0.555    0.11

1    10  0.722  0.367    0.12

Difference = mu (0) - mu (1)

Estimate for difference:  -0.517

95% CI for difference:  (-0.852, -0.183)

T-Test of difference = 0 (vs not =): T-Value = -3.19  P-Value = 0.004  DF = 25
```


Boxplot of EPS
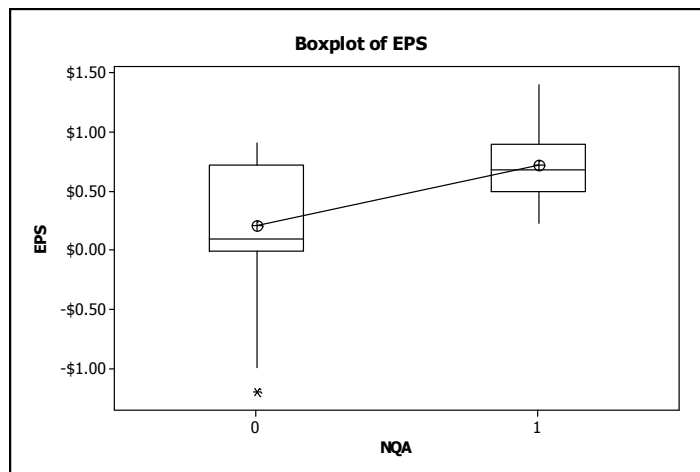
Two-Sample T-Test and CI: Current Ratio, NQA

```
Two-sample T for CR

NQA   N    Mean    StDev   SE Mean

0     24   1.133   0.203    0.041

1     10   0.8017  0.0743   0.024

Difference = mu (0) - mu (1)

Estimate for difference:  0.3310

95% CI for difference:  (0.2339, 0.4282)

T-Test of difference = 0 (vs not =): T-Value = 6.95  P-Value = 0.000  DF = 31
```


Boxplot of Current Ratio
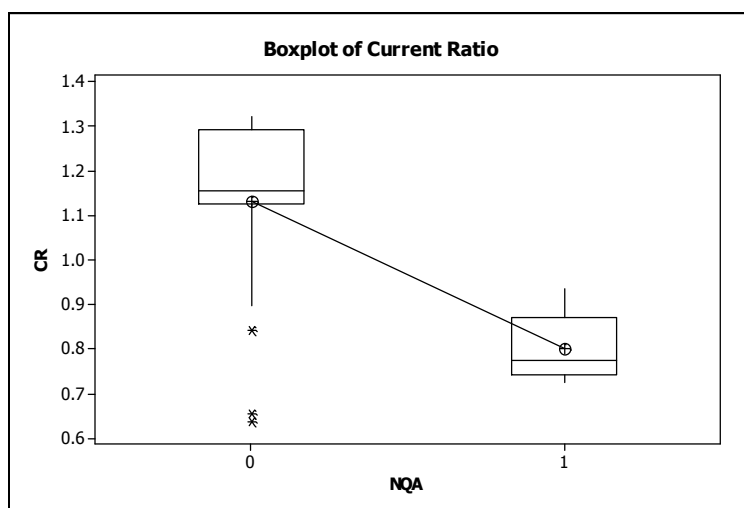
Year of MBNQA Award: 2002   Company: Motorola Inc.   SIC: 3663

Results for: SIC 3663

Two-Sample T-Test and CI: ROA, NQA

```
Two-sample T for ROA

NQA   N     Mean     StDev   SE Mean

0     45   -0.0067   0.0802   0.012

1     10   0.00853   0.00842  0.0027

Difference = mu (0) - mu (1)

Estimate for difference:  -0.0152

95% CI for difference:  (-0.0399, 0.0094)
```

T-Test of difference = 0 (vs not =): T-Value = -1.24 P-Value = 0.220 DF = 47
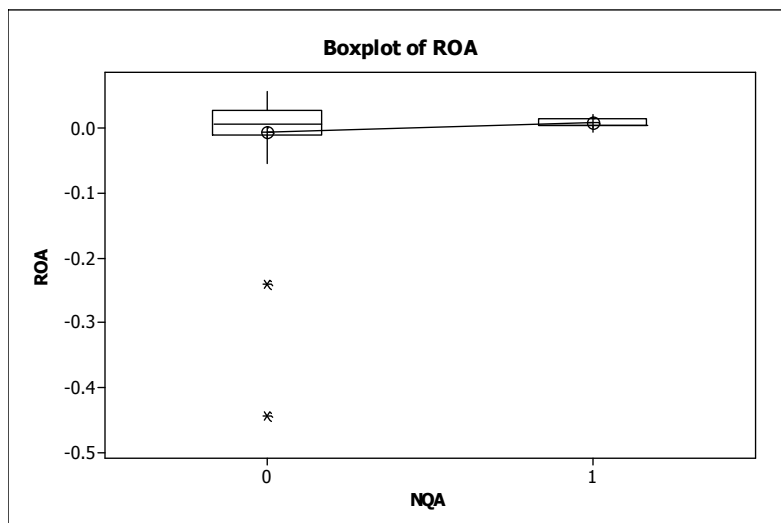
Two-Sample T-Test and CI: EPS, NQA

```
Two-sample T for EPS

NQA   N    Mean   StDev  SE Mean

0    38  -0.071  0.909    0.15

1    10   0.112  0.111    0.035

Difference = mu (0) - mu (1)

Estimate for difference:  -0.183

95% CI for difference:  (-0.489, 0.124)

T-Test of difference = 0 (vs not =): T-Value = -1.21  P-Value = 0.235  DF = 40
```
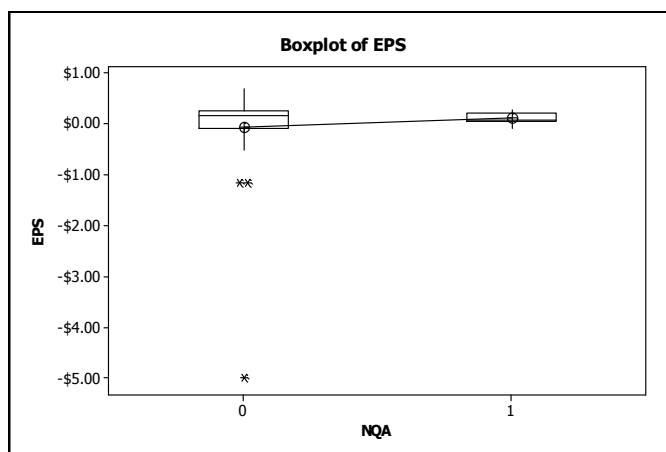
Two-Sample T-Test and CI: Current Ratio, NQA

```
Two-sample T for Current Ratio

NQA   N    Mean   StDev   SE Mean

0     45   1.934  0.483   0.072

1     10   1.905  0.107   0.034

Difference = mu (0) - mu (1)

Estimate for difference:  0.0293

95% CI for difference:  (-0.1304, 0.1889)

T-Test of difference = 0 (vs not =): T-Value = 0.37   P-Value = 0.715   DF = 52
```


Boxplot of Current Ratio
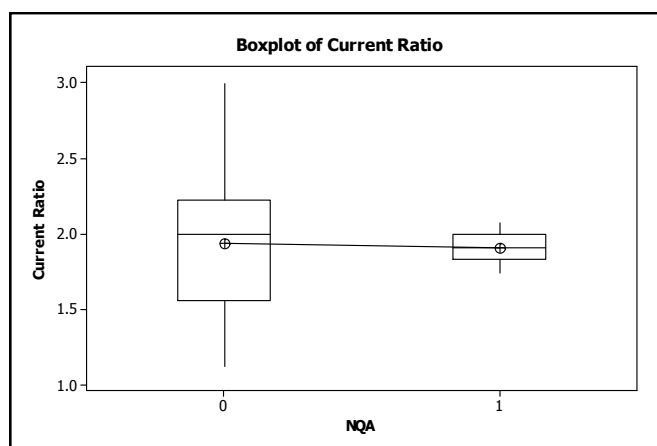
Year of MBNQA Award: 1998   Company: Solar Turbine (Caterpillar) SIC: 3531

Results for: SIC 3531

Two-Sample T-Test and CI: ROA, NQA

```
Two-sample T for ROA

NQA   N     Mean    StDev   SE Mean

0     18   0.0100   0.0117  0.0028

1     10   0.00990  0.00186 0.00059

Difference = mu (0) - mu (1)

Estimate for difference:  0.00011

95% CI for difference:  (-0.00583, 0.00605)

T-Test of difference = 0 (vs not =): T-Value = 0.04   P-Value = 0.968   DF = 18
```

Boxplot of ROA
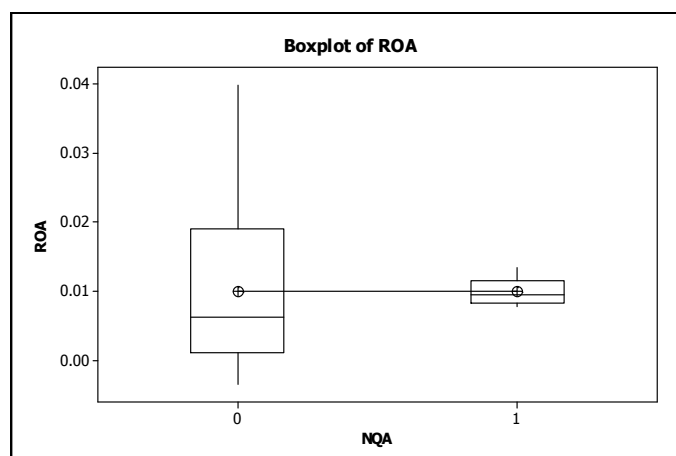
Results for: SIC 3531

Mann-Whitney Test and CI: EPS_1, EPS_0

```
        N  Median

EPS_1  10  0.7450

EPS_0  18  0.4425

Point estimate for ETA1-ETA2 is 0.3025

95.3 Percent CI for ETA1-ETA2 is (-0.2901,0.6898)

W = 156.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.6147

The test is significant at 0.6145 (adjusted for ties)
```

Mann-Whitney Test and CI: Current Ratio_1, Current Ratio_0

```
                 N  Median

Current Ratio_1  10  1.4797

Current Ratio_0  18  1.9053

Point estimate for ETA1-ETA2 is -0.3921

95.3 Percent CI for ETA1-ETA2 is (-0.6720,0.0447)

W = 126.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.3751
```

Year of MBNQA Award: 1997   Company: Xerox Business Services SIC: 3577

Results for: SIC 3577

Mann-Whitney Test and CI: ROA_0, ROA_1

```
        N   Median

ROA_0  20  0.02741

ROA_1  10  0.01182

Point estimate for ETA1-ETA2 is 0.02181

95.5 Percent CI for ETA1-ETA2 is (0.00144,0.03475)

W = 359.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0329
```

Mann-Whitney Test and CI: EPS_0, EPS_1

```
        N   Median

EPS_0  20   0.555

EPS_1  10   0.550

Point estimate for ETA1-ETA2 is -0.090

95.5 Percent CI for ETA1-ETA2 is (-0.490,0.310)

W = 296.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.5526

The test is significant at 0.5523 (adjusted for ties)
```

Two-Sample T-Test and CI: Current Ratio, NQA

```
Two-sample T for Current Ratio

NQA  N    Mean   StDev  SE Mean

0    20  1.5564  0.0835   0.019

1    10  1.512   0.121    0.038

Difference = mu (0) - mu (1)

Estimate for difference:  0.0444

95% CI for difference:  (-0.0477, 0.1365)

T-Test of difference = 0 (vs not =): T-Value = 1.04  P-Value = 0.316  DF = 13
```

Boxplot of Current Ratio
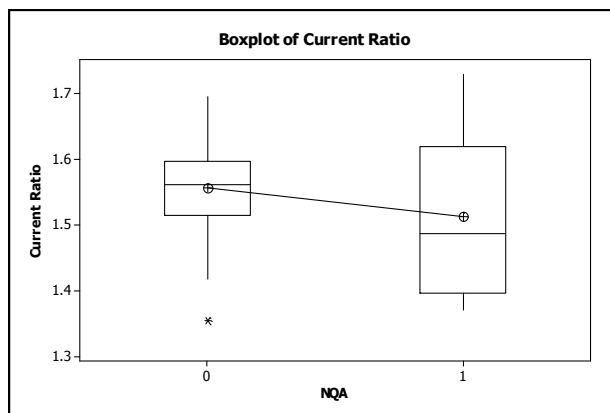
Year of MBNQA Award: 1997   Company: 3M Co.   SIC: 2670

Results for: SIC 2670

Mann-Whitney Test and CI: ROA_0, ROA_1

```
         N   Median

ROA_0  35  0.01926

ROA_1  10  0.02861

Point estimate for ETA1-ETA2 is -0.00950

95.2 Percent CI for ETA1-ETA2 is (-0.01739,-0.00228)

W = 696.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0031
```

Mann-Whitney Test and CI: EPS_0, EPS_1

```
         N   Median

EPS_0  36  0.5200

EPS_1  10  0.9650

Point estimate for ETA1-ETA2 is -0.4500

95.3 Percent CI for ETA1-ETA2 is (-0.6101,-0.1800)

W = 744.5

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0072

The test is significant at 0.0071 (adjusted for ties)
```

Mann-Whitney Test and CI: Current Ratio_0, Current Ratio_1

```
                 N  Median

Current Ratio_0  35  1.3799

Current Ratio_1  10  1.5347

Point estimate for ETA1-ETA2 is -0.1659

95.2 Percent CI for ETA1-ETA2 is (-0.3283,0.1095)

W = 758.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.2043
```

Year of MBNQA Award: 1997   Company: Solectron Corp.   SIC: 3672

Results for: SIC 3672

Mann-Whitney Test and CI: ROA_0, ROA_1

```
       N   Median

ROA_0  48  0.01940

ROA_1  10  0.02318

Point estimate for ETA1-ETA2 is -0.00451

95.1 Percent CI for ETA1-ETA2 is (-0.01256,0.00621)

W = 1346.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.1525
```

Mann-Whitney Test and CI: EPS_0, EPS_1

```
       N   Median

EPS_0  48  0.4150

EPS_1  10  0.4050

Point estimate for ETA1-ETA2 is -0.0150

95.1 Percent CI for ETA1-ETA2 is (-0.1700,0.1200)

W = 1405.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.8289

The test is significant at 0.8288 (adjusted for ties)
```

Mann-Whitney Test and CI: Current Ratio_0, Current Ratio_1

```
                 N  Median

Current Ratio_0  48  1.6590

Current Ratio_1  10  2.6313

Point estimate for ETA1-ETA2 is -0.8856

95.1 Percent CI for ETA1-ETA2 is (-1.1480,-0.5495)

W = 1251.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0007
```

Year of MBNQA Award: 1997   Company: Merrill Lynch   SIC: 6211

Results for: SIC 6211

Mann-Whitney Test and CI: ROA_0, ROA_1

```
        N   Median

ROA_0  76  0.00167

ROA_1  10  0.00167

Point estimate for ETA1-ETA2 is 0.00000

95.0 Percent CI for ETA1-ETA2 is (-0.00046,0.00068)

W = 3307.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.9946
```

Two-Sample T-Test and CI: EPS, NQA

```
Two-sample T for EPS

NQA  N   Mean  StDev  SE Mean

0   63  1.186  0.590   0.074

1   10  1.160  0.613    0.19

Difference = mu (0) - mu (1)

Estimate for difference:  0.026

95% CI for difference:  (-0.431, 0.483)

T-Test of difference = 0 (vs not =): T-Value = 0.12  P-Value = 0.904  DF = 11
```

Boxplot of EPS
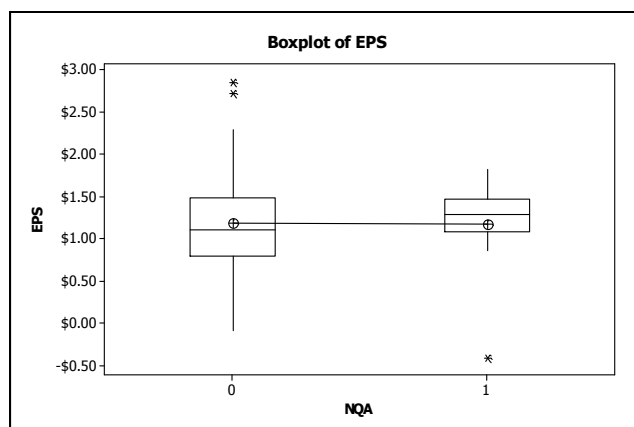
Test of Hypothesis 4

H$_0$4: There is no difference in ROA for NQA-winning firms and comparable

firms of key competitors.

H$_1$4: There is a statistically significant difference in ROA for NQA-winning

firms and comparable firms of key competitors.

Table 16

Results of Hypothesis Test 4

Award Year	SIC	ROA Significance test P-value
2003	3721	0.002*
2002	3663	0.220
1998	3531	0.968
1997	3577	0.033*
1997	2670	0.003*
1997	3672	0.153
1997	6211	0.995

*Statistically significant at the .05 level

The previous tests indicate significance for the SIC codes 2670, 3577, and 3721.

Test of Hypothesis 5

$H_0 5$:   There is no difference in the current ratio for NQA-winning firms and

comparable firms of key competitors.

$H_1 5$:   There is a statistically significant difference in the current ratio for NQA-

winning firms and comparable firms of key competitors.

Table 17

Results of Hypothesis Test 5

Award Year	SIC	EPS Significance test P-value	
2003	3721	0.004*	*
2002	3663	0.235	
1998	3531	0.6145	
1997	3577	0.5526	
1997	2670	0.0072*	*
1997	3672	0.8289	
1997	6211	0.904	

*Statistically significant at the .05 level

The previous tests indicted significance for the SIC codes 2670 and 3721.

Test of Hypothesis 6

$H_0 6$:   There is no difference in EPS for NQA-winning firms and comparable

firms of key competitors.

$H_1 6$:   There is a statistically significant difference in EPS for NQA-winning

firms and comparable firms of key competitors.

Table 18

Results of Hypothesis Test 6

Award Year	SIC	Current ratio Significance test P-value	
2003	3721	0.000*	*
2002	3663	0.715	
1998	3531	0.3751	
1997	3577	0.316	
1997	2670	0.2043	
1997	3672	0.0007*	*
1997	6211		

Note. Current ratio data not available for SIC 6211 from EDGAR.

*Statistically significant at the .05 level

The previous tests indicate significance for the SIC codes 3772 and 3721.

Summary

        The purpose of this section is to consolidate and summarize the findings of the

multiple comparison tests noted in the previous text. This study tested the research

hypotheses by using multiple *t*-tests that produced a microarray of test results. As such,

the tests provide a high degree of certainty in each of the tests individually and the tests

were designed to address the specific research questions in relations to the three study

variables.

        However, associated with the practice of performing multiple comparisons is the

increase in the probability of committing a Type I error. That is, the probability of

committing a Type I error increases as the number *t*-tests increase. This is called the

family-wise error rate. This likelihood of committing a false positive can be calculated by

for a single test:

$$1 - \alpha = 1 - .05 = .95$$

as the alpha level used throughout this study is .05. Consequently, the risk of committing

a Type I error increases accordingly:

$$1 - .95^{k}$$

where k is the number of tests performed.

To counter the risk of a Type I error, a Bonferroni adjustment of the alpha level

was considered for use to adjust the significance level for the individual tests. In this

single-step procedure, the level of significance of the alpha (.05 for this study) is

decreased by dividing it by the number of tests performed (Marczyk, DeMatteo, &

Destinger, 2005; Myers & Well, 2003; Thyer, 2008). For example, if five t-tests were

performed for a research hypothesis, than the level of significance for any one of the tests

would be calculated as:

$$.05 / 5 = .01$$

However, using the Bonferroni adjustment also raises concerns as the number of

tests increases. The results may be considered too conservative as the number of

comparison tests increase. For example, after only 10 tests, the Bonferroni adjustment

changes a typical alpha of .05 to, .005. To counter this conservatism and to provide a

more powerful answer, the Holm's sequential Bonferroni adjustment was used in this

study. The Holm's step-down procedure starts with the Bonferroni techniques and then

performs a sequential series of rejections in that it examines each test in an ordered

sequence of the level of significance (Holm, 1979). In this procedure, " values are ranked

from largest to smallest and the smallest P value is tested at alpha/c, the next at alpha/(c-1), the next at alpha/(c-2), etc" (Quinn & Keough, 2002, p. 50). More specifically, the procedure for performing the Holm's multi-step procedure in this study is:

1. Individual tests were conducted for each of the research hypotheses using the appropriate parametric or nonparametric test

2. The results were then rank ordered from the smallest to the largest probability values

3. The smallest *p*-value was then tested against a critical value of .05 divided by the number of tests performed within that family group. This derives the Holm's adjusted Bonferroni value.

4. The second smallest *p*-value was then tested against a critical value of .05 divided by the number of tests performed minus 1, and so on for the remainder of the tests within that family group.

5. The alpha levels were compared to the rankings to identify the statistically significant comparisons

6. Once a difference was not found to be statistically significant, all subsequent tests were declared nonsignificant (Jones, 1998).

Summary of Data for Research Question 1

The following tables contain a summary of the data produced so far regarding the significance tests of the two research questions. Additional columns were added to both tables to add a column to show the Holm's sequential Bonferroni adjustment, abbreviated HSBA in the following columns. The procedure from the preceding paragraph was followed in order to resort each of the columns in order to make family-wise comparisons

based on the unadjusted significance values of the underlying hypothesis tests, either the parametric or the nonparametric test, as appropriate. Consequently, each of the research variables tested have a different sort order as the order is solely based on the ascending value of the underlying *p*-value.

Summary Data for Research Question 1

The information in the following table relates to research hypotheses 1 through 3, the ROA, EPS and the current ratio and is represented in the following columns labeled; ROA Significance test P-value, EPS Significance test P-value, and Current ration Significance test P-value. These hypotheses were tested by comparing the individual company performance before and after winning the NQA, 10 quarterly periods before and 10 quarterly periods after the middle of the year of the award date. Then the columns labeled ROA HSBA Sig, EPS HSBA SIG and Current ratio HSBA Sig, were added to perform the Holm's sequential Bonferroni adjustment.

Table 19

Summary Results for HSBA Tests for Research Question 1

Company	ROA Significance test P-value	ROA HSBA Sig	Company	EPS Significance test P-value	EPS HSBA Sig	Company	Current ratio Significance test P-value	Current ration HSBA Sig
Solar Turbine (Caterpillar)	0.006 ∗	0.00714	Solar Turbine (Caterpillar)	0.006 ∗	0.00714	Motorola Inc.	0.000 ∗	0.00714
Motorola Inc.	0.041	0.00833	Solectron	0.03	0.00833	3M Co.	0.001 ∗	0.00833
Xerox Business Services	0.103	0.01000	Merrill Lynch	0.041	0.01000	Boeing Co.	0.024	0.01000
3M Co.	0.262	0.01250	Motorola Inc.	0.154	0.01250	Solar Turbine (Caterpillar)	0.154	0.01250
Solectron	0.283	0.01667	3M Co.	0.221	0.01667	Solectron	0.603	0.01667
Boeing Co.	0.411	0.02500	Boeing Co.	0.308	0.02500	Xerox Business Services	0.946	0.02500
Merrill Lynch	0.76	0.05000	Xerox Business Services	0.359	0.05000	Merrill Lynch		0.05000

*Statistically significant for HSBA at the .05 level

Interpretation of the Data for Research Question 1

Table 20 indicates only four statistically significant data points at the .05 alpha level using the HSBA technique. The Solar Turbine Company did perform better before and after winning the NQA in the variables of ROA and EPS, which corresponds to research hypotheses 1 and 2. In the research variable of current ratio, which corresponds to research hypothesis 3, Motorola and the 3M company performed better after winning their NQA than before.

Summary of Data for Research Question 2

The information in the following table relates to research hypotheses 4 through 6, concerning the research variables ROA, EPS and current ratio. These hypotheses were tested by comparing the performance of the NQA-winning firm with the key competitors within the primary SIC of the winning firm. It is measured for 10 quarterly periods from the middle of the year of the award date.

Again, the same procedure is used in Table 22 as is used in Table 21: The individual research hypotheses were sorted by their unadjusted *p*-values and then the Holm's sequential Bonferroni adjustments were made.

Table 19

Summary Results for HSBA Tests for Research Question 2

SIC	ROA Significance test P-value	ROA HSBA Sig	SIC	EPS Significance test P-value	ROA HSBA Sig	SIC	Current ratio Significance test P-value	ROA HSBA Sig
3721	0.002 *	0.00714	3721	0.004 *	0.00714	3721	0.000 *	0.00714
2670	0.003 *	0.00833	2670	0.0072 *	0.00833	3672	0.0007 *	0.00833
3577	0.033	0.01000	3663	0.235	0.01000	2670	0.2043	0.01000
3672	0.153	0.01250	3577	0.5526	0.01250	3577	0.316	0.01250
3663	0.220	0.01667	3531	0.6145	0.01667	3531	0.3751	0.01667
3531	0.968	0.02500	3672	0.8289	0.02500	3663	0.715	0.02500
6211	0.995	0.05000	6211	0.904	0.05000	6211		0.05000

*Statistically significant for HSBA

Interpretation of the Data for Research Question 2

The previous table indicates only six statistically significant data points at the .05 alpha level using the HSBA technique. The NQA-winning firms performed better than their key competitors in the SIC categories of 3721 and 2670 for the research variables of ROA and EPS, which correspond to research hypotheses 4 and 5. The NQA-winning firms out-performed their key competitors in the SIC categories of 3721 and 3672, for current ratio, which corresponds to research hypothesis 6.

Chapter V

Summary and Conclusions

Overview of Study

This study examined the impact on performance results and shareholder value for firms that won a Malcolm Baldrige National Quality Award. Past researchers often addressed shareholder value by focusing on the winning company's stock price (Easton & Jarrell, 1998; Singhal & Hendricks, 2001). This is a credible approach and conforms to the tenets of the random walks theory which state that a company's stock price will adjust according to the inherent value of the firm (Koop, 2000; Malkiel, 2005). The research questions in the preceding studies were tested by the change in the company's stock price before and after winning an NQA. Nevertheless, other researchers did not find the association between share price and firm value to be universal thereby this conclusion would sever the linkage between company performance and shareholder value. It is because of this dissonance that this study used three financial performance metrics instead of the stock price to determine shareholder value. The ones chosen for this study were ROA, EPS and current ratio. These were chose as they represented key elements of the income statement and balance sheet and widely accepted in accounting and investment circles as key measures of firm performance. The use of the current ratio in determining shareholder value also introduced the element of financial risk into the determination.

The literature review for this study included a review of literature in the areas of shareholder value and shareholder/stakeholder theory, research and statistical techniques, quality management and various quality competitions such as the NQA.

There are two research questions in this study. First, did the performance of firms that won a NQA improve their financial performance thereby potentially increasing shareholder return? Second, was the performance of NQA-winning firms better than the performance of other key competitors within the primary SIC category of the NQA-winning firm, measuring those same three financial performance metrics?

Three research variables were chosen to perform hypothesis testing on. These were the ROA, EPS and the current ratio. These three were selected because of their immediate relation to shareholder value. These metrics are also widely used throughout the financial and investment communities. The underlying metrics for these variables are also associated with income statements and balance sheets, and required for reporting to the U.S. Securities and Exchange Commission for firms that publically trade their stock.

Methodologically, this study used t-tests, and nonparametric equivalents, in order to provide a dichotomous answer to the research questions 1 through 6. Prior to performing the hypothesis testing however, tests were run to determine the normality of the data of the company or SIC under examination. If the normality tests showed a normal distribution of data points, parametrics testing was used, otherwise, nonparametric equivalent tests were used. To aid in the understanding of the data, graphical displays were used throughout to enable an exploratory data analysis, prior to hypothesis testing. In Chapter IV, the results of the many hypothesis tests were arranged in microarrays in order to answer the specific hypotheses tests. Finally, because of the number of tests involve, the significance levels for each of the hypotheses tests were adjusted using the Holm's sequential Bonferroni technique in order to minimize the risk of a Type I error.

Summary of Study Results

The below tables contain a summary of the tests that were statistically significant. The study found that for research question 1, only Solar Turbine, Motorola, and 3M Co. showed evidence of improvement in their performance for the research variables under study. No company showed an improvement in performance in all three research variables following their winning of a NQA.

Table 21

Summary of Significant Results from Research Question 1

SIC CODE	NQA-winning Firm	Hypothesis #	Research Variable
3531	Solar Turbine	1	ROA
3531	Solar Turbine	2	EPS
3663	Motorola	3	Current ratio
2670	3M Co.	3	Current ratio

As indicated in the following table, this study found that for research question 2, only Boeing Co, 3M Co., and Solectron showed evidence of superior performance for the research variables tested in relation to their key competitors within their primary SIC. The Boeing Co. showed superior performance in all three research variables following their winning of a NQA.

Table 22

Summary of Significant Results from Research Question 2

SIC CODE	NQA-winning Firm	Hypothesis #	Research Variable
3721	Boeing Co.	4	ROA
2670	3M Co.	4	ROA
3721	Boeing Co.	5	EPS
2670	3M Co.	5	EPS
3721	Boeing Co.	6	Current ratio
3672	Solectron	6	Current ratio

Conclusions Based on Study Results

Based on the results of the tests in this study, there is a lack of clear, compelling, and consistent evidence that winning a NQA ensures a firm's competitive advantage and provides an increase in shareholder value with respect to the three study variables. Although some performance improvements have been noted in Table 24, with respect to the three research variables used, there in not enough evidence to embark on a NQA competition if the underlying goal was to increase financial performance in the short-term.

Implication of Findings

The underlying significance and value to the research questions answered in this study are potentially significant to investors and business owners and managers alike. This is because business owners and managers are constantly in a state of high competition and must continuously refine their operations in order to succeed and evolve in the marketplace. Although there may be other non-tangible benefits gained from

competing in a NQA, the expectation of a financial return on investment for the effort is in question.

Study Limitations and Recommendations for Future Research

Limitations

The underlying evaluation structure used for NQA competitions used by the NQA program may not be aligned with those causative factors that contribute most to company financial performance. Winners of the NQA are based on the evaluation elements as described in detail in Chapter II (Baldrige National Quality Program, 2008). As noted previously, the results of tests used in this study indicate a lack of evidence that winning a NQA increases shareholder value with respect to the three research variables used in this study. However, aside from performance within the firm, perhaps the weighting of the NQA evaluation criteria is a factor on why there is no significant linkage. That is to say, that perhaps the structure and weighting of the NQA scoring is not focusing on the true independent variables that may drive future financial performance. It would seem logical that firms that are succeeding, that is, out-competing their rivals in the marketplace should score well in any management criteria. Perhaps the findings of this study suggest a re-examination of what constitutes management success and those parameters need to be mirrored in any competition evaluation scheme. A radical departure from the current NQA evaluation scheme may be in order whereby research is done to identify what performance elements drive improved financial performance. This departure would drive a need to identify the specific independent variables that exist in a high-performing firm that drive improved financial performance, that is, their dependent variables. For example, a multiple regression might help identify those causative factors.

The most prominent causative factors could then be tested for other firms in other industries to determine repeatability. Perhaps these variables then could be used as the basis of a new scoring system to evaluate firms during NQA competitions.

The limited number of companies studied and the length of the study period may degrade the analyses. This study examined seven NQA-winning firms. While this was all the firms that met the selection criteria, it is a small number of firms on which to base a business decision. Many of the business winners of the NQA are privately owned firms and are not required to report their financial performance in the manner of publically traded firms. In addition, 5 years was the defined study period for research question 1 and two and one half years was defined as the study period for research question 2. These were set as the minimum level of time to meet the criteria of long-term as opposed to short term (Groebner et al., 2005). It is possible that the NQA-winning firms will perform well in the long-term, in which case there should not be an unfounded expectation of short-term financial benefits to be derived from competing in an NQA. If this factor could be substantiated, business managers, and company owners,

The limited number of research variables may not fully reflect the change in performance of the companies under study. Three key financial performance indicators were used for this study; ROA, EPS and current ratio. Although these three criteria are critically important to management and investors, many other metrics could have provided a viable measure of shareholder value and the results of the tests could have been different. Profit margin for example, would be a powerful metric to gauge company performance because it shows the relationship between income and expenses (Vance, 2003). Revenue per employee would be another metric to compare company performance

as for many companies, labor costs are the most significant of all costs. A business that is run more efficiently should reflect a higher increase in sales per employee.

The lack of qualitative data in the study may not have allowed a strategic view of company performance. This paper was designed as a quantitative study that focused on three numeric research variables in a pre-test, post-test situation. The pre-test is the period before the NQA-winning firms won their NQA while the post-test is the period after their winning. The results of the hypotheses tests in this study do not address the issue of why performance did or did not improve. They only show whether there was a significant difference in the financial performance indicators before and after the NQA award date. The underlying causal factors of performance changes is of vital interest to management and the NQA program managers as well. As stated by Silverman (2005), "some qualitative researchers believe that qualitative methods can provide a 'deeper' understanding of the social phenomenon than would be obtained from purely quantitative data" (p. 10). It is possible for there to exist other research variables that would have supported the research hypotheses to a greater degree. Qualitative research also focuses on "naturally occurring, ordinary event in natural settings, so that we have a strong handle on what 'real life' is like" (Miles, 1994, p. 10). This factor would add considerable credibility to business mangers and the investment community.

The limited time period used in this study may not have given the firms enough time to show substantive performance improvement. It is possible the winning an NQA can produce improvements in company performance in the long-term but, this was not within the scope of this study and there is no evidence available one way or the other.

One final concern should be raised about relying solely on quantitative data. Quantitative approaches are excellent analytical tools and are "derived from a positivist model which encourages us to chart the relation between variables which are operationally defined by the researcher" (Silverman, 2005, p. 9). This approach may hide significant relationships that are not considered or discovered by the quantitative researcher but may be important to management. For example, it is possible that teamwork and employee morale were positively affected, but this positive effect did not translate into financial performance gains. Interviews with company managers, for example, could have revealed other factors that were relevant to company performance during the study period. These other events could have mitigated the effects of the changes brought about by adapting NQA management techniques, resulting in the lack of evidence of performance improvement.

Use of the Bonferroni Technique. The Bonferroni adjustment was used to minimize the risk of Type I error, however, this technique is not universally used in hypothesis testing. In this study, the number of hypothesis tests used suggested its use but this technique could also hide a number of significant relationships in its attempt to lessen Type I risks.

Future Research

The following sections provide concepts for development by researchers in the future.

Methodology. The methodology of this study was based on *t*-tests. The hypotheses tests were designed to answer the question of a change in company performance, and therefore shareholder value, before and after the adaption of NQA

management techniques. Nevertheless, other techniques could be used as well. An example would be logistic regression. This kind of regression is used for testing the relationship between a dichotomous dependent variable and one or more continuous independent variables. This study could have been designed so that the dependent variable was whether the firm had won a NQA or not and the independent variables could have been the same as the research variables used in the study. The hypothesis tests, in this case, would have shown if the results fit the pattern of a NQA-winning company or not.

Another technique that could have been used was a variation of the Analysis of Covariance (ANCOVA) to determine if there is a difference in the slope of change of NQA and non-NQA winning firms. ANCOVA can be used when the independent variable is categorical, in this case, whether a firm won a NQA or not, and when the dependent variable is numeric, such as anyone of the three research variables used. The hypothesis test, in this case would identify if the patterns of performance were the same or not.

Interviews of participants. There could be merit in conducting interviews with managers who were involved in the preparation and transformation process during the NQA competition. One important question that management would need to answer before embarking in a quality improvement initiative is how difficult and time consuming it was to implement. This would provide management with the ability to perform a cost and benefit analysis of the level of resources spent to participate in the competition and the value to the company. They could also provide a bound to reality of how difficult it was to change to use NQA techniques and just how much it improved operations.

Silverman (2005) stated, "Grandiose claims about originality, scope or applicability to social problems are all hostages to fortune" (p. 49). Senior management could also be asked to participate in another NQA competition in the future and, importantly, if they are still using the techniques adapted in order to win the NQA in the first place.

Appendix A

Company Performance Data from COMPUSTAT

Company Performance Data From COMPUSTAT North America

This Appendix contains the source data for each of the MBNQA-winning firms under study. This data includes 5 years of quarterly data for the variables under study, ROA, EPS and current ratio. The 5-year period includes the year of award, and the two preceding and the two following years. The source for this data was COMPUSTAT Quarterly Fundamentals file. For each company, the source file is shown and then followed by the descriptive statistics in tabular form, and then a graphical display of the boxplots and the histogram for each of the variables. The purpose of the descriptive statistics and the graphics is to provide a beginning to understanding the performance before and after NQA award, no statistical conclusions are drawn from Appendix A. A 'dummy' variable was added to file in order to distinguish between pre-award and post-award performance before performing the operation. Pre-award data are indicated with a 0 in the Award column, while post-award data are indicated with a 1. This variable is used during the hypothesis testing for assessing a difference in pre-award and post-award performance.

Year of MBNQA Award: 2003　Company: Boeing Co.　SIC: 3721

Fiscal Year	Fiscal Quarter	Current Assets	Assets	Current Liabilities	Liabilities	Net Income	Sales (Net)	ROA	EPS (Dil) Incl Extr Items	Current Ratio	Award
2001	1	$17,171	$43,798	$18,106	$31,564	$1,237	$13,293	0.028	$1.45	0.948	0
2001	2	$17,189	$44,697	$17,773	$33,188	$840	$15,516	0.019	$0.99	0.967	0
2001	3	$17,933	$47,905	$21,340	$36,585	$650	$13,687	0.014	$0.80	0.840	0
2001	4	$16,206	$48,343	$20,486	$37,518	$100	$15,702	0.002	$0.12	0.791	0
2002	1	$16,073	$46,551	$19,215	$36,798	-$1,249	$13,821	-0.027	-$1.54	0.836	0
2002	2	$15,760	$47,228	$19,139	$36,826	$779	$13,857	0.016	$0.96	0.823	0
2002	3	$16,611	$48,320	$19,024	$37,417	$372	$12,690	0.008	$0.46	0.873	0
2002	4	$16,855	$52,342	$19,810	$44,646	$590	$13,701	0.011	$0.73	0.851	0
2003	1	$16,714	$51,227	$18,434	$43,943	-$478	$12,199	-0.009	-$0.60	0.907	0
2003	2	$16,449	$51,651	$19,246	$44,685	-$192	$12,717	-0.004	-$0.24	0.855	0
2003	3	$15,615	$52,255	$18,944	$44,905	$256	$12,184	0.005	$0.31	0.824	1
2003	4	$17,258	$53,035	$18,448	$44,896	$1,132	$13,156	0.021	$1.40	0.935	1
2004	1	$16,681	$53,800	$18,572	$44,941	$623	$12,903	0.012	$0.77	0.898	1
2004	2	$18,069	$54,283	$20,971	$45,334	$607	$13,088	0.011	$0.75	0.862	1
2004	3	$16,484	$55,388	$21,482	$45,846	$456	$13,152	0.008	$0.56	0.767	1
2004	4	$15,100	$53,963	$20,835	$42,677	$186	$13,314	0.003	$0.23	0.725	1
2005	1	$17,445	$56,714	$23,401	$45,236	$535	$12,681	0.009	$0.66	0.745	1
2005	2	$18,243	$56,494	$24,424	$45,362	$566	$14,684	0.010	$0.70	0.747	1
2005	3	$19,159	$58,318	$26,116	$48,895	$1,011	$12,355	0.017	$1.26	0.734	1
2005	4	$21,968	$60,058	$28,188	$48,999	$460	$13,901	0.008	$0.58	0.779	1

Year of MBNQA Award: 2002   Company: Motorola Inc.   SIC: 3663

Fiscal Year	Fiscal Quarter	Current Assets	Assets	Current Liabilities	Liabilities	Net Income (Loss)	Sales (Net)	ROA	EPS (Diluted) Including Extraordinary Items	Current Ratio	Award
2000	1	$18,659	$43,159	$13,390	$22,589	$448	$8,752	0.010	$0.59	1.394	0
2000	2	$20,001	$45,641	$14,781	$24,168	$204	$9,255	0.004	$0.09	1.353	0
2000	3	$19,423	$44,177	$15,470	$23,519	$531	$9,493	0.012	$0.23	1.256	0
2000	4	$19,885	$42,343	$16,257	$23,731	$135	$10,080	0.003	$0.06	1.223	0
2001	1	$18,669	$39,521	$13,622	$22,877	-$533	$7,683	-0.013	-$0.24	1.371	0
2001	2	$19,514	$38,728	$12,925	$22,427	-$759	$7,486	-0.020	-$0.35	1.510	0
2001	3	$18,981	$34,259	$11,345	$19,975	-$1,408	$7,392	-0.041	-$0.64	1.673	0
2001	4	$17,149	$33,398	$9,698	$19,707	-$1,237	$7,312	-0.037	-$0.55	1.768	0
2002	1	$16,268	$31,752	$9,588	$18,731	-$449	$6,181	-0.014	-$0.20	1.697	0
2002	2	$16,613	$30,163	$9,827	$19,122	-$2,321	$6,869	-0.077	-$1.02	1.691	0
2002	3	$16,577	$30,221	$9,517	$18,909	$111	$6,532	0.004	$0.05	1.742	1
2002	4	$17,134	$31,152	$9,810	$19,913	$174	$7,697	0.006	$0.08	1.747	1
2003	1	$16,213	$29,920	$8,457	$18,558	$169	$6,043	0.006	$0.07	1.917	1
2003	2	$15,574	$29,905	$8,324	$18,047	$119	$6,163	0.004	$0.05	1.871	1
2003	3	$16,377	$30,471	$8,817	$18,520	$116	$6,829	0.004	$0.05	1.857	1
2003	4	$17,907	$32,098	$9,433	$19,409	$489	$8,023	0.015	$0.20	1.898	1
2004	1	$18,768	$32,350	$9,608	$19,227	$609	$7,441	0.019	$0.25	1.953	1
2004	2	$19,227	$32,171	$9,638	$19,047	-$203	$7,541	-0.006	-$0.09	1.995	1
2004	3	$21,990	$34,550	$10,593	$19,400	$479	$7,499	0.014	$0.20	2.076	1
2004	4	$21,082	$30,889	$10,573	$17,558	$647	$8,842	0.021	$0.26	1.994	1

Year of MBNQA Award: 1998   Company: Solar Turbine (Caterpillar) SIC: 3531

Fiscal Year	Fiscal Quarter	Current Assets	Assets	Current Liabilities	Liabilities	Net Income	Sales (Net)	ROA	EPS (Dil) Incl Extr Items	Current Ratio	Award
1996	1	$7,995	$17,412	$6,298	$13,771	$296	$3,844	0.017	$1.51	1.269	0
1996	2	$8,341	$18,122	$6,898	$14,337	$374	$4,180	0.021	$1.91	1.209	0
1996	3	$9,074	$18,598	$6,886	$14,619	$310	$4,033	0.017	$1.59	1.318	0
1996	4	$8,783	$18,728	$7,013	$14,612	$381	$4,465	0.020	$1.97	1.252	0
1997	1	$9,079	$19,292	$6,289	$14,926	$394	$4,262	0.020	$2.06	1.444	0
1997	2	$9,819	$20,197	$6,498	$15,681	$435	$4,870	0.022	$2.26	1.511	0
1997	3	$10,196	$20,758	$6,538	$16,072	$385	$4,600	0.019	$1.01	1.559	0
1997	4	$9,814	$20,756	$6,379	$16,077	$451	$5,193	0.022	$1.20	1.538	0
1998	1	$10,876	$23,577	$7,437	$18,568	$430	$4,794	0.018	$1.15	1.462	0
1998	2	$11,686	$25,106	$7,679	$19,973	$446	$5,604	0.018	$1.20	1.522	0
1998	3	$11,786	$25,134	$7,405	$19,964	$336	$5,173	0.013	$0.92	1.592	1
1998	4	$11,459	$25,128	$7,945	$19,997	$301	$5,406	0.012	$0.83	1.442	1
1999	1	$11,903	$25,719	$7,770	$20,406	$205	$4,867	0.008	$0.57	1.532	1
1999	2	$12,252	$26,755	$8,207	$21,509	$283	$5,101	0.011	$0.78	1.493	1
1999	3	$11,977	$26,459	$7,600	$21,061	$219	$4,715	0.008	$0.61	1.576	1
1999	4	$11,734	$26,635	$8,178	$21,170	$239	$5,019	0.009	$0.67	1.435	1
2000	1	$11,970	$26,963	$8,162	$21,467	$258	$4,919	0.010	$0.73	1.467	1
2000	2	$12,358	$27,884	$8,495	$22,426	$315	$5,363	0.011	$0.90	1.455	1
2000	3	$12,440	$27,840	$8,107	$22,295	$216	$4,779	0.008	$0.62	1.534	1
2000	4	$12,521	$28,464	$8,568	$22,864	$264	$5,114	0.009	$0.76	1.461	1

Year of MBNQA Award: 1997   Company: Xerox Business Services SIC: 3577

Fiscal Year	Fiscal Quarter	Current Assets	Assets	Current Liabilities	Liabilities	Net Income	Sales (Net)	ROA	EPS (Dil) Incl Extr Items	Current Ratio	Award
1995	1	$9,503	$39,370	$6,457	$33,960	$147	$3,767	0.004	$1.20	1.472	0
1995	2	$9,736	$37,650	$6,344	$31,675	$238	$4,054	0.006	$1.95	1.535	0
1995	3	$9,954	$37,626	$6,354	$31,517	$236	$4,012	0.006	$1.93	1.567	0
1995	4	$9,833	$25,969	$6,999	$21,130	-$1,093	$4,755	-0.042	-$10.36	1.405	0
1996	1	$10,209	$26,375	$6,681	$21,539	$237	$3,928	0.009	$1.95	1.528	0
1996	2	$10,281	$26,318	$6,630	$21,356	$293	$4,217	0.011	$0.81	1.551	0
1996	3	$10,467	$26,543	$6,571	$21,431	$250	$4,158	0.009	$0.68	1.593	0
1996	4	$10,152	$26,818	$7,204	$21,381	$426	$5,075	0.016	$1.17	1.409	0
1997	1	$10,186	$26,688	$6,472	$21,334	$270	$4,017	0.010	$0.75	1.574	0
1997	2	$10,545	$27,833	$6,954	$22,896	$337	$4,351	0.012	$0.94	1.516	0
1997	3	$10,517	$27,248	$7,304	$22,151	$320	$4,370	0.012	$0.89	1.440	1
1997	4	$10,766	$27,732	$7,692	$22,349	$525	$5,406	0.019	$1.46	1.400	1
1998	1	$11,116	$27,551	$7,069	$22,216	$111	$4,304	0.004	$0.32	1.572	1
1998	2	$11,582	$28,937	$8,353	$24,578	-$711	$4,742	-0.025	-$2.19	1.387	1
1998	3	$12,221	$29,665	$8,921	$25,051	$381	$4,607	0.013	$1.05	1.370	1
1998	4	$12,475	$30,024	$8,507	$24,726	$614	$5,796	0.020	$1.79	1.466	1
1999	1	$12,371	$29,276	$7,670	$24,527	$343	$4,300	0.012	$0.48	1.613	1
1999	2	$12,482	$28,631	$7,218	$23,626	$448	$4,862	0.016	$0.62	1.729	1
1999	3	$12,576	$28,952	$7,690	$23,815	$205	$4,800	0.007	$0.29	1.635	1
1999	4	$11,985	$28,814	$7,950	$23,406	$343	$5,605	0.012	$0.47	1.508	1

Year of MBNQA Award: 1997   Company: 3M Co.SIC: 2670

Fiscal Year	Fiscal Quarter	Current Assets	Assets	Current Liabilities	Liabilities	Net Income	Sales (Net)	ROA	EPS (Dil) Incl Extr Items	Current Ratio	Award
1995	1	$7,436	$14,203	$3,609	$7,077	$376	$3,361	0.026	$0.88	2.060	0
1995	2	$7,783	$14,751	$3,907	$7,457	$353	$3,424	0.024	$0.84	1.992	0
1995	3	$7,613	$14,525	$3,826	$7,257	$344	$3,370	0.024	$0.81	1.990	0
1995	4	$6,395	$14,183	$3,724	$6,816	-$97	$3,305	-0.007	-$0.24	1.717	0
1996	1	$6,452	$14,123	$3,864	$7,150	$362	$3,468	0.026	$0.85	1.670	0
1996	2	$6,642	$13,211	$3,980	$7,116	$381	$3,522	0.029	$0.90	1.669	0
1996	3	$7,044	$13,689	$4,351	$7,394	$398	$3,623	0.029	$0.93	1.619	0
1996	4	$6,486	$13,364	$3,789	$6,707	$385	$3,623	0.029	$0.89	1.712	0
1997	1	$6,437	$13,296	$3,685	$7,060	$410	$3,714	0.031	$0.97	1.747	0
1997	2	$6,718	$13,594	$3,535	$7,245	$418	$3,817	0.031	$0.99	1.900	1
1997	3	$6,623	$13,421	$3,483	$7,097	$927	$3,826	0.069	$2.21	1.902	1
1997	4	$6,168	$13,238	$3,983	$6,951	$366	$3,713	0.028	$0.89	1.549	1
1998	1	$6,372	$13,657	$4,212	$7,644	$400	$3,700	0.029	$0.98	1.513	1
1998	2	$6,366	$13,878	$4,383	$7,834	$386	$3,770	0.028	$0.94	1.452	1
1998	3	$6,490	$13,965	$4,500	$8,081	$178	$3,766	0.013	$0.44	1.442	1
1998	4	$6,318	$14,153	$4,386	$7,827	$211	$3,785	0.015	$0.52	1.440	1
1999	1	$6,056	$13,746	$3,982	$7,777	$384	$3,776	0.028	$0.95	1.521	1
1999	2	$6,238	$13,367	$3,680	$7,194	$476	$3,863	0.036	$1.17	1.695	1
1999	3	$6,583	$13,905	$3,865	$7,535	$459	$3,997	0.033	$1.13	1.703	1
1999	4	$6,066	$13,896	$3,819	$7,236	$444	$4,023	0.032	$1.10	1.588	1

Year of MBNQA Award: 1997   Company: Solectron Corp.   SIC: 3672

Fiscal Year	Fiscal Quarter	Current Assets	Assets	Current Liabilities	Liabilities	Net Income	Sales (Net)	ROA	EPS (Dil) Incl Extr Items	Current Ratio	Award
1995	2	$618	$789	$269	$416	$18	$471	0.023	$0.38	-2.300	0
1995	3	$672	$865	$312	$462	$20	$517	0.024	$0.42	-2.151	0
1995	4	$726	$941	$371	$403	$23	$571	0.024	$0.45	-1.959	0
1996	1	$791	$1,031	$419	$459	$27	$691	0.027	$0.52	-1.886	0
1996	2	$976	$1,229	$358	$624	$28	$657	0.023	$0.52	-2.727	0
1996	3	$1,111	$1,420	$370	$759	$28	$681	0.020	$0.53	-3.005	0
1996	4	$1,145	$1,452	$358	$752	$32	$789	0.022	$0.59	-3.194	0
1997	1	$1,309	$1,624	$457	$852	$31	$808	0.019	$0.58	-2.866	0
1997	2	$1,366	$1,675	$479	$870	$38	$859	0.022	$0.65	-2.851	0
1997	3	$1,470	$1,809	$560	$951	$42	$983	0.023	$0.71	-2.623	0
1997	4	$1,476	$1,852	$544	$933	$47	$1,045	0.026	$0.40	-2.713	1
1998	1	$1,582	$2,010	$640	$1,031	$45	$1,137	0.022	$0.38	-2.470	1
1998	2	$1,576	$2,017	$597	$986	$49	$1,187	0.024	$0.41	-2.639	1
1998	3	$1,747	$2,204	$721	$1,118	$49	$1,278	0.022	$0.41	-2.422	1
1998	4	$1,888	$2,411	$841	$1,229	$56	$1,686	0.023	$0.46	-2.245	1
1999	1	$2,106	$2,713	$1,047	$1,440	$76	$2,203	0.028	$0.56	-2.011	1
1999	2	$2,680	$3,384	$946	$2,094	$78	$2,160	0.023	$0.28	-2.831	1
1999	3	$2,687	$3,455	$900	$1,834	$92	$2,598	0.027	$0.32	-2.986	1
1999	4	$3,994	$4,835	$1,113	$2,042	$104	$2,708	0.021	$0.34	-3.588	1

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NOTE: 1st quarter 1995 data not available

Year of MBNQA Award: 1997   Company: Merrill Lynch SIC: 6211

Fiscal Year	Fiscal Quarter	Current Assets	Assets	Current Liabilities	Liabilities	Net Income	Sales (Net)	ROA	EPS (Dil) Incl Extr Items	Current Ratio	Award
1995	1	.	$176,733	.	$171,029	$227	$5,204	0.0013	$1.08		0
1995	2	.	$174,853	.	$168,969	$283	$5,585	0.0016	$1.39		0
1995	3	.	$185,473	.	$179,395	$300	$5,431	0.0016	$1.46		0
1995	4	.	$176,857	.	$170,716	$304	$5,293	0.0017	$1.49		0
1996	1	.	$195,884	.	$189,520	$409	$6,019	0.0021	$2.03		0
1996	2	.	$205,175	.	$198,661	$434	$6,190	0.0021	$2.19		0
1996	3	.	$207,911	.	$201,293	$331	$6,201	0.0016	$1.68		0
1996	4	.	$213,016	.	$206,124	$445	$6,446	0.0021	$2.27		0
1997	1	.	$247,603	.	$240,678	$473	$7,650	0.0019	$2.32		0
1997	2	.	$268,036	.	$260,768	$491	$8,200	0.0018	$1.24		0
1997	3	.	$288,430	.	$280,633	$502	$8,338	0.0017	$1.24		1
1997	4	.	$292,819	.	$284,490	$469	$8,311	0.0016	$1.15		1
1998	1	.	$353,424	.	$344,423	$514	$9,063	0.0015	$1.26		1
1998	2	.	$365,451	.	$355,760	$549	$9,322	0.0015	$1.31		1
1998	3	.	$353,419	.	$343,624	-$163	$8,344	-0.0005	-$0.42		1
1998	4	.	$299,804	.	$289,672	$359	$7,845	0.0012	$0.86		1
1999	1	.	$314,620	.	$303,928	$609	$8,567	0.0019	$1.40		1
1999	2	.	$324,740	.	$313,294	$712	$8,857	0.0022	$1.64		1
1999	3	.	$312,936	.	$300,836	$579	$8,497	0.0019	$1.34		1
1999	4	.	$328,071	.	$315,269	$793	$9,419	0.0024	$1.82		1

Appendix B

Performance Data from Key Competitors

Performance Data of Key Competitors within SIC from COMPUSTAT North America

The following tables contain the performance results of the three research variables for the key competitors and therefore provide information to support answering research question 2. The firms were identified based on the total sales for the SIC for the 5-year period applicable for each NQA-winning firm. Then the key competitors were identified based on their percentage of the total sales for that SIC during the 5-year study period. However, firms with less than 3% of the market share for the 5-year period were dropped off the calculations as they were not considered as key competitors within their SIC group.

In the below tables, 10 quarterly periods of data are shown with data for each of the research variables starting in the middle of the year in which the NQA award was given. The NQA column on the end was added to indicate a dummy variable. A 1 in this column indicates the NQA-winning firm while a 0 in this column indicates a non-WQA-winning firm for the time period.

Note that in several instances, there were missing quarterly data points available from COMPUSTAT.

Year of MBNQA Award: 2003   Company: Boeing Co.   SIC: 3721

Fiscal Year	Fiscal Quarter	Company Name	ROA	EPS (Dil) Incl Extr Items	Current Ratio	NQA
2003	4	BAE SYSTEMS PLC	0.003	$0.09	0.899	0
2004	2	BAE SYSTEMS PLC	-0.028	-$1.00	0.907	0
2004	4	BAE SYSTEMS PLC	-0.005	-$0.23	0.843	0
2005	2	BAE SYSTEMS PLC	0.016	$0.72	0.635	0
2005	4	BAE SYSTEMS PLC	0.011	$0.47	0.653	0
2003	3	BOEING CO	0.005	$0.31	0.824	1
2003	4	BOEING CO	0.021	$1.40	0.935	1
2004	1	BOEING CO	0.012	$0.77	0.898	1
2004	2	BOEING CO	0.011	$0.75	0.862	1
2004	3	BOEING CO	0.008	$0.56	0.767	1
2004	4	BOEING CO	0.003	$0.23	0.725	1
2005	1	BOEING CO	0.009	$0.66	0.745	1
2005	2	BOEING CO	0.010	$0.70	0.747	1
2005	3	BOEING CO	0.017	$1.26	0.734	1
2005	4	BOEING CO	0.008	$0.58	0.779	1
2003	3	BOMBARDIER INC -CL B	0.007	$0.10	1.172	0
2003	4	BOMBARDIER INC -CL B	-0.018	-$0.26	1.146	0
2004	1	BOMBARDIER INC -CL B	-0.009	-$0.10	1.127	0
2004	2	BOMBARDIER INC -CL B	0.001	$0.01	1.127	0
2004	3	BOMBARDIER INC -CL B	0.001	$0.00	1.129	0
2004	4	BOMBARDIER INC -CL B	0.003	$0.02	1.129	0
2005	1	BOMBARDIER INC -CL B	0.003	$0.03	1.133	0
2005	2	BOMBARDIER INC -CL B	0.007	$0.06	1.155	0
2005	3	BOMBARDIER INC -CL B	-0.001	-$0.01	1.159	0
2003	3	TEXTRON INC	0.003	$0.34	1.295	0
2003	4	TEXTRON INC	0.006	$0.60	1.324	0
2004	1	TEXTRON INC	0.002	$0.26	1.321	0
2004	2	TEXTRON INC	0.006	$0.71	1.321	0
2004	3	TEXTRON INC	0.007	$0.73	1.320	0
2004	4	TEXTRON INC	0.008	$0.89	1.299	0
2005	1	TEXTRON INC	0.008	$0.91	1.293	0
2005	2	TEXTRON INC	0.008	$0.89	1.293	0
2005	3	TEXTRON INC	-0.010	-$1.20	1.260	0
2005	4	TEXTRON INC	0.007	$0.88	1.248	0

Year of MBNQA Award: 2002   Company: Motorola Inc.   SIC: 3663

Fiscal Year	Fiscal Quarter	Company Name	ROA	EPS (Diluted) Including Extraordinary Items	Current Ratio	NQA
2002	3	ERICSSON (LM) TELEFON	-0.021	-$0.43	2.113	0
2002	4	ERICSSON (LM) TELEFON	-0.043	-$0.65	2.273	0
2003	1	ERICSSON (LM) TELEFON	-0.021	-$0.32	2.186	0
2003	2	ERICSSON (LM) TELEFON	-0.016	-$0.23	2.455	0
2003	3	ERICSSON (LM) TELEFON	-0.023	-$0.34	2.259	0
2003	4	ERICSSON (LM) TELEFON	-0.004	-$0.07	2.414	0
2004	1	ERICSSON (LM) TELEFON	0.016	$0.25	2.512	0
2004	2	ERICSSON (LM) TELEFON	0.029	$0.44	2.744	0
2004	3	ERICSSON (LM) TELEFON	0.028	$0.43	2.898	0
2004	4	ERICSSON (LM) TELEFON	0.039	$0.67	2.995	0
2005	1	ERICSSON (LM) TELEFON	0.024	$0.41	1.898	
2002	3	MOTOROLA INC	0.004	$0.05	1.742	1
2002	4	MOTOROLA INC	0.006	$0.08	1.747	1
2003	1	MOTOROLA INC	0.006	$0.07	1.917	1
2003	2	MOTOROLA INC	0.004	$0.05	1.871	1
2003	3	MOTOROLA INC	0.004	$0.05	1.857	1
2003	4	MOTOROLA INC	0.015	$0.20	1.898	1
2004	1	MOTOROLA INC	0.019	$0.25	1.953	1
2004	2	MOTOROLA INC	-0.006	-$0.09	1.995	1
2004	3	MOTOROLA INC	0.014	$0.20	2.076	1
2004	4	MOTOROLA INC	0.021	$0.26	1.994	1
2005	1	MOTOROLA INC	0.022	$0.28	2.105	1
2002	3	NOKIA (AB) OY	0.027	$0.13	1.847	0
2002	4	NOKIA (AB) OY	0.051	$0.26	2.090	0
2003	1	NOKIA (AB) OY	0.041	$0.22	1.914	0
2003	2	NOKIA (AB) OY	0.030	$0.16	2.194	0
2003	3	NOKIA (AB) OY	0.036	$0.21	2.202	0
2003	4	NOKIA (AB) OY	0.056	$0.35	2.425	0
2004	1	NOKIA (AB) OY	0.034	$0.21	2.097	0
2004	2	NOKIA (AB) OY	0.031	$0.19	2.344	0
2004	3	NOKIA (AB) OY	0.031	$0.18	2.368	0
2004	4	NOKIA (AB) OY	0.053	$0.37	2.448	0
2005	1	NOKIA (AB) OY	0.038	$0.25	2.098	0
2002	3	SHARP CORP		$0.11		0
2002	4	SHARP CORP	-0.002	-$0.03	1.357	0
2003	1	SHARP CORP	0.007	$0.11	1.323	0
2003	2	SHARP CORP	0.007	$0.12	1.249	0
2003	3	SHARP CORP	0.009	$0.16	1.202	0
2003	4	SHARP CORP	0.007	$0.14	1.209	0
2004	1	SHARP CORP	0.009	$0.16	1.125	0
2004	2	SHARP CORP	0.008	$0.16	1.133	0
2004	3	SHARP CORP	0.010	$0.21	1.122	0
2004	4	SHARP CORP	0.006	$0.12	1.120	0
2002	3	THOMSON	0.020	$0.48	1.788	0
2002	4	THOMSON	0.026	$0.48	1.752	0
2003	1	THOMSON	0.008	-$0.19	1.953	0
2003	2	THOMSON	-0.010	-$0.19	2.155	0
2003	3	THOMSON	0.001	$0.25	2.077	0
2003	4	THOMSON	0.012	$0.25	1.998	0
2004	1	THOMSON	-0.005	-$0.42	1.914	0
2004	2	THOMSON	-0.022	-$0.42	1.831	0
2004	3	THOMSON	-0.038	-$1.16	1.927	0
2004	4	THOMSON	-0.055	-$1.16	2.022	0
2002	3	SOLECTRON GLOBAL SVCS	-0.019	-$0.53	1.951	0
2002	4	SOLECTRON GLOBAL SVCS	-0.240	-$5.00	2.216	0
2003	1	SOLECTRON GLOBAL SVCS	-0.007	.	2.237	0
2003	2	SOLECTRON GLOBAL SVCS	-0.011	.	2.192	0
2003	3	SOLECTRON GLOBAL SVCS	-0.445	.	1.583	0
2003	4	SOLECTRON GLOBAL SVCS	-0.027	.	1.531	0
2004	1	SOLECTRON GLOBAL SVCS	-0.019	.	1.506	0
2004	2	SOLECTRON GLOBAL SVCS	-0.011	.	1.668	0
2004	3	SOLECTRON GLOBAL SVCS	0.004	.	2.018	0
2004	4	SOLECTRON GLOBAL SVCS	0.000	.	2.134	0
2005	1	SOLECTRON GLOBAL SVCS	0.010	.	2.312	0
2005	2	SOLECTRON GLOBAL SVCS	0.000	.	2.358	0

Year of MBNQA Award: 1998   Company: Solar Turbine (Caterpillar) SIC: 3531

Fiscal Year	Fiscal Quarter	Company Name	ROA	EPS	Current Ratio	NQA
1996	3	CATERPILLAR INC	0.017	$1.590	1.318	1
1996	4	CATERPILLAR INC	0.020	$1.970	1.252	1
1997	1	CATERPILLAR INC	0.020	$2.060	1.444	1
1997	2	CATERPILLAR INC	0.022	$2.260	1.511	1
1997	3	CATERPILLAR INC	0.019	$1.010	1.559	1
1997	4	CATERPILLAR INC	0.022	$1.200	1.538	1
1998	1	CATERPILLAR INC	0.018	$1.150	1.462	1
1998	2	CATERPILLAR INC	0.018	$1.200	1.522	1
1998	3	CATERPILLAR INC	0.013	$0.920	1.592	1
1998	4	CATERPILLAR INC	0.012	$0.830	1.442	1
1999	1	CATERPILLAR INC	0.008	$0.570	1.532	1
1999	2	CATERPILLAR INC	0.011	$0.780	1.493	1
1999	3	CATERPILLAR INC	0.008	$0.610	1.576	1
1999	4	CATERPILLAR INC	0.009	$0.670	1.435	1
2000	1	CATERPILLAR INC	0.010	$0.730	1.467	1
2000	2	CATERPILLAR INC	0.011	$0.900	1.455	1
2000	3	CATERPILLAR INC	0.008	$0.620	1.534	1
2000	4	CATERPILLAR INC	0.009	$0.760	1.461	1
1998	3	KOMATSU LTD	-0.0035	-$0.200	1.344	0
1998	4	KOMATSU LTD	-0.0035	-$0.200	1.421	0
1999	1	KOMATSU LTD	0.003	$0.175	1.422	0
1999	2	KOMATSU LTD	0.0030	$0.175	1.422	0
1999	3	KOMATSU LTD	0.0016	$0.090	1.457	0
1999	4	KOMATSU LTD	0.0016	$0.090	1.493	0
2000	1	KOMATSU LTD	0.001	$0.060	1.426	0
2000	2	KOMATSU LTD	0.001	$0.060	1.358	0
1998	3	TEREX CORP	0.018	$0.880	2.079	0
1998	4	TEREX CORP	0.016	$0.810	1.814	0
1999	1	TEREX CORP	0.021	$1.160	1.997	0
1999	2	TEREX CORP	0.022	$1.300	2.107	0
1999	3	TEREX CORP	0.014	$1.070	2.189	0
1999	4	TEREX CORP	0.040	$3.040	2.270	0
2000	1	TEREX CORP	0.009	$0.710	2.252	0
2000	2	TEREX CORP	0.012	$0.930	2.224	0
2000	3	TEREX CORP	0.024	$1.790	2.447	0
2000	4	TEREX CORP	0.000	-$0.030	2.158	0

Year of MBNQA Award: 1997   Company: Xerox Business Services SIC: 3577

Fiscal Year	Fiscal Quarter	Company Name	ROA	EPS	Current Ratio	NQA
1997	2	CANON INC	0.011	$1.30	1.483	0
1997	3	CANON INC	0.009	$1.30	1.504	0
1997	4	CANON INC	0.009	$1.30	1.526	0
1998	1	CANON INC	0.010	$0.23	1.533	0
1998	2	CANON INC	0.010	$0.24	1.540	0
1998	3	CANON INC	0.021	$0.30	1.570	0
1998	4	CANON INC	0.020	$0.30	1.599	0
1999	1	CANON INC	0.006	$0.15	1.587	0
1999	2	CANON INC	0.006	$0.15	1.575	0
1999	3	CANON INC	0.014	$0.24	1.635	0
1999	4	CANON INC	0.014	$0.24	1.695	0
1997	3	XEROX CORP	0.012	$0.89	1.440	1
1997	4	XEROX CORP	0.019	$1.46	1.400	1
1998	1	XEROX CORP	0.004	$0.32	1.572	1
1998	2	XEROX CORP	-0.025	-$2.19	1.387	1
1998	3	XEROX CORP	0.013	$1.05	1.370	1
1998	4	XEROX CORP	0.020	$1.79	1.466	1
1999	1	XEROX CORP	0.012	$0.48	1.613	1
1999	2	XEROX CORP	0.016	$0.62	1.729	1
1999	3	XEROX CORP	0.007	$0.29	1.635	1
1999	4	XEROX CORP	0.012	$0.47	1.508	1
2000	1	XEROX CORP	-0.008	-$0.39	1.328	1
1997	3	LEXMARK INTL INC -CL A	0.034	$0.54	1.355	0
1997	4	LEXMARK INTL INC -CL A	0.047	$0.78	1.418	0
1998	1	LEXMARK INTL INC -CL A	0.040	$0.69	1.509	0
1998	2	LEXMARK INTL INC -CL A	0.041	$0.75	1.579	0
1998	3	LEXMARK INTL INC -CL A	0.042	$0.81	1.552	0
1998	4	LEXMARK INTL INC -CL A	0.055	$1.16	1.684	0
1999	1	LEXMARK INTL INC -CL A	0.048	$0.96	1.541	0
1999	2	LEXMARK INTL INC -CL A	0.050	$0.55	1.673	0
1999	3	LEXMARK INTL INC -CL A	0.046	$0.56	1.573	0
1999	4	LEXMARK INTL INC -CL A	0.059	$0.73	1.480	0
2000	1	LEXMARK INTL INC -CL A	0.046	$0.59	1.729	0

Year of MBNQA Award: 1997   Company: 3M Co.SIC: 2670

Fiscal Year	Fiscal Quarter	Company Name	ROA	EPS	Current Ratio	NQA
1997	3	AVERY DENNISON CORP	0.026	$0.50	1.337	0
1997	4	AVERY DENNISON CORP	0.027	$0.52	1.260	0
1998	1	AVERY DENNISON CORP	0.026	$0.52	1.317	0
1998	2	AVERY DENNISON CORP	0.027	$0.55	1.298	0
1998	3	AVERY DENNISON CORP	0.026	$0.54	1.383	0
1998	4	AVERY DENNISON CORP	0.026	$0.54	1.207	0
1999	1	AVERY DENNISON CORP	0.008	$0.18	1.196	0
1999	2	AVERY DENNISON CORP	0.027	$0.63	1.210	0
1999	3	AVERY DENNISON CORP	0.026	$0.65	1.224	0
1999	4	AVERY DENNISON CORP	0.026	$0.67	1.124	0
1997	3	BEMIS CO INC	0.019	$0.47	1.996	0
1997	4	BEMIS CO INC	0.025	$0.64	2.056	0
1998	1	BEMIS CO INC	0.015	$0.39	2.260	0
1998	2	BEMIS CO INC	0.019	$0.51	2.143	0
1998	3	BEMIS CO INC	0.019	$0.51	2.217	0
1998	4	BEMIS CO INC	0.018	$0.49	2.133	0
1999	1	BEMIS CO INC	0.013	$0.36	2.273	0
1999	2	BEMIS CO INC	0.021	$0.60	2.292	0
1999	3	BEMIS CO INC	0.020	$0.59	2.244	0
1999	4	BEMIS CO INC	0.022	$0.63	2.304	0
1997	3	3M CO	0.069	$2.21	1.902	1
1997	4	3M CO	0.028	$0.89	1.549	1
1998	1	3M CO	0.029	$0.98	1.513	1
1998	2	3M CO	0.028	$0.94	1.452	1
1998	3	3M CO	0.013	$0.44	1.442	1
1998	4	3M CO	0.015	$0.52	1.440	1
1999	1	3M CO	0.028	$0.95	1.521	1
1999	2	3M CO	0.036	$1.17	1.695	1
1999	3	3M CO	0.033	$1.13	1.703	1
1999	4	3M CO	0.032	$1.10	1.588	1
1997	3	SEALED AIR CORP	0.075	$0.45	1.550	0
1997	4	SEALED AIR CORP	0.125	$0.85	1.533	0
1998	1	SEALED AIR CORP	0.007	$0.22	1.368	0
1998	2	SEALED AIR CORP	0.009	$0.21	1.502	0
1998	3	SEALED AIR CORP	-0.013	-$0.85	1.529	0
1998	4	SEALED AIR CORP	0.016	$0.56	1.579	0
1999	1	SEALED AIR CORP	0.012	$0.34	1.245	0
1999	2	SEALED AIR CORP	0.013	$0.40	1.508	0
1999	3	SEALED AIR CORP	0.014	$0.43	1.287	0
1999	4	SEALED AIR CORP	0.016	$0.50	1.380	0
1997	4	SAPPI LTD	0.015	$3.66	1.163	0
1998	4	SAPPI LTD	0.027	$7.59	1.019	0
1999	2	SAPPI LTD	0.005	$1.13	0.736	0
1999	3	SAPPI LTD	0.002	$0.44	0.696	0
1999	4	SAPPI LTD	0.011	$2.72	0.683	0

Year of MBNQA Award: 1997   Company: Solectron Corp.   SIC: 3672

Fiscal Year	Fiscal Quarter	Company Name	ROA	EPS	Current Ratio	NQA
1997	3	DII GROUP INC	0.017	$0.35	-2.049	0
1997	4	DII GROUP INC	0.022	$0.44	-2.150	0
1998	1	DII GROUP INC	-0.055	-$1.19	-2.144	0
1998	2	DII GROUP INC	0.009	$0.19	-2.090	0
1998	3	DII GROUP INC	0.009	$0.21	-1.904	0
1998	4	DII GROUP INC	0.003	$0.09	-1.420	0
1999	1	DII GROUP INC	0.012	$0.31	-1.505	0
1999	2	DII GROUP INC	0.015	$0.40	-1.293	0
1999	3	DII GROUP INC	0.017	$0.52	-1.199	0
1999	4	DII GROUP INC	0.019	$0.55	-1.555	0
1997	3	FLEXTRONICS INTERNATIONAL	0.009	$0.29	-1.660	0
1997	4	FLEXTRONICS INTERNATIONAL	0.001	$0.04	-1.395	0
1998	1	FLEXTRONICS INTERNATIONAL	0.017	$0.57	-1.275	0
1998	2	FLEXTRONICS INTERNATIONAL	0.019	$0.68	-1.277	0
1998	3	FLEXTRONICS INTERNATIONAL	0.017	$0.72	-1.898	0
1998	4	FLEXTRONICS INTERNATIONAL	0.014	$0.28	-1.584	0
1999	1	FLEXTRONICS INTERNATIONAL	0.020	$0.29	-1.483	0
1999	2	FLEXTRONICS INTERNATIONAL	0.021	$0.40	-1.249	0
1999	3	FLEXTRONICS INTERNATIONAL	0.021	$0.24	-1.730	0
1997	3	HADCO CORP	0.023	$0.93	-1.610	0
1997	4	HADCO CORP	0.023	$0.84	-1.475	0
1998	1	HADCO CORP	0.023	$0.90	-1.583	0
1998	2	HADCO CORP	-0.081	-$4.54	-1.796	0
1998	3	HADCO CORP	-0.009	-$0.52	-1.790	0
1998	4	HADCO CORP	0.001	$0.03	-1.710	0
1999	1	HADCO CORP	0.003	$0.15	-1.789	0
1999	2	HADCO CORP	0.006	$0.34	-1.654	0
1999	3	HADCO CORP	0.009	$0.48	-1.630	0
1999	4	HADCO CORP	0.012	$0.63	-1.297	0
1997	3	JABIL CIRCUIT INC	0.039	$0.76	-1.658	0
1997	4	JABIL CIRCUIT INC	0.044	$0.47	-1.577	0
1998	1	JABIL CIRCUIT INC	0.041	$0.50	-1.447	0
1998	2	JABIL CIRCUIT INC	0.044	$0.52	-1.597	0
1998	3	JABIL CIRCUIT INC	0.039	$0.45	-1.712	0
1998	4	JABIL CIRCUIT INC	0.001	$0.01	-1.555	0
1999	1	JABIL CIRCUIT INC	0.032	$0.48	-1.400	0
1999	2	JABIL CIRCUIT INC	0.032	$0.27	-1.479	0
1999	3	JABIL CIRCUIT INC	0.027	$0.24	-1.884	0
1999	4	JABIL CIRCUIT INC	0.022	$0.22	-1.777	0
1997	3	SANMINA-SCI CORP	0.048	$0.58	-3.707	0
1997	4	SANMINA-SCI CORP	-0.018	-$0.26	-3.884	0
1998	1	SANMINA-SCI CORP	0.042	$0.58	-2.894	0
1998	2	SANMINA-SCI CORP	0.053	$0.80	-2.411	0
1998	3	SANMINA-SCI CORP	0.056	$0.43	-2.672	0
1998	4	SANMINA-SCI CORP	0.033	$0.39	-3.075	0
1999	2	SANMINA-SCI CORP	0.048	$0.48	-2.703	0
1999	3	SANMINA-SCI CORP	0.036	$0.54	-4.959	0
1999	4	SANMINA-SCI CORP	0.037	$0.60	-4.072	0
1997	3	SOLECTRON CORP	0.023	$0.71	-2.623	1
1997	4	SOLECTRON CORP	0.026	$0.40	-2.713	1
1998	1	SOLECTRON CORP	0.022	$0.38	-2.470	1
1998	2	SOLECTRON CORP	0.024	$0.41	-2.639	1
1998	3	SOLECTRON CORP	0.022	$0.41	-2.422	1
1998	4	SOLECTRON CORP	0.023	$0.46	-2.245	1
1999	1	SOLECTRON CORP	0.028	$0.56	-2.011	1
1999	2	SOLECTRON CORP	0.023	$0.28	-2.831	1
1999	3	SOLECTRON CORP	0.027	$0.32	-2.986	1
1999	4	SOLECTRON CORP	0.021	$0.34	-3.588	1

Year of MBNQA Award: 1997   Company: Merrill Lynch SIC: 6211

Fiscal Year	Fiscal Quarter	Company Name	ROA	EPS	Current Ratio	NQA
1997	3	AXA FINANCIAL INC	0.0012	$0.81		0
1997	4	AXA FINANCIAL INC	-0.0001	-$0.09		0
1998	1	AXA FINANCIAL INC	0.0017	$1.15		0
1998	2	AXA FINANCIAL INC	0.0015	$1.06		0
1998	3	AXA FINANCIAL INC	0.0009	$0.62		0
1998	4	AXA FINANCIAL INC	0.0011	$0.79		0
1999	2	AXA FINANCIAL INC	0.0033	$2.71		0
1999	3	AXA FINANCIAL INC	0.0012	$1.03		0
1999	4	AXA FINANCIAL INC	0.0014	$0.64		0
1997	3	BEAR STEARNS COMPANIES INC	0.0014	$1.14		0
1997	4	BEAR STEARNS COMPANIES INC	0.0013	$1.15		0
1998	1	BEAR STEARNS COMPANIES INC	0.0011	$1.11		0
1998	2	BEAR STEARNS COMPANIES INC	0.0012	$1.11		0
1998	3	BEAR STEARNS COMPANIES INC	0.0010	$1.15		0
1998	4	BEAR STEARNS COMPANIES INC	0.0011	$1.23		0
1999	1	BEAR STEARNS COMPANIES INC	0.0004	$0.40		0
1999	2	BEAR STEARNS COMPANIES INC	0.0009	$0.88		0
1999	3	BEAR STEARNS COMPANIES INC	0.0012	$1.42		0
1999	4	BEAR STEARNS COMPANIES INC	0.0017	$1.85		0
1997	3	CITIGROUP GLOBAL MKTS HLDGS	0.0022	.		0
1997	4	CITIGROUP GLOBAL MKTS HLDGS	-0.0008	.		0
1998	1	CITIGROUP GLOBAL MKTS HLDGS	0.0017	.		0
1998	2	CITIGROUP GLOBAL MKTS HLDGS	0.0020	.		0
1998	3	CITIGROUP GLOBAL MKTS HLDGS	-0.0014	.		0
1998	4	CITIGROUP GLOBAL MKTS HLDGS	0.0002	.		0
1999	1	CITIGROUP GLOBAL MKTS HLDGS	0.0037	.		0
1999	2	CITIGROUP GLOBAL MKTS HLDGS	0.0032	.		0
1999	3	CITIGROUP GLOBAL MKTS HLDGS	0.0025	.		0
1999	4	CITIGROUP GLOBAL MKTS HLDGS	0.0033	.		0
1997	3	CREDIT SUISSE USA INC	0.0016	$1.85		0
1997	4	CREDIT SUISSE USA INC	0.0014	$1.53		0
1998	1	CREDIT SUISSE USA INC	0.0018	$2.00		0
1998	2	CREDIT SUISSE USA INC	0.0018	$1.05		0
1998	3	CREDIT SUISSE USA INC	0.0003	$0.15		0
1998	4	CREDIT SUISSE USA INC	0.0009	$0.47		0
1999	1	CREDIT SUISSE USA INC	0.0013	$0.84		0
1999	2	CREDIT SUISSE USA INC	0.0019	$1.00		0
1999	3	CREDIT SUISSE USA INC	0.0012	$0.75		0
1999	4	CREDIT SUISSE USA INC	0.0018	$1.19		0
1999	2	GOLDMAN SACHS GROUP INC	0.0014	$0.71		0
1999	3	GOLDMAN SACHS GROUP INC	0.0027	$1.32		0
1999	4	GOLDMAN SACHS GROUP INC	0.0029	$1.48		0
1997	3	LEHMAN BROTHERS HOLDINGS INC	0.0013	$1.30		0
1997	4	LEHMAN BROTHERS HOLDINGS INC	0.0012	$1.30		0
1998	1	LEHMAN BROTHERS HOLDINGS INC	0.0011	$1.44		0
1998	2	LEHMAN BROTHERS HOLDINGS INC	0.0018	$2.12		0
1998	3	LEHMAN BROTHERS HOLDINGS INC	0.0008	$1.10		0
1998	4	LEHMAN BROTHERS HOLDINGS INC	0.0005	$0.51		0
1999	1	LEHMAN BROTHERS HOLDINGS INC	0.0012	$1.57		0
1999	2	LEHMAN BROTHERS HOLDINGS INC	0.0017	$2.09		0
1999	3	LEHMAN BROTHERS HOLDINGS INC	0.0014	$2.20		0
1999	4	LEHMAN BROTHERS HOLDINGS INC	0.0016	$2.28		0
1997	2	MERRILL LYNCH & CO INC	0.0018	$1.24		1
1997	3	MERRILL LYNCH & CO INC	0.0017	$1.24		1
1997	4	MERRILL LYNCH & CO INC	0.0016	$1.15		1
1998	1	MERRILL LYNCH & CO INC	0.0015	$1.26		1
1998	2	MERRILL LYNCH & CO INC	0.0015	$1.31		1
1998	3	MERRILL LYNCH & CO INC	-0.0005	-$0.42		1
1998	4	MERRILL LYNCH & CO INC	0.0012	$0.86		1
1999	1	MERRILL LYNCH & CO INC	0.0019	$1.40		1
1999	2	MERRILL LYNCH & CO INC	0.0022	$1.64		1
1999	3	MERRILL LYNCH & CO INC	0.0019	$1.34		1
1999	4	MERRILL LYNCH & CO INC	0.0024	$1.82		1
1997	3	MORGAN STANLEY	0.0024	$1.09		0
1997	4	MORGAN STANLEY	0.0027	$1.30		0
1998	1	MORGAN STANLEY	0.0017	$0.91		0
1998	2	MORGAN STANLEY	0.0022	$1.37		0
1998	3	MORGAN STANLEY	0.0017	$1.01		0
1998	4	MORGAN STANLEY	0.0039	$2.07		0
1999	1	MORGAN STANLEY	0.0032	$1.76		0
1999	2	MORGAN STANLEY	0.0034	$1.95		0
1999	3	MORGAN STANLEY	0.0028	$1.65		0
1999	4	MORGAN STANLEY	0.0044	$2.84		0
1997	3	PAINE WEBBER GROUP	0.0019	$1.05		0
1997	4	PAINE WEBBER GROUP	0.0019	$0.68		0
1998	1	PAINE WEBBER GROUP	0.0020	$0.77		0
1998	2	PAINE WEBBER GROUP	0.0020	$0.82		0
1998	3	PAINE WEBBER GROUP	0.0013	$0.51		0
1998	4	PAINE WEBBER GROUP	0.0019	$0.63		0
1999	1	PAINE WEBBER GROUP	0.0028	$1.01		0
1999	2	PAINE WEBBER GROUP	0.0028	$1.02		0
1999	3	PAINE WEBBER GROUP	0.0025	$0.86		0
1999	4	PAINE WEBBER GROUP	0.0027	$0.67		0

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