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The Malcolm Baldrige National Quality Award Process in Public Higher Education Institutions and Effects on Organizational Performance: A Historical Perspective

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- Bailey, B. D. & Liu, P. (1998). Electronics manufacturing company hand assembly productivity improvement. *Journal of Industrial Technology*, Volume 15-1.

THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD PROCESS IN PUBLIC
HIGHER EDUCATION INSTITUTIONS AND EFFECTS ON ORGANIZATIONAL
PERFORMANCE: A HISTORICAL PERSPECTIVE

A Dissertation

Presented to

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Department of Applied Engineering and Technology Management

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In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

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Keywords: technology management, Malcolm Baldrige National Quality Award, organizational
performance, higher education

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ABSTRACT

Public undergraduate higher education institutions face a number of seemingly intractable problems. Among those problems are cost, accountability and access. The Malcolm Baldrige National Quality Award process is designed to help organization of any type address problems of organizational performance. This process has been used by manufacturing, healthcare, and educational institutions among others. The purpose of this study was to explore performance differences between award recipients and non-recipients on measures related to these three challenges in public higher education.

Two major research questions were postulated, and tested using historical data. The first questions asked if award recipients performed better than non-recipients against measures related to these three challenges at the time of the award. The second question asked if the rate of change in this performance was different for award recipients and non-recipients in the time period leading up to the award.

A theoretical framework was proposed, composed of the three challenges as constructs. Each construct was associated with multiple measures. The first question was tested using MANCOVA procedures to test the theoretical framework. Each construct was then tested with the same procedure. Finally, univariate results were analyzed for each of the 12 dependent variables. The same model and levels of analysis applied to the second question using repeated measures MANCOVA.

Significant differences at alpha .05 were found for several spending variables, minority success, and for two year institutions, graduation rates. Support for the theoretical framework as a whole was not found. However, it was also concluded that award recipients performed better on some measures where management actions had a direct effect such as cost. Accountability measures were affected indirectly by management actions, and the results for this construct were more mixed. Finally, it was concluded that access was not responsive to management solutions, and may be more strongly affected by public policy.

PREFACE

The Malcolm Baldrige National Quality Award has been in existence for over 20 years. Cost, accountability, and access have been major challenges for public higher education for even longer. Although the Baldrige process has been used in a limited way in higher education since the early 1990s, evidence of its efficacy, particularly related to these challenges is anecdotal at best. Previous research studies on results from the Baldrige process have focused mostly on manufacturing organizations.

The purpose of this study was to begin to establish a body of research that tests the efficacy of the Baldrige approach in various types of organizations. This study was to a degree exploratory. A theoretical framework was constructed based on the challenges and was tested. Twelve dependent variables were proposed and tested. There is ample room for improvement and refinement of these research elements. This author hopes that this line of research will be continued to establish the benefits and limitations of the Baldrige process in various types of organizations.

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CHAPTER 1

Introduction

Chapter Overview

The purpose of this chapter was to establish a framework for this research. This study investigated the use of the Malcolm Baldrige National Quality Award (MBNQA) criteria and process by public higher education institutions (HEIs) to determine effects on organizational performance. A brief background is presented, and the appropriateness of using quality awards as an indicator of successful Total Quality Management (TQM) implementation is examined.

Background

When faced with significant challenges, many U.S. manufacturing companies implemented Total Quality Management (TQM) with mixed results. Nonetheless, this implementation spread to other sectors including service, non-profits, healthcare, and education. Just as American manufacturing has faced an end to its global dominance, unprecedented challenges face public higher education institutions in the U.S. today.

When faced with significant challenges, many U.S. manufacturing companies implemented Total Quality Management (TQM) with mixed results. Nonetheless, this implementation spread to other sectors including service, non-profits, healthcare, and education. Just as American manufacturing has faced an end to its global dominance, unprecedented challenges face public higher education institutions in the U.S. today.

A significant number of higher education institutions at least toyed with TQM in the 1990s (Aly & Akpovi, 2001; Anderson, 1995). Many declared failure and moved on. Others are still trying (Arif & Smiley, 2004; Blackmore, 2004; Comm & Mathaisel, 2003; Mitra, 2004). One difficulty in assessing TQM efforts is that definitions of TQM, while aligned in principle, differ in specifics. Like many quality improvement efforts, successful implementation may also be difficult to define clearly. One approach to this assessment of TQM implementation is to use the Malcolm Baldrige National Quality Award (MBNQA) process. This process aligns well with the principles of TQM. It has been argued (Hendricks & Singhal, 1997) that receiving quality awards is an appropriate measure of successful implementation of TQM. The receipt of quality recognition based on the MBNQA process and criteria will be used as an indicator of successful TQM implementation. This study examined the efficacy of public higher education institutions that have received quality awards in addressing important challenges for undergraduate education. The structure of the research itself is also presented: a statement of the purpose of the study, a statement of the problem, the research questions to be investigated and their justification, and statements of the purpose, need, assumptions and limitations related to the methodology.

Statement of Purpose

This research grew from previous coursework and research on quality in higher education, interest in organizational performance related to quality initiatives, and from involvement with the MBNQA process. In a previous review of the literature, it became apparent that, in spite of the many differences among higher education institutions (HEIs), they shared some common challenges regarding undergraduate education. This literature review was

expanded and became the basis for much of Chapter 2, which subsequently identified cost, accountability and access as the most prominent of these challenges.

This led the researcher to consider whether successful use of the MBNQA process might result in better performance regarding these challenges. A search of the literature revealed some empirical studies of the effects of MBNQA process on the financial performance of for-profit companies, but no more than anecdotal information about how this process affects the performance of HEIs.

Although the MBNQA process and criteria are most readily associated with the awards bestowed each year, they also represent comprehensive criteria for management, and most importantly a systematic improvement process. The criteria and the process are used not only by MBNQA, but also by the state award organizations. From this point forward, reference to MBNQA refers to the criteria and process and applies to both state and national award organizations. This consistency allows analysis of many more organizations than if only recipients of the national award were examined. The purpose of this study was to determine if use of the Malcolm Baldrige National Quality Award process by public higher education institutions (HEIs) impacts organizational performance on key challenges in undergraduate education.

Statement of the Problem

Although TQM efforts in higher education are more than 20 years old, research on its effectiveness consists primarily of a few case studies. Badri et al. (2005) suggested that future research evaluate other samples and different educational organizations, so that results may be generalized to a greater degree. There has been broad agreement that public higher education in the U.S. is facing unprecedented challenges. MBNQA process is one approach that may help

HEIs to address these challenges, but currently there is little empirical evidence of its effectiveness relevant to the challenges.

Statement of the Research Questions and Hypotheses

Below are the fundamental research questions and associated performance hypotheses for this study. The hypotheses were further developed after measures were established in Chapter 3.

RQ1. Do public HEIs that have successfully implemented the Malcolm Baldrige National Quality Award criteria and process perform differently from similar institutions on key measures of cost, accountability, and access?

H₀1. There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access.

H_a1. There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access.

RQ2. Do performance changes on key measures of cost, accountability and access in the period preceding a quality award differ between award recipients and non-recipients?

H₀2. There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from the base year to the performance year.

H_a2. There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from the base year to the performance year.

Justification of Research Questions

University of Wisconsin-Stout (NIST, 2001), Monfort Business School (NIST, 2004) and Richland College (NIST, 2005) were the only higher education organizations to receive the

Baldrige award since it became available to the education sector in 1999. State award organizations did not limit participation, and made awards prior to this. The application summaries of these three award recipients present measures of cost, quality, access and competitive performance, with relevant comparisons. However, a broader study is needed to improve our understanding of the relationships between the use of the Baldrige process and organizational performance on key challenges.

Statement of the Need

This study tested assumptions regarding the efficacy of the MBNQA process in improving performance against key challenges in higher education. Results of this study may influence institutional decisions regarding implementation of the Baldrige process and approaches to addressing key challenges.

Statement of the Assumptions

The following assumptions were made by this study. This study assumed that the broad challenges faced by public higher education institutions in the U.S. were congruent with the challenges faced by individual institutions. This study also assumed that recognition through a state or national quality award process is an appropriate and adequate proxy for successful TQM implementation. The primary data sources for this study were the national and state quality award websites, U.S. Department of Education Integrated Postsecondary Education Data System (IPEDS) archival survey data, and the U.S. Census Bureau. It was assumed that this data, though self reported, is as comprehensive and accurate as possible.

This study utilized both repeated measures MANOVA and MANOVA procedures for analysis of the research questions. MANOVA assumes that observations are independent, follow a multivariate normal distribution, and that covariance matrices for the dependent variables are

equal (Stevens, 2009). Repeated measures MANOVA makes the same assumptions, except for independence. These assumptions were tested prior to data analysis.

Statement of the Limitations

The primary limitation of this study was the small number of public higher education institutions which have received recognition from state and national quality award programs in the U.S. The study was also limited by the fact that the data in the IPEDS surveys and U.S. Census Bureau data were self reported. Because this study was based on archival data, it was also limited by the inability to randomly select and assign subjects randomly to experimental and control groups.

Statement of the Methodology

Subjects. The subjects of this study were public higher education institutions in the U.S. HEIs that have won quality awards were identified through the state and national quality award websites and compared with those that have not won quality awards.

Research design. This study used review of the literature and statistical analysis. The literature review was utilized to verify broad organizational challenges, and identify appropriate measures of organizational performance relative to these challenges. Comparison of organizational performance of quality award recipients before and after implementation of the Baldrige process utilized repeated measures MANOVA. The comparison of the organizational performance of quality award recipients with non-recipients in the award year utilized MANOVA.

Procedures. The key challenges facing public HEIs were identified through a comprehensive review of the literature as presented in Chapter 2. Measures of organizational performance related to those challenges were identified, selected, and defined in further literature

review found in Chapter 3. The research questions were answered by analyzing repeated measures MANOVA, and MANOVA as noted above.

Definition of Key Terms

The following key terms were defined for the purpose of this study.

Base year was used for performance comparison purposes, and represents the time period six years before a recipient's award year.

Full time equivalent (FTE) uses different formulas for two-year and four-year institutions to account for part time students in several measures.

HEI refers to public higher education institutions.

Implementation period was the period between the base year and the performance year.

Malcolm Baldrige National Quality Award process (MBNQA) (Blazey, 2008) represents both a set of criteria and an assessment / improvement process. For the purposes of this paper, MBNQA refers to both the criteria and the process.

Performance year represents the time period during which the institutions performance qualified it for an award. It was one year before the year the award was received.

State awards refers to state level quality award organizations that use the MBNQA criteria and general process (Blazey, 2008). Many state award systems modify details of the process to align with state organizational needs.

Total Quality Management (TQM) "is the system of managerial, statistical, and technological concepts and techniques to achieve quality objectives throughout an organization" (Gyrna et al, 2007).

Summary

The purpose of this chapter was to introduce the research topic, describe the relevant issues, and establish a framework for the research. Background was presented that described use of TQM by higher education institutions and challenges they face. Justification was presented for using MBNQA recognition as an indicator of successful TQM implementation. The proposed research was described in terms of the problem statement, research questions, the purpose and need for the study, and assumptions and limitations regarding the proposed methodology.

CHAPTER 2

Literature Review

Overview

The purpose of this chapter is to establish through a review of the literature, the major challenges facing public HEIs. This review also describes the Malcolm Baldrige National Quality Award (MBNQA) criteria and process, its history and evolution, and its applicability to different types of organizations. This review also summarizes previous research regarding the effectiveness MBNQA process for improving organizational performance.

Major Topics

Public HEIs today face many challenges. This literature review determined which challenges were most prominent, enduring, and which may respond to management approaches. One such management approach is the Malcolm Baldrige National Quality Award process. This process has been used successfully by many different types of organizations. This literature review examines its history, and applicability to higher education.

Higher Education Challenges

While technical colleges, community colleges, public and private universities face similar problems, this research focused on publicly funded colleges and universities offering undergraduate education, and exclude private and for-profit institutions. From this point forward; this study simply refers to these as public HEIs. This review establishes that the most

pressing challenges facing public HEIs now and in the near future are cost, accountability, and access. These challenges were among those cited in a report commissioned by the Secretary of Education (U.S. Department of Education, 2006). These challenges are also interrelated. For example, efforts to improve retention and graduation rates (accountability) could lead an institution to recruit more affluent suburban White students, which might limit access to other underserved groups (Martin, 2005). These educational challenges also have far reaching social implications. It is not an exaggeration to state that the success of higher education in America is necessary for the maintenance and expansion of our standard of living.

Costs. Funding is probably the most pressing challenge for public HEIs (Selingo, 2005). Government support, fundraising, and tuition are the primary sources of funding for most public HEIs (White, 2005). Most direct government funding comes from state government. Support from state governments has been declining relative to need for more than 20 years, and this trend is not likely to reverse (Canesale, 2000). Medicaid spending by the states has been rising, and this is likely to continue. This spending often comes at the expense of funding for higher education (Kane & Orszag, 2003; Rosenstone, 2004; Zumeta, 2005). Medicaid spending has replaced higher education as the second largest state budget item (Rosenstone, 2004; Zumeta, 2005). In fiscal year 2003 – 2004, overall state spending on higher education was reduced by 2.1%, the largest one year decline (Arnone, 2004; White, 2005; Zumeta, 2005) prior to the 2008 financial crisis. Federal support for public HEIs comes in the form of student aid, but for the foreseeable future, congress is expected to hold the line or reduce funds for student aid (White, 2005).

Fundraising is suffering as well. Just as fundraising is receiving much more attention from public HEIs (Selingo, 2005), many foundations have reduced giving to higher education

(White, 2005). Reductions in both government funding and fundraising have caused public HEIs to increase tuition significantly (Levine, 2005).

Examining sources of funding provides a limited view of the problem. Since this study was interested in the performance of the institution, this study examined elements that these institutions have the most direct control over. HEIs have little control over the funding they receive from the government or their donors.

HEIs have more direct control over what they charge for tuition and fees and how much they spend on expenses to deliver their service; in other words, the value they deliver for the dollars they spend. Academia generally has responded to increasing costs by simply passing them along to the customer; financial pressures from rising costs and cuts in funding have resulted in large tuition increases (Rosenstone, 2004). The National Report Card on Higher Education reports that the increase in higher education costs have outpaced other major sectors of the economy since 1982 (Finney et al., 2008). From 1982 until 2007, college tuition and fees have increased 439%, while healthcare has increased 251%, and median family income has increased only 147% (Finney et al., 2008). There is evidence that continuing the current rate of tuition increases will not be tolerated by state governments (White, 2005). Tuition increases have now created issues of equity and access to public institutions of higher education (Levine, 2005).

Accountability. The challenge of quality is often couched in terms of accountability and begins with perceptions regarding public institutions of higher education. In this area, some of the news is relatively good. Public opinion generally reflects a high degree of trust in public HEIs (Selingo, 2004; Wadsworth, 2005). Measures of satisfaction with public HEIs are relatively high. But satisfaction with access and cost are becoming more important, satisfaction

with these issues is declining (Wadsworth, 2005). While perceptions are still positive, expectations are changing. Public higher education is seen increasingly as a private rather than a public good (Rosenstone, 2004). Colleges and universities are often seen as a ticket to financial security and economic status rather than serving a larger public purpose (Fallows, 2005).

Public opinion may be lagging the reality regarding public HEIs. Criticism regarding performance and results (Maeroff, 2005) is growing. It is hard to determine whether the performance of public HEIs is good or bad because they resist measurement (Mathews, 2005). Public HEIs have been able to blame failures on their students, unlike public primary and secondary schools (Wadsworth, 2005). Most defenses of public institutions of higher education rely on the same arguments; they have respected professors and brilliant students and do well in the rankings (Mathews, 2005).

There is a perception that a college degree is now the key to the middle class, replacing the high school diploma. With this shift in perception, the public may expect these public HEIs to be subject to scrutiny similar to K-12 education (Wadsworth, 2005). On available measures such as expenditures per student, faculty salaries, teaching loads, and academic credentials for incoming students, the performance of public institutions has declined compared to private universities (Kane & Orszag, 2003). However, these indirect measures are far from ideal (Christ, 2004). Where public HEIs have information regarding performance, they often do not make it available publicly (Mathews, 2005). One reason for the decline in contributions from foundations may be a lack of measurable results (Marcy, 2003).

Pressure has increased for public HEIs to demonstrate accountability by clearly defining goals and measuring results (Hersh & Merrow, 2005). Even three-fourths of public university presidents agree that colleges need to be more accountable for students' educational outcomes

(Selingo, 2005). Accountability goes beyond student performance. In future reauthorization of the Higher Education Act, congress may make changes that require assessment and accountability like those in the No Child Left Behind Act (White, 2005). Even if there is no action from congress, the Secretary of Education's Commission on the Future of Higher Education could propose standardized testing of college students (Field, 2005; Lederman, 2005).

Access. Public HEIs were intended to provide access to higher education for all sectors of the population. Public higher education was meant to be democratic, and it is a principle mechanism for making our social contract work (Yankelovich, 2005). However, cost, recruitment strategies, financial aid, and demographics have combined to make public HEIs less accessible to many Americans. While many public HEIs are committed to being accessible, they are also driven by forces that cause them to become more selective (Martin, 2005). According to the National Center for Public Policy in Higher Education, America is underperforming in higher education particularly in areas of participation and affordability (Malveaux, 2004). These trends have combined to deny access to at least 250,000 prospective students in 2003 – 2004 (Zumeta, 2005). The 2008 National Report Card on Higher Education reports that participation and affordability have not improved (Finney et al., 2008).

Tuition rate increases have caused harm to students and families, particularly the most financially vulnerable (Conklin & Reindl, 2004; Zumeta, 2005). The increase in the cost of college has been well documented. Tuition increases have exceeded the rate of inflation for 20 years (Canesale, 2000; Christ, 2004; Healy, 2005; Rosenstone, 2004; Selingo, 2004).

State governments have attempted to maintain access for low-income students and keep tuition low for state residents, while offering a high quality public education to all students (Kane & Orszag, 2003). With reductions in state support and increased enrollment, states and their

HEIs are being forced make choices between commitments (Kane & Orszag, 2003). As costs have increased and government funds have decreased, colleges have used different strategies for recruitment and financial aid to help ease the financial strain. Statistically, the best way to improve retention and graduation rates is to recruit White middle and upper class students from suburban areas (Martin, 2005). Enrollment strategies such as these are often used to attract more affluent students (Hossler, 2004; Rosenstone, 2004). Financial aid policies have further aggravated this inequity. Need-based financial aid is a key to providing access for students of modest means. Financial aid policies, however, have shifted from primarily need-based to predominantly merit-based, and the federal government has reduced grants in favor of loans and tax credits (Rosenstone, 2004; Zumeta, 2005). As a result, the amount of aid provided to students in the highest income quartile exceeds the average amount provided to students in the lowest income quartile (Hossler, 2004; Rosenstone, 2004).

These factors combine with changing demographics to deny access to those in lower socioeconomic strata, and certain minorities. Just as these factors diminish access for certain groups, those groups are growing significantly as prospective students. In some areas, prospective students will be overwhelmingly Hispanic in coming years (Fallows, 2005). Gaps in college enrollment by race and income are widening (Kane & Orszag, 2003). There is significantly less access for Hispanics than for Whites (Merrow, 2005), and graduation rates are lower among low-income and certain minorities (Christ, 2004). A majority of Americans are worried about access to public HEIs (Hersh & Merrow, 2005). Much of the public no longer sees the opportunity to go to college as a privilege, but rather as a right (Wadsworth, 2005). Nearly half of Americans believe that it is harder to get into college today than 10 years ago (Selingo, 2004).

The Malcolm Baldrige National Quality Award Criteria and Process

The Malcolm Baldrige National Quality Award criteria and process represent a systematic approach to the implementation of the best established management practices. The process relies on an iterative process of organizational assessment and improvement. The criteria is non-prescriptive but comprehensive, covering leadership, strategic planning and implementation, customer focus, measurement, analysis and knowledge management, workforce focus, process management and results. Implementation is intended to direct and align management actions and decisions to address problems important to the organization.

Evolution of the process. Legislation creating The Malcolm Baldrige National Quality award was signed into law in 1987 (H.B. 112, 1987). The criteria were developed in 1988, and represented a comprehensive quality system for manufacturing or service. Over time, there have been many changes both to the criteria and the applicants (Lee, Zuckweiler, & Trimi, 2006). By the late 1990s, the emphasis had shifted from quality systems to organizational performance (Evans & Lindsay, 2005). For the first decade, most of the applicants were from manufacturing. The remaining applicants were small business and service organizations (Baldrige, 2009). During this time, the criteria evolved through annual revisions to reflect a more comprehensive view of the role of quality as a management tool. The criteria came to reflect a broader systematic approach to management, which might be applied to organizations of any type. Also over time, many state and local quality award organizations arose and adopted the same MBNQA process, criteria, and similar procedures. Currently, there are approximately 42 active state and local awards. In the 1990s interest grew in areas such as healthcare and higher education. Some healthcare and higher education organizations, while not yet included in the national award, began to apply for state awards by the mid 1990s. Baldrige criteria specifically

for these areas were introduced in 1999, and the first national awards in education were granted in 2001 (Baldrige, 2009).

These healthcare and education criteria were very similar to the traditional business and nonprofit criteria, but contained language more familiar to those who work in those sectors. These sectors became much more active in the Baldrige process after this addition. The majority of applicants now come from healthcare, followed by education. Manufacturing firms currently apply in much smaller numbers. For example, there were a total of 70 Baldrige Award applications for 2009, with the award category breakdown as follows: manufacturing (2); service (4); small business (5); healthcare (42); education (9); and nonprofit (8) (Newman, 2009). In 2002, the breakdown looked much different: 8 healthcare organizations applied as well as 7 manufacturers, 4 service companies, 8 small businesses and 10 education organizations. There were nearly as many healthcare applicants (42) in 2009 as the total number of applicants (49) in 2002 (Juras, 2002).

State quality awards. After the MBNQA process was begun, state and local quality award organizations modeled after MBNQA process began to appear. These organizations were created to complement MBNQA by serving more organizations and aiding organizational development. These organizations now form a network called The Alliance for Performance Excellence. There are currently 37 state and five local or regional award organizations (Belter, 2009). These state award organizations use the criteria developed by MBNQA. They also follow the same general process as MBNQA, with one notable exception. While MBNQA has one quality award level, most state awards have multiple levels of recognition. This is done to encourage organizations to participate and to facilitate organizational development. The California Council for Excellence, for example, has three award levels (Barron, 2009). The

California Challenge award is the lowest level award, and its primary purpose is developmental. The second level is the California Prospector Recognition. This award, while developmental, also recognizes progress toward organizational excellence. The highest award is the Eureka Award for Performance Excellence, which emulates the MBNQA. Most states have a similar scheme of award levels, although naming conventions vary. Some of these state organizations have been in continuous operation since the early 1990s. Some have had periods of inactivity, and some were new within the last few years.

Previous research on Baldrige effectiveness. Much of the previous research in this area involved application summaries from Baldrige award recipients, similar case studies, or surveys. Beginning in 1996, Hendrick and Singhal published a series of empirical studies that investigated the financial and operational effects related to quality awards. Their studies used data from the early 1980s through the early 1990s. Those studies used a variety of quality awards as indicators of successful TQM implementation. They were also limited to manufacturing and service organizations. In this series of articles they examined: market value (1996), revenue, costs, capital expenditures, total assets, and number of employees (1997), return on sales, return on assets (1999), and stock price (2001) against matched comparisons (Hendricks & Singhal, 1996). They found evidence that quality award recipients performed significantly better than comparison firms on many, but not all of these measures over multi-year periods.

This study built on previous studies in several ways. Analysis was applied to the performance of public HEIs that have received recognition for successful implementation of the MBNQA criteria and process. In previous studies (Hendricks & Singhal, 1996, 1997, 1999, 2001) quality awards included those presented by companies to their suppliers, as well as other quality award programs. Those quality awards had varied, and sometimes unknown, criteria.

This study used a more consistent identifier: institutions that have won a state or national award based on the Baldrige criteria and process. Finally, this study examined the quality award recipients in the context of the three major challenges facing higher education today.

Summary

The purpose of this chapter was to provide a review of the literature to establish broad consensus on the important challenges confronting public higher education today. The chapter also described the history of the MBNQA process, and its evolution. A summary of the broad use of the MBNQA process across diverse types of organizations was presented. Important research on the effectiveness of the MBNQA process for improving organizational performance was presented. Trends in the use of the MBNQA process indicate that use of the criteria and process by public HEIs has continued at relatively low levels (<10 applicants annually) throughout the last decade. The literature review also identified the major challenges facing public HEIs as cost, accountability, and access. Public HEI performance in response to these challenges was the focus for the remainder of this study.

CHAPTER 3

Methodology

Overview

The purpose of this chapter was to establish the methods that were used to investigate organizational performance results that public HEIs may have realized after implementing the Malcolm Baldrige National Quality Award (MBNQA) criteria and process. Major challenges facing public HEIs were identified through literature review in the previous chapter. Appropriate organizational measures for these challenges are identified, selected and defined through additional literature review in this chapter. The selection of these measures indicates what data should be collected to address the research questions. These research questions were investigated using quantitative analysis of this data. The research questions are: (RQ1) Do public HEIs that have successfully implemented the Malcolm Baldrige National Quality Award criteria and process perform differently from similar institutions on key measures of cost, accountability and access? and (RQ2) Do performance changes on key measures of cost, accountability and access in the period preceding a quality award differ between award recipients and non-recipients?

Research Design

This research study is an ex post facto study, relying on archival data. This study made two comparisons of institutional performance. Performance of award recipients at the time of

recognition was compared with performance of those that did not receive recognition. Changes in performance were compared for a period before recognition until the period of successful implementation of the Malcolm Baldrige National Quality Award (MBNQA) process. Analysis of differences between the means of two groups is typically done using procedures from ANOVA (Best & Kahn, 2003). There were three main reasons for choosing MANOVA procedures in this study. First, the number of dependent variables in this study required 10 different ANOVA tests. This approach resulted in an accumulation of error, known as family-wise error (Stevens, 2009) which distorts the alpha level. Corrections for family-wise error are made in MANOVA procedures (Stevens, 2009). MANOVA was chosen to protect against this error. Second, the factors used in this study were categorical and the multiple dependent variables were continuous making the use of MANOVA appropriate. Third, simple ANOVA procedures would not test the model or the constructs. MANOVA procedures were selected for the analysis of the first research question. In order to analyze performance changes across time for the second research questions, a repeated measures MANOVA procedure was chosen.

Limitations of the Study

This study was intended to explore relationships between the MBNQA criteria and process, and the performance of public higher education institutions on three common challenges. Using archival IPEDS data, variables were constructed to align with these challenges. This data was then analyzed to compare award recipients with non-recipients. This approach has a number of limitations.

The measures used were measures of convenience, and may not be ideal. This was partly because IPEDS data collection has changed over time. For example, perhaps the best and most common current measure for graduation performance may be graduation time. This measure

would reflect the percentage of a given cohort that graduated in 150% of the planned time. Unfortunately, the graduation time measure could not be used. This data was only collected beginning in 2006 (reflecting a year 2000 cohort). Prior to that, the measure was unavailable, and could not be constructed from available data. Similar issues existed with other preferred measures as well, precluding their use. The result was that some of these measures were coarser than might be desired. However, they did serve to give us an initial indication of performance.

Missing data was another limitation of this study. Approximately 14% of the dataset was missing. This was particularly problematic in the instances where complete years of data were missing. Listwise deletion of these cases would have reduced the number of cases to an undesirable level. Cases with values missing, other than by complete years, were excluded from the matching process. Values missing by year were imputed using the institutional mean.

Although IPEDS data was gathered for thousands of institutions, many were not relevant to this study. The exclusion of non-relevant cases reduced the data set to 1480 cases. Listwise deletions for missing data further reduced the data set to 915 cases. Due to violations of normality and homogeneity of variance a matched set of comparisons was created that resulted in 116 cases being tested; 58 award recipients and 58 non-recipients. This was a smaller sample size than hoped for but was judged by this researcher to be adequate.

Differences between the award organizations were another limitation. The national award has only one level. State awards have three or four levels. Although naming conventions differ from state to state, these award levels appear comparable. However, since each organization conducts its own training, and sets its own policies, it seemed likely that there would be some variation in how this process was executed from state to state. In spite of these apparent differences, this study provides evidence that the award structure was applied as

designed. National awards, and the top two levels of state awards were intended reflect progress and performance in the MBNQA framework. The two lower award levels in state programs were meant to reward interest and commitment. This study found performance differences only when these top three award levels were grouped together, indicating that differences between state award methodologies were not meaningful.

Data Description

The population for this study was all public undergraduate institutions of higher education in the U.S. that received federal funding and was, therefore, required to report data to the Integrated Postsecondary Education Data System (IPEDS). For this study, the population was divided into two groups for comparison; those which had been awarded recognition from state or national quality awards and those that had not. Award was the independent variable for this study. Because there are multiple award levels, more granular comparisons were also considered (Table 1). This study compared the performance of recipients against non-recipients, and compared changes in performance from a period before recognition, until the period that qualified for recognition on measures that reflect the three major challenges described elsewhere in this paper.

Table 1

State and National Award Levels

Level	Purpose	Use
5	Recognize role model processes and results	MBNQA
4	Recognize role model processes and results	All state programs
3	Recognize progress	All state programs
2	Recognize commitment	Most state programs
1	Promote interest and engagement	Some state programs

Note. States have different naming conventions for these levels and some invert the numbering order.

There were three major sources of data for this study; websites of the award organizations, the Integrated Post-secondary Education Data System (IPEDS) database, and census data (Table 2). The first data set was used to identify award recipients from state and federal programs. The MNBQA website links to the Alliance for Performance Excellence, a network of state and local quality award organizations. The Alliance website contains links to each state award. By examining the MNBQA website and the websites of all state and local quality award organizations, this study identified all public HEIs which have been recognized by these organizations. This data was used for groupings within the independent variables.

The second major source of data is referred to as IPEDS. This data was collected and maintained by the National Center for Educational Statistics (NCES) of the U.S. Department of Education, Institute of Educational Sciences. All institutions that participate in, or apply to participate in any federal student financial aid program authorized by Title IV of the Higher Education Act of 1965, as amended (20 USC 1094, Section 487(a)(17) and 34 CFT 668

14(b)(19)) are required to complete all IPEDS surveys. More than 6,700 institutions complete IPEDS surveys each year, including research universities, state colleges and universities, private religious and liberal arts colleges, for-profit institutions, and community and technical colleges (NCES, 2009). A list of institutions participating in IPEDS represented the population of this study. This list was coded, using data from award organization websites to indicate award status; award recipients and non-recipients in corresponding years. Data from IPEDS was also used to supply control variables, including Carnegie Classification, size and geographic region. IPEDS was also the source of data for all of the performance measures which were the dependent variables.

The third source of data proposed was the U.S. Census Bureau. Although the U.S. Census Bureau conducts a full census only every 10 years, updates are published every other year. Data from the U.S. Census Bureau was intended to supplement IPEDS data for some performance measures (dependent variables). The measures identified in the following section were the proposed dependent variables for the study. Data for those measures was to come primarily from the IPEDS data supplemented by census data (Table 2).

Table 2

Variables and Data Sources

Variable Type	Primary Source	Supplementary Source
Independent Variable	Award Websites	
Covariates	IPEDS Database	
Dependent Variables	IPEDS Database	Census Data

Having identified the major challenges facing public HEIs (cost, accountability, and access), this study identified appropriate institutional performance measures related to these challenges. Performance measures were identified through a literature review focused on what measures are commonly used, how they aligned with the three major challenges, and available IPEDS data. It was the intent of this study to identify multiple relevant measures for each challenge. It was understood at this point, that these variables were likely to need refinement as the study progressed.

Preliminary Findings

Identification and evaluation of measures. After reviewing the literature for possible measures, and conducting an evaluation for alignment with the performance challenges of interest to this study, the following criteria were used for selecting measures:

1. Measures must be aligned with one or more of the three organizational challenges.
2. Comparable data must be available for most of the award recipients, and a control group.
3. Data sources must be consistent across award recipients and controls.
4. Data must be publicly available.

Possible measures. To identify possible measures, additional review of the literature was performed. A broad review was performed to identify commonly used measures. Then, a focused review was performed for measures associated with each of the three major challenges (cost, accountability, and access).

Broad review for measures. The National Center for Public Policy and Higher Education publishes a bi-annual report: *Measuring up: A Report Card on Higher Education*. This report was selected as a starting point for identifying possible measures. From the latest

version of this report (Finney et al., 2008), the following key measures were considered.

1. Preparation: Percentage of 18- to 24-year-olds with a high school credential (1990 to 2006).
2. Participation: Percentage of 18- to 24-year-olds enrolled in college (1991 to 2007).
3. Affordability: Percentage of income (average of all income groups) needed to pay for college expenses at public four-year institutions (1999-2007).
4. Completion: Certificates and degrees awarded per 1,000 state residents (age 18-44) without a college degree (1992 to 2007).
5. Benefits: Percentage of 25- to 64-year-olds with a bachelor's degree or higher (1990 to 2006).

The measures in this report were used to examine how well states, rather than institutions, perform (Finney et al., 2008). Some of these measures were not relevant to this study of public institutions of higher education or were too broad in scope for the purposes of this study.

Preparation (#1) examined how well a state's high schools prepare students for college and was beyond the scope of this study. Participation (#2) measured the percentage of 18-24 year olds enrolled in college. Applied to a specific service area, this measure was relevant to the challenges of cost and access. Affordability (#3) examined the percentage of income needed to pay for college. Again, applied to a particular service area, this measure was relevant to both cost and access. Completion (#4) examined the number of certificates and degrees awarded to residents (18-44) without a college degree. This measure was relevant to the challenge of accountability. The benefits (#5) measure examined the economic benefits that are realized from degree completion in that particular state, and it was beyond the scope of this study. A summary of measures selected from this report is shown in Table 3.

Table 3

Measures From the Report Card on Higher Education

Measure	Relevance	Associated Challenges
Preparation (#1) examined how well a state's high schools prepare students for college.	Not relevant. Beyond scope of the study.	None
Participation (#2) measured the percentage of 18 – 24 year olds enrolled in college.	Relevant when applied to a specific service area.	Cost, Access
Affordability (#3) examined the percentage of income needed to pay for college.	Relevant when applied to a specific service area.	Cost, Access
Completion (#4) examined the number of certificates and degrees awarded to residents (18 – 44) without a college degree.	Relevant when applied to a specific service area.	Accountability, Access
Benefits (#5) measure examined the economic benefits that are realized from degree completion.	Not relevant. Beyond scope of the study.	None

The above analysis of measures from the *Report Card on Higher Education* found three measures (participation, affordability, and completion) relevant to the three major challenges facing public HEIs (cost, access and accountability). In order to identify more possible measures, a literature review was done for each challenge and the results are reported below.

Measures of cost. Most public HEIs have three major sources of funding: government support, fundraising, and tuition (White, 2005). All three of these sources are under pressure. A simplified cost formula for public institutions might look like this:

$$\text{Gross cost} = \text{State funding} + \text{Fundraising} - \text{expenses}$$

Although many colleges focus on the funding side of this formula, they have limited control in this area. They can lobby their states for funding, but legislatures decide how much

funding will be allotted. Government support from states has been declining relative to need for 20 years and this decline is likely to continue (Canesale, 2000). State spending on Medicare has risen steadily and this growth has had a negative impact on funding for higher education (Kane & Orszag, 2003; Rosenstone, 2004; Zumeta, 2005)

Public HEIs have emulated private universities by engaging in vigorous fundraising efforts. However, institutions may have limited control over fundraising success. Although fundraising has been a higher priority for public HEIs in recent years (Selingo, 2005), gifts to higher education from foundations have decreased (White, 2005). Finally, tuition has increased (Levine, 2005) to the point that institutions are being pressured by government to contain costs (White, 2005), and these increases may be threatening equity and access (Levine, 2005).

The focus on funding sources only considers one side of the equation. Since this study was interested in the performance of the institution, there was a need to examine the operations that these institutions control. Because institutions have little direct control over the funding they receive from the government or their donors, and they have only modest control over what they charge for tuition and fees, these areas may not be the appropriate focus of efforts to address cost.

Institutions have much greater control over how much they spend on the expenses to deliver their service, and the value they deliver for the dollars spent. A study by Kelly and Jones (2005) contends that it is important to examine institutional performance relative to funding. In other words, how effectively do institutions use the funds they get? Quality systems approaches require that quality issues be addressed from the perspective of customers. From a customer perspective, this study was more interested in how this funding crisis translates into costs or benefits for students.

Cost measures considered included the cost of attendance relative to the median income of the service area (2003). Kelly and Jones (2005) suggested several measures which were relevant to our cost comparisons. These included degree productivity: total undergraduate awards per 100 FTE undergraduates, and the rate of graduation within 150% of the scheduled time. Both of these measures can be applied to either two year or four year institutions. The 150% of scheduled time graduation rate is a commonly used measure (Noel-Levitz, 2009). Lovett & Mundhenk (2004) equate this measure with return on investment. Another proposed measure of cost performance was general and educational spending per student (Noel-Levitz, 2009).

The additional measures identified in this section, which reflect the cost of education, were added to the list of dependent variables. These measures were: affordability, graduation rate, graduation time, spending, and participation. These proposed measures are defined in Table 4, and presented to show justification and alignment with the three challenges in Table 5.

Measures of access. Reductions in funding have increased the cost of higher education and consequently reduced access (Rosenstone, 2004). Rosenstone (2004) also noted that the average amount of scholarship assistance to students in the highest income quartile is greater than the amount that goes to students in the lowest income quartile. The participation gap between White students and African Americans and Latinos has increased (Malveaux, 2004). Since there is a strong positive correlation between socioeconomic class and academic performance, merit based aid limits access for those from a lower socioeconomic strata (Hossler, 2004).

The additional measures identified in this section, which reflect access to higher education, were added to the list of dependent variables. These measures were: financial aid,

opportunity (both low income and minority), retention and participation. Table 4 includes definitions for these measures, and Table 5 shows how they align with the three challenges. It should be noted, that many of these measures aligned with more than one of these challenges. For example, graduation rate and graduation time were associated with accountability. These measures represented outcomes important to constituents. These measures also aligned with cost, since they are one indication of value received for dollars spent. This overlap is appropriate, since the challenges are interrelated, as described in Chapter 2.

Aligning measures to challenges. Potentially useful and relevant measures were identified and selected in the previous section. The proposed measures are defined in Table 4.

Table 4

Proposed Measures and Definitions

Measure	Definition
Affordability	Cost of attendance relative to the service area median income. (Total cost / median income).
Graduation Rate	Total undergraduate awards per 100 FTE. (Graduate awards / FTE)
Graduation Time	Graduation within 150% of scheduled time. (% of cohort graduating in 150% of scheduled time).
Spending	Educational and General spending per FTE. (Educational spending + General Spending / FTE).
Financial Aid	Proportion of need-based to merit-based financial aid. (Total need-based aid / Total merit-based aid).
Opportunity	Percentage of minority and low income graduates relative to service area demographics. (Minority students / minority population, low income students / low income population).
Retention	Retention Rates (seniors / juniors, sophomores / juniors, sophomores / freshman previous year).

Table 4 (continued)

Measure	Definition
Participation	Participation Rate in the service area (18 – 24) (Students / residents)
Completion	Completion – certificates and diplomas awarded (18 – 44) relative to residents in the service area without a college degree. (certificates and diplomas awarded / residents without a degree).

Table 5 illustrates how these measures are aligned with the relevant challenges, and provides references from the literature for each measure.

Table 5

Proposed Measures and Justification Aligned With Challenges

Measure	Costs	Accountability	Access	References
Affordability	X		X	Burke (2003); Finney et al. (2008)
Graduation Rate	X	X		Burke (2003, 2006); Kelly & Jones (2005); Trible (2005)
Graduation Time	X	X		Burke (2003, 2006); Kelly & Jones (2005); Lovett & Mundhenk (2004); Noel-Levitz (2009); Schreiner (2009); Trible (2005)
Spending	X			Noel-Levitz (2009)
Financial Aid			X	Hossler (2004); Rosenstone (2004)
Opportunity			X	Malveaux (2004)

Table 5 (continued)

Measure	Costs	Accountability	Access	References
Retention		X	X	Burke (2003, 2006); Schreiner (2009); Trible (2005)
Participation			X	Finney et al. (2008)
Completion		X	X	Burke (2003, 2006); Finney et al. (2008); Schreiner (2009); Trible (2005)

Note. The references noted represent support in the literature for the selected measures.

Data Collection and Reduction

The three major sources of data for this study; websites of the award organizations, the IPEDS database, and census data, were all readily available, but each required varying amounts of cleaning and coding to be useful for analysis. A list of award recipients was extracted from the MBNQA website, and the websites of the state award programs. Other information extracted from these websites included the level of their award(s), the year of the award, and if there were multiple award for an institution, those years, and levels.

After the Quality award data was collected, it was filtered to select public HEIs for which IPEDS data was available. Award recipients which were private institutions were removed so that this study was examining only public institutions of higher education. These remaining institutions were still likely to represent several different types of institutions including regional state universities and community or technical colleges.

The IPEDS data was sorted to identify direct or derived measures that aligned with the challenges identified in this study. These datasets were downloadable from the NCES website in Excel or SPSS formats. Yearly data was used to identify the comparison groups for the study, and the data was coded to indicate award recipients and non-recipients. To control for these differences in institutional type, size, and geographic region, additional factors or covariates were added to the design. Additional data from these survey databases provided information for the covariates (Carnegie Classification, size, and geographic region). Performance data was also drawn directly from the IPEDS database for direct or derived measures of the dependent variables.

The U.S. Census Bureau data was intended to supplement IPEDS data for measures that related performance to the demographics of the service. Data from these two sources was used to calculate ratios for the dependent variables of: affordability, opportunity, participation, and completion. Although nine measures were identified in the previous section, one of these measures, Opportunity, had two distinct aspects; low income opportunity and minority opportunity. Two dependent variables were identified for opportunity, one for minority opportunity, and one for low income opportunity.

Data Analysis

Variables. The independent variable for the first comparison was award. This was categorical variable with two levels; recipients and non-recipients. A more granular analysis was also considered, using award levels as the independent variable with six levels. Comparing all public HEIs led to discussion of various differences between types of institutions. For this reason, Carnegie Classification, geographic region, and size were used as additional factors or covariates. The 10 performance measures, aligned with the three challenges in Table 5, were

proposed as the dependent variables for both comparisons in this study. The independent variables were categorical, and the dependent variables were all continuous.

The second comparison in this study used repeated measures. The factor of interest in the second comparison was the interaction of years and award. Years was a categorical variable with two levels; the year beginning implementation and the year of successful implementation. The year of implementation was referred to as the base year. The year of successful implementation was referred to as the performance year. The period between the base year and the performance year was referred to as the implementation period. A more granular analysis was considered, including award levels as an alternative independent variable. These levels included: no award, one level for each of the four state award levels, and the national award level. Since there were approximately 120 award recipients, the n of each cell in the ANOVA table was equal to approximately 120.

Analysis. There were three levels of analysis in this study. First, the three challenges of cost, accountability, and access together comprised a theoretical framework, which represented the broadest level of analysis. This was the first multivariate analysis. Second, each of these challenges was a construct in the model. Each construct was analyzed separately from the complete model using multivariate analysis. Third, the 10 dependent variables were to be analyzed independently through univariate analysis.

This study addressed two major questions. Do public HEIs, which have successfully implemented the Malcolm Baldrige National Quality Award criteria and process, perform differently from similar institutions on key measures of cost, accountability, and access? Do performance changes on key measures of cost, accountability, and access in the period preceding a quality award differ for award recipients and non-recipients? Since both comparisons utilized

categorical independent variables, and multiple continuous dependent variables, MANOVA or MANCOVA techniques were used for analysis.

Hypotheses. The first level multivariate analysis examined differences in the set of measures that represent the theoretical framework. The multivariate hypotheses for the two research questions are presented below, and in notation form in Table 6. H_01 : There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access. H_{a1} : There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access. H_02 : There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from the base year to the performance year. H_{a2} : There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from the base year to the performance year.

Table 6

Theoretical Framework Hypotheses

	Null Hypotheses	Alternate Hypotheses
RQ1	$H_01: \text{Perf}_{AR} = \text{Perf}_{NR}$	$H_11: \text{Perf}_{AR} \neq \text{Perf}_{NR}$
RQ2	$H_02: \text{Perf}_{ARchg} = \text{Perf}_{NRchg}$	$H_12: \text{Perf}_{ARchg} \neq \text{Perf}_{NRchg}$

Note. AR = award recipients; NR = non-recipients; chg = change from base year to performance year.

Each of the three constructs of cost, accountability, and access was analyzed separately in the second level of multivariate analysis. The multivariate hypotheses for the three constructs

and relative to the two research questions are presented in Table 7. The construct hypotheses are also presented in descriptive form in Chapter 4.

Table 7

Construct Hypotheses

Construct	RQ1 Hypotheses	RQ2 Hypotheses
Cost	H ₀ 1.1: Cost _{AR} = Cost _{NR} H ₁ 1.1: Cost _{AR} ≠ Cost _{NR}	H ₀ 2.1: Cost _{ARchg} = Cost _{NRchg} H ₁ 2.1: Cost _{ARchg} ≠ Cost _{NRchg}
Accountability	H ₀ 1.2: Accnt _{AR} = Accnt _{NR} H ₁ 1.2: Accnt _{AR} ≠ Accnt _{NR}	H ₀ 2.2: Accnt _{ARchg} = Accnt _{NRchg} H ₁ 2.2: Accnt _{ARchg} ≠ Accnt _{NRchg}
Access	H ₀ 1.3: Access _{AR} = Access _{NR} H ₁ 1.3: Access _{AR} ≠ Access _{NR}	H ₀ 2.3: Access _{ARchg} = Access _{NRchg} H ₁ 2.3: Access _{ARchg} ≠ Access _{NRchg}

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year.

There were two sets of specific univariate hypotheses associated with each of the dependent variables. The first set of hypotheses (hypotheses numbered H_x1.0.X) was used to test the performance of award recipients against non-recipients in the performance year. The second set of hypotheses numbered (H_x2.0.X) was used to test for differences in performance changes from the base year to the performance year, between award recipients and non-recipients. The univariate hypotheses for each dependent variable are presented in Table 8.

Table 8

Univariate Hypotheses

Dependent Variable	RQ1	RQ2
Cost Ratio	H ₀ 1.1.1: $COR_{AR} = COR_{NR}$ H ₁ 1.1.1: $COR_{AR} \neq COR_{NR}$	H ₀ 2.1.1: $COR_{ARchg} = COR_{NRchg}$ H ₁ 2.1.1: $COR_{ARchg} \neq COR_{NRchg}$
Spending Ratio	H ₀ 1.1.2: $SPR_{AR} = SPR_{NR}$ H ₁ 1.1.2: $SPR_{AR} \neq SPR_{NR}$	H ₀ 2.1.2: $SPR_{ARchg} = SPR_{NRchg}$ H ₁ 2.1.2: $SPR_{ARchg} \neq SPR_{NRchg}$
Graduation Rate	H ₀ 1.2.1: $GR_{AR} = GR_{NR}$ H ₁ 1.2.1: $GR_{AR} \neq GR_{NR}$	H ₀ 2.2.1: $GR_{ARchg} = GR_{NRchg}$ H ₁ 2.2.1: $GR_{ARchg} \neq GR_{NRchg}$
Graduation Time	H ₀ 1.2.2: $GT_{AR} = GT_{NR}$ H ₁ 1.2.2: $GT_{AR} \neq GT_{NR}$	H ₀ 2.2.2: $GT_{ARchg} = GT_{NRchg}$ H ₁ 2.2.2: $GT_{ARchg} \neq GT_{NRchg}$
Retention Rate	H ₀ 1.2.3: $RR_{AR} = RR_{NR}$ H ₁ 1.2.3: $RR_{AR} \neq RR_{NR}$	H ₀ 2.2.3: $RR_{ARchg} = RR_{NRchg}$ H ₁ 2.2.3: $RR_{ARchg} \neq RR_{NRchg}$
Completion Rate	H ₀ 1.2.4: $CMPR_{AR} = CMPR_{NR}$ H ₁ 1.2.4: $CMPR_{AR} \neq CMPR_{NR}$	H ₀ 2.2.4: $CMPR_{ARchg} = CMPR_{NRchg}$ H ₁ 2.2.4: $CMPR_{ARchg} \neq CMPR_{NRchg}$
Financial Aid Ratio	H ₀ 1.3.1: $FAR_{AR} = FAR_{NR}$ H ₁ 1.3.1: $FAR_{AR} \neq FAR_{NR}$	H ₀ 2.3. 1: $FAR_{ARchg} = FAR_{NRchg}$ H ₁ 2.3.1: $FAR_{ARchg} \neq FAR_{NRchg}$
Minority Ratio	H ₀ 1.3.2: $MR_{AR} = MR_{NR}$ H ₁ 1.3.2: $MR_{AR} \neq MR_{NR}$	H ₀ 2.3.2: $MR_{ARchg} = MR_{NRchg}$ H ₁ 2.3.2: $MR_{ARchg} \neq MR_{NRchg}$
Low Income Ratio	H ₀ 1.3.3: $LIR_{AR} = LIR_{NR}$ H ₀ 1.3.3: $LIR_{AR} \neq LIR_{NR}$	H ₀ 2.3.3: $LIR_{ARchg} = LIR_{NRchg}$ H ₀ 2.3.3: $LIR_{ARchg} \neq LIR_{NRchg}$
Student Ratio	H ₀ 1.3.4: $STR_{AR} = STR_{NR}$ H ₀ 1.3.4: $STR_{AR} \neq STR_{NR}$	H ₀ 2.3.4: $STR_{ARchg} = STR_{NRchg}$ H ₀ 2.3.4: $STR_{ARchg} \neq STR_{NRchg}$

Note. AR = award recipients, NR = non-recipients, chg = change in performance from base year to performance year.

Hypotheses testing. The first set of hypotheses (hypotheses numbered H_x1.0.X) was tested by comparing performance of award recipients against other public HEIs in the performance year. The proposed comparison was to include either all of the population data, or a

matched sample taken to achieve balance between the two groups in terms of size. MANOVA results included both multivariate and univariate *f*-tests. The multivariate *f*-tests indicated whether award recognition explained performance differences on the dependent variables as a set. Univariate *f*-tests determined if there were significant differences between award recipients and non-recipients for each dependent variable. Paired comparisons indicated whether the means for the award recipients were higher or lower than the means for the non-recipients for each dependent variable. Partial eta squared was used to assess effect size. MANOVA was used to control for the family error rate that resulted from using multiple ANOVA procedures. This approach minimized the probability of making one or more type I errors.

The second set of hypotheses numbered ($H_{x2.0.X}$) tested change in performance of award recipients and non-recipients from the beginning of the implementation (base year), until successful implementation (performance year) of the Baldrige process. Differences between award recipients and non-recipients in these changes were analyzed using repeated measures MANOVA. Since different institutions received their awards in different years, it was necessary to recode the data to reflect this. The award year was coded zero. Since the award is based on information from the previous year, the year before the award was coded -1, representing the time of successful implementation (performance year). Since implementation is thought to take five years on average (Hendricks & Singhal, 1997), the year six years before the award represents the beginning of implementation (base year) and was coded -6. Performance in year -1 was compared to performance in year -6. This coding scheme is represented in Table 9, including examples to illustrate how the coding scheme was applied. Each example represents an award recipient institution from a different year. Results were reported as base year and performance year.

Table 9

Data Coding for Repeated Measures

	Base Year	Implementation Period					Performance Year	Award Conferred
Coded yr.	-6	-5	-4	-3	-2		-1	0
Example 1	2000						2005	2006
Example 2	1995						2000	2001
Example 3	1993						1998	1999
Example 4	1991						1996	1997

The repeated measures MANOVA procedure tested for differences in the mean from base year to the performance year within subjects and between subjects. The multivariate f -tests indicated the significance of change differences between the years for the theoretical framework and the three constructs. The univariate f -tests determined whether any differences between years were statistically significant for each dependent variable. Pairwise comparisons indicated whether the means from the base year were higher or lower than the means from the performance year for each dependent variable. Partial eta squared values were used to assess effect size. This testing regimen and the related comparisons of interest are presented in Table 10.

Table 10

Hypothesis Testing Regimen

Level of Analysis	Statistical Method	Comparison of Interest	Test Statistics
RQ1 Theoretical framework RQ1 Constructs	MANCOVA	Award	Multivariate f -tests Estimated means and confidence intervals
RQ1 Dependent Variables	ANCOVA	Award	Univariate f -tests Estimated means and confidence intervals
RQ2 Theoretical framework RQ2 Constructs	Repeated Measures MANCOVA	Years and Years*Award	Multivariate f -tests Estimated means and confidence intervals
RQ2 Dependent Variables	Repeated Measures ANCOVA	Years and Years*Award	Univariate f -tests Estimated means and confidence intervals

Significance level. A significance level (alpha) of .05 was first considered for this study, and is commonly used in studies of this type. This would result in a 5% chance of rejecting a true null hypothesis (Type I error). Protection against Type I error is desirable, as there may be some risk to capital, disruptions, and the well being of people that could occur as a result of policy changes. However, given the nature of the Baldrige process, it was thought that the effects of Type I error would be neutral rather than negative. These risks are moderate; not involving life or death, and any policy changes are not likely to be catastrophic or irreversible. Additionally, the risks described above must be balanced against the risks of no action if the

researcher failed to detect a difference because alpha was set too low. A more liberal alpha of .1 would give more power to detect real differences. Both Kinnear & Gray (2010) and Spicer (2005) contend that researchers may have erred too much in favor of avoiding type I error at the expense of power. Cohen (1992) suggested that exploratory studies such as this one use an alpha of .1. However, analysis of the data in regards to the MANOVA assumptions of multivariate normality, homogeneity of the covariance matrix, and linearity, revealed violations. Although MANOVA is robust to these violations (Stevens, 2009), it was decided to set the significance level (alpha) at the more conservative level of .05.

Hypotheses

Chapter 1 outlined the basic research questions and the related descriptive hypotheses. Those hypotheses were expanded and refined in this section based upon the measures established above. Three levels of analysis were defined; theoretical framework, construct, and dependent variable. The research questions, all related hypotheses, and proposed statistical tests were presented. Hypotheses for both research questions were presented for the theoretical framework in Table 6, for the three constructs of cost, accountability, and access in Table 7, and for the 10 dependent variables in Table 8.

Summary

This chapter presented a basis for the methods to examine the research questions, described the research dataset, and explained the approach to data collection and reduction. Hypotheses related to each research question, and to each organizational challenge were presented, as well as an approach to testing each of them.

CHAPTER 4

Results and Findings

Overview

The purpose of this chapter is to describe the data preparation, the statistical methods used to analyze the data in this study, and the findings from those analyses. Included in this chapter is the identification, refinement, and construction of variables aligned with the theoretical framework and the constructs of cost, accountability, and access. MANCOVA analysis and repeated measures MANCOVA procedures are described and discussed relevant to the two research questions. Analysis for each question was performed at the multivariate level for the theoretical framework and each of the three constructs, and univariate results are examined for each dependent variable, in order to identify possible performance differences between award recipients and non-recipients.

Choosing and Constructing Variables

Close examination of available IPEDS data from 1987 through 2008 required that many of the variables used in this study be further refined. The following section describes the nature of the data that was collected, and how revision decisions were made.

Census data. Prior to the beginning of the study, IPEDS data were scanned to determine how much data were available to conduct the study. Available data spans the entire period of

interest (1987-2008) and includes several thousand higher education institutions each year. It was concluded that there was adequate data within the IPEDS databases to conduct the study.

IPEDS data was to be complemented by census data. Upon beginning the study a review of census data revealed several obstacles to using this data. Complete census data was available only once a decade and initially it appeared that the Census Bureau's more frequent surveys would be an adequate substitute. There were three major problems that made the use of this data impractical. First, the studies were only conducted and published every other year, while IPEDS data was compiled yearly, making the establishment of equivalent comparisons for each year of IPEDS data impossible except by interpolation. Second, no common geographic identifier was found to link census data to IPEDS data. This meant that census data and IPEDS data would have to be matched case by case for hundreds of cases, involving more labor than was feasible for this study. Third, the data from the survey consisted of estimates and measures were not consistent or comprehensive across surveys.

The purpose of using census data was to reconcile geographic and demographic differences in the IPEDS data. Further examination of IPEDS data revealed that some of these objectives could be managed using factors or covariates from the IPEDS data. Therefore, the census data was to some extent redundant. As a result census data was excluded, removing an unnecessary layer of complexity from the study.

Identifying factors. The factors in this study served two purposes. The first purpose was used to discriminate between recipients and non-recipients and among different levels of award recipients. The second was to ensure that award recipients were compared with institutions that had similar general characteristics.

Award recipients were identified from the MBNQA website, and the various state award websites. Several different schemes for categorizing institutions were considered, and three were tried. The first approach was to create a categorical variable with two levels. This factor was named awards. Institutions were coded with one (1) representing the award recipient group, and zero (0) representing the non-recipient group. Award simply groups the population into those that have been award recipients and those that have not. This allows a simple two group analysis.

Institutions can be grouped in several additional ways. At the other extreme, the factor named highest award level provides six levels for comparison. Award recipients are grouped into five levels based on the level of the award, with five being the highest, and indicating MBNQA recipients, and level one being the lowest, indicating the lowest level of recognition at the state level. Level zero represents those that have not been recognized by quality award organizations.

By collapsing some of these six categories, another alternative for this factor was created. This alternative factor collapsed the top three levels into one group, and the bottom three levels into another group. Awards at level three or higher were considered to be more representative of mature or maturing high performance organizations. Award levels one and two were thought to be more indicative of recognition for effort rather than accomplishment. This variable was named award status. The alternative factors of interest are shown in Table 11.

Table 11

Alternative Factors of Interest

Alternative #1		Alternative #2		Alternative #3	
Award	Description	Award Level	Description	Award Status	Description
1	Award recipients	5	National recipients	2	Award levels 5, 4, 3
0	Non-recipients	4	State award top level	1	Award levels 2, 1
		3	State award 2 nd level	0	
		2	State award 3 rd level		
		1	State award 4 th level		
		0	Non-recipients		

The second purpose for factors in this study was to improve comparability. There was concern that comparisons across of institutions with different missions, sizes, types, and geographic and demographic areas would be problematic. Since institutional performance may vary due to a number of structural, geographical and demographical characteristics, other factors were identified from the IPEDS data to help mitigate these differences. There were multiple possible factors for demographics, geographic area, and for mission and type. These are listed in Table 12, in order, from the most coarse grouping to the most granular, within each area of concern. There was an important trade-off involved in the selection of factors. Groupings that offered more levels, provided more granular analysis, and may identify differences that might not be apparent with coarser groups. However, more granular grouping also created smaller groups, and negatively affected sample size.

Table 12

Comparison Concerns, Factors, and Descriptions

Concern	Factor	Description
Characteristics	Locale	This variable uses seven categories to describe the location of the institution, ranging from rural to large city
Geographic area	Obereg,	Obereg classifies institutions by 8 geographic areas.
	State	This is the state where an institution is located. This variable serves the same function as Obereg, but may allow more granular comparisons.
Institution Size	Size (total Enrollment)	Institution size was the total number of students at all levels.
Mission and Type	Iclevel,	Iclevel uses 3 levels to categorize institutions based on the type of degrees granted.
	hloffer	This variable is similar to the Iclevel, but uses nine categories to classify institutions by the highest level of degree offered.
	Carnegie Codes	A set of codes, developed by the Carnegie Foundation, and used by IPEDS, to categorize institutions based primarily on institutional focus and highest level of degree offering. There were 10 Carnegie Codes of interest to this study.

Four factors, one from each area of concern, were selected from this list. The first factor, locale was selected to group institutions based on the degree of urbanization. Second, institutional size (size) was selected to account for differences in total student population. Institutional size was a categorical variable with five levels. However, data was also available to express size as a continuous variable so it could be used as a covariate. The third factor, region (obereg) was selected for geographical characteristics because state would result in too many

levels. There were a number of considerations for determining a factor for mission and type. Both Hoffer and Carnegie Codes make these distinctions, but also have more levels than desirable. Hoffer has nine levels, and Carnegie Code (2000) has eight. Level was chosen for the fourth factor, because it would result in fewer groups. This factor was named type, and had three levels, but only two were applicable to the institutions in this study. Those two levels simply separate two year institutions from four year institutions.

Selecting and Defining Dependent Variables

Ten dependent variables were originally proposed for this study based on a review of the literature. Table 4 showed the original dependent variables and their definitions. Further study of the available IPEDS data resulted in some changes to these variables to accommodate available data. In one case a variable was eliminated because data was not available, and in some cases additional dependent variables were defined. All of these changes maintain the alignment of dependent variables with the study constructs of cost, access, and accountability. This section describes the search for data for the originally proposed variables; the data that was found, and the changes that were made. It also describes the IPEDS variables, their relationships to the dependent variables, and the steps necessary to construct the dependent variables from IPEDS variables.

IPEDS data from 1987 through 2008 was examined. Across these years, some of the surveys changed, some variable names changed, and in some cases the IPEDS survey questions changed, making it necessary to select or construct measures that were comparable across all the years. Each of the original dependent variables is discussed below.

Affordability. Affordability (cor) was originally defined as the cost of attendance relative to the service area median income. This variable was refined in several ways. The cost

of attendance measure would include the cost of housing and meals, which was likely to vary by location. This was one reason for including median income in the equation. As the data was reported in IPEDS, the cost of tuition and fees can be separated from total cost. The cost of tuition and fees can then be compared among similar institutions using factors that allow comparison of institutions similar in type, size, and geographical location.

Tuition and fee data were reported in combined fashion from 1987 through 1998, and were reported separately from 2000 through 2008. For all years tuition was reported for in-district students, in-state students, and out of state students. Since the focus of this study was performance for the service area, the numbers reported for the smallest service area were used. For example, if an institution reported an in-district rate that was less than the in-state rate, the in-district rate was used. This variable was renamed tuition and fees.

Graduation rate. Graduation rate was originally defined as total undergraduate awards per 100 FTE students. Total undergraduate awards data included all diplomas and certificates awarded in a given year. FTE was not directly reported in the earliest years of the study. In later years it was reported, and after 2000 the formula for calculating FTE was more sophisticated than in earlier years. For consistency across years the year 2000 formula was used for all FTE calculations. This graduation rate variable was unchanged.

Graduation time. Graduation time was originally defined as graduation within 150% of Scheduled time (% of cohort graduating in 150% of scheduled time). Calculation of graduation time required knowledge of the original cohort size, and the number of students from this cohort who graduated in 150% of scheduled time. This would be three years for a two year institution, and six years for a four year institution. This measure was broadly supported in the literature review, and appears to be becoming a standard measure. Unfortunately, this data was not

available before 2006. There was not an adequate cohort data and completion data before that year to make a meaningful calculation. For these reasons, this variable has been removed from the study.

Spending. Spending was originally defined as educational and general spending per FTE (educational spending + general spending / FTE). The purpose of this variable was to indicate how much of the institutions resources were dedicated to activities closely related to education. A close look at the data revealed that educational and general spending was made up of several IPEDS variables: instruction, research, public service, academic support, student services, institutional support, operation and maintenance, and scholarship and fellowship spending. Later surveys also included some financial transfers. For the purposes of this study, educational and general spending was the sum of six of the eight IPEDS variables listed here. The research and public service variables were excluded, since the majority of institutions did not report on these two variables.

It may be noted, that some of these IPEDS variables were more directly related to undergraduate education than others. For that reason, a new variable was added here to tighten the focus on undergraduate education. The new variable was called direct spending, and was the sum of instruction, student services, and scholarships divided by FTE. Both of these variables compared spending with the number of FTE students. The dependent variable spending was renamed general and educational spending, and was supplemented by the new dependent variable named direct spending.

Financial aid. The original definition for the financial aid variable was proportion of need-based to merit-based financial aid (total need-based aid / total merit-based aid). Examination of the IPEDS data revealed that it was not possible to make a clear distinction

between need-based and merit-based financial aid. Financial aid variables within IPEDS were slightly different in later years than in early years, but it was possible to make some reasonable comparisons. Early data (up to 1996) included the following variables: total federal Pell grants, other federal grants, state grants, local grants, private grants, institutional grants and total scholarship and fellowship spending. Later surveys categorized financial aid somewhat differently. All federal grants were reported together including Pell grants. Private grants were not reported. Because of these reporting differences, it was more difficult to compare total grant and scholarship expenditures for early years with later years. However, the total scholarship and fellowship spending variable from IPEDS financial data was comparable across the years.

As a result of this examination, three new variables were defined for financial aid. The first of these new variables was federal grants. Since the majority of federal aid was in Pell grants which were need-based, this variable was used as a surrogate for need-based aid. The remainder of the financial aid comes from state, local or institutional sources, and it was not possible to determine how much was need-based or merit-based. Therefore, the second financial aid variable was simply total financial aid as indicated by the scholarship and fellowship spending variable in the IPEDS financial data. Both measures were analyzed on a per student (FTE) basis. In order to relate spending more directly to cost, a third financial aid variable was added. This variable was a ratio of scholarship and fellowship spending to tuition and fees.

Opportunity. Opportunity as originally defined included two measures: percentage of minority and low income graduates relative to service area demographics (minority students / minority population, low income students / low income population). IPEDS data did not contain any information that would be useful in determining low income students other than Pell grant

information, which was not consistent across years. For this reason, Low income opportunity was removed as a variable.

Two new opportunity variables were defined. Minority data was available for enrollment and completions. The first added variable was minority completions as a proportion of total completions. This variable was named minority completions. An additional variable named minority success was also added. This variable compared minority completions with minority enrollment.

Retention. The retention variable required a minor change in definition. Originally, it was defined as retention rates (seniors / juniors, sophomores / juniors, sophomores / freshman previous year). Data on the number of students at each level was not broadly available. In later years, there were direct measures of retention, which accounted for transfers in and out. Unfortunately, comparable data was not available in earlier years, so transfers were not considered for analysis.

Instead, expected returns were compared with actual returns based on student population data. Expected returns were calculated by establishing the total undergraduate enrollment for the previous year, then subtracting completions for that year (prior year undergraduates - prior year completions). Actual returns were calculated by establishing the total undergraduate enrollment for the current year and subtracting current freshmen (current year undergraduates - current year freshmen). Retention rate was then calculated by dividing actual returns by expected returns. For example, to determine retention for 1996, total undergraduates in 1995 minus completions in 1995 was divided by total undergraduates in 1996 minus freshmen in 1996. While this measure was less precise than one that included transfers in and out, it allowed comparisons across all the years of interest for this study.

Participation. Participation was originally defined as participation rate in the service area (ages 18-24) (students / residents). Student age data was available from IPEDS data in only a few years. A measure of minority participation was substituted. This new variable measured minority enrollment as a proportion of total enrollment, and was named minority enrollment.

Completion. The original definition for completion was certificates and diplomas awarded (ages 18-44) relative to residents in the service area without a college degree (certificates and diplomas awarded / residents without a degree). Again, since age data was unavailable this definition was modified. Completion was calculated by dividing the total number of undergraduates by the total number of completions.

The revised study variables are listed and defined in Table 13. It should be noted again, that in instances where local demographic data has been removed from the variable, such as completion, factors discussed elsewhere were used to ensure comparisons of similar institutions.

Table 13

New Study Measures and Definitions

Measure	Definition
tuition and fees	Total of tuition and fees for the lesser of in-district students or in-state students.
graduation rate	Total undergraduate completions per 100 FTE. (completions / FTE)*100
general and educational spending	General and educational spending per FTE. (instruction, academic support, student services, institutional support, operational support, scholarships and fellowships) / FTE
direct spending	Direct spending per FTE. (instruction + student services + scholarship and fellowship spending) / FTE

Table 13 (continued)

Measure	Definition
Federal grants	Total federal aid per FTE (Pell grants + other federal grants / FTE)
Scholarship & fellowship spending	Total scholarship and fellowship spending / FTE
Tuition funding	Total scholarship and fellowship spending / tuition and fees
minority completions	Minority completions / total completions
minority success	Minority completions / minority undergraduate enrollment.
retention	The number of undergraduates in the previous year minus the number of completions divided by the number of undergraduates in the current year minus freshmen.
minority enrollment	Minority undergraduate enrollment / total undergraduate enrollment
completions	Certificates and diplomas awarded / total undergraduate enrollment

The relation of the original proposed variables to the higher level constructs of cost, accountability, and access was demonstrated in Table 5 where each measure was identified with each construct to which it appeared related. This created overlap in the relationships which accurately reflects the real world situation. However for the purpose of analysis, the new dependent variables were aligned with the construct to which they were most strongly related allowing no overlap, as shown in Table 14. The result was that five of the dependent variables were aligned with cost, five with accountability, and two with access.

Table 14

New Measures and Relationships to Constructs

Measure	Abbreviation	Cost	Accountability	Access
Tuition and fees	t_f	X		
Graduation rate	gr		X	
General and educational spending	spnd1	X		
Direct spending	spnd2	X		
Federal grants	faid1			X
Scholarship & fellowship spending	faid2	X		
Tuition funding	faid3	X		
Minority completions	mcmp		X	
Minority success	msuc		X	
Retention	ret		X	
Minority enrollment	menrl			X
Completion	comp		X	

Constructing Dependent Variables

The IPEDS data in its original form was not configured in a way that was directly usable in this study. It was necessary to use the IPEDS variables to construct the study variables. This was accomplished in three steps. First, the IPEDS data of interest were identified and organized. Second, in some cases component variables were constructed. Table 15 illustrates the relationship of IPEDS variables to the component variables. Third, component variables and IPEDS variables were used in combination to calculate the study variables.

Table 15

Relationship of IPEDS Variables to Component Variables

Component Variables	Criteria, or combination	IPEDS Variables
Full time equivalent enrollment (FTE)	$2\text{yr FTE} = \text{ftug} + (\text{ptug} * .335737)$ $4\text{yr FTE} = \text{ftug} + (\text{ptug} * .403543)$	Total men and women, part-time and full-time, enrolled.
Total undergraduate enrollment	Total of the following categories:	Men and women, part-time and full-time, enrolled.
Total freshman enrollment	Total of the following categories:	Freshman men and women, part-time and full-time enrolled
G & e spending	Total of the following categories:	Instructional, academic support, student services, institutional support, operations, and scholarship and fellowship spending.
Direct spending	Total of the following categories:	Instructional, student services, and scholarship and fellowship spending.
Completions	Total of completions (diplomas and certificates) for all of the following categories:	Completions for men and women, part-time and full-time.
Minority completions	Total of completions (diplomas and certificates) for all of the following categories:	Men and women, part-time and full-time in all minority groups
Minority enrollment	Total all part- and full-time minority enrollment	Total minority men and women, part-time and full-time, enrolled

Note. ftug = full time undergraduates, ptug = part time undergraduates.

After compiling the component variables, the dependent variables for the study were constructed in this final step to create the study variables. The resulting continuous variables were the dependent variables for the study and are illustrated in Table 16.

Table 16

Study Variable Construction

Study Variables	Criteria, or combination	Component or IPEDS variables
Tuition and fees (t_f)	Lower of in district and in-state / FTE	tuition and fees and full time equivalent enrollment (FTE)
Graduation rate (gr)	(completions / FTE)*100	Completions and full time equivalent enrollment (FTE)
General and educational spending (spend1)	G & e spending / FTE	General and educational spending and full time equivalent enrollment (FTE)
Direct spending (spend2)	Direct spending / FTE	Direct student spending and full time equivalent enrollment (FTE)
Federal grants (faid 1)	Federal grants / FTE	Federal grants and full time equivalent enrollment (FTE)
Scholarship and fellowship spending (faid 2)	Scholarship and fellowship spending/ FTE	Scholarship and fellowship spending and full time equivalent enrollment (FTE)
Tuition funding (faid3)	Scholarship and fellowship spending/ tuition and fees	Scholarship and fellowship spending and tuition and fees
Minority completions (mcmp)	Minority completions / completions	Minority completions and completions
Minority success (msuc)	Minority completions / minority undergraduate enrollment	Minority completions and minority undergraduate enrollment

Table 16 (continued)

Study Variables	Criteria, or combination	Component or IPEDS variables
Retention (ret)	[Totug (current year) - Totfrsh (current year)] / [Totug (previous yr) - comps(previous yr)]	Total enrollment, total freshman enrollment and completions
Minority enrollment	Minority enrollment / total undergraduate enrollment	Minority enrollment and total undergraduate enrollment
Completions (comp)	completions / total undergraduate enrollment	Completions and total undergraduate enrollment

Data Reduction

More than 6,700 institutions complete IPEDS surveys each year. Many of these institutions were not of interest for this study. An initial master list of institutions was created by identifying institutions that responded to the primary IPEDS survey every year from 1988 through 2008. Since the focus of this study was U.S. public undergraduate education, all for-profit institutions, graduate only institutions, job training programs and special purpose institutions were removed. A total of 1,480 institutions remained after these criteria were met.

From the quality award website data, 107 recognition awards were identified for higher education institutions between 1993 and 2008. After the removal of for-profit institutions, there were 83 institutions of higher education that had received recognition. However, several institutions were recognized in multiple years. It was also possible for a unit within an organization to be recognized. In cases where there was recognition for both a unit and the whole institution, the case for the whole institution was used. After consolidating the cases of

multiple recipients, there were 61 distinct institutions that had received recognition at the state or national level.

Missing Data

Missing data is a common occurrence in certain types of research, including repeated measures and longitudinal studies (Stevens, 2009). The problem is pervasive in empirical social science research (Stevens, 2009). It was also true for this study. Data in this study were missing in three distinct ways. First, IPEDS conducted multiple surveys, and some institutions responded to the primary survey which identified institutional characteristics, but not to some other surveys. Second, institutions may respond to multiple surveys but failed to answer some of the questions within the surveys. Third, there were some important surveys that either were not conducted, or not compiled for public use. Data for three of the 20 years were missing in this way. For 1999, no survey data was available. For 1997 and 1998, there was no financial survey data available, and the financial survey contained data that affected about half of the dependent variables.

The data set for dependent variables included 1,480 cases, of which 61 were award recipients. Approximately 14.5% of the values were missing. Missing years of data accounted for about three-fourths of these missing values. While the study spanned 20 years, not all of the data were of interest to the study. For each award recipient, only the performance year (award year minus one), and the base year (award year minus six) were relevant.

There is little consensus regarding how to handle missing data (Stevens, 2009). The primary choice was whether to remove cases with missing data or try to estimate the missing values. Because there are no hard and fast rules, researcher judgment is necessary to decide when to drop subjects or variables from the analysis (Huberty & Olejnik, 2007). As this

discussion began, it should be noted that there was no missing data on award or other factors for this study, only for dependent variables.

A number of data imputations methods were investigated; including regression based estimates, mean replacement, multiple imputation, maximum likelihood, and expectation maximization. Some of these methods require analysis of the reasons why data is missing (Little, 1995). However, the more sophisticated methods studied appear to be more appropriate for cross-sectional data. Regression estimation could be accomplished by using existing values on some variables to estimate other variables. But, since complete years were missing, this was not feasible. Likewise, traditional mean replacement, which uses the mean across cases did not seem to be the best approach, because it could introduce bias. This researcher did not feel that the mean across cases was the best predictor of a given value.

Roth, Switzer, and Switzer (1999) made a distinction between what they call missing instrument and missing cases. They recommend using what they labeled the *person mean* (Roth et al., 1999). The equivalent in this study was the institutional mean. Using this method, the mean would be determined by using the mean of the values occurring before and after the missing value by case. So instead of using a mean that comes from across cases, means were determined within cases. It is logical that the best estimates of a given value for a specific institution would be the values from the same variable for the periods before and after the missing value. For example, the best estimator of 1999 enrollment for a specific institution might be the average of enrollment at that same institution in 1998 and 2000. Missing values for all variables that were missing complete years were estimated using the institutional mean method described by Roth et al. (1999). Since our cases are institutions rather than persons, this was referred to as the institutional mean.

The removal of cases is fairly straightforward. One common solution is to remove cases where data is missing using either pairwise or listwise deletion (Allison, 2002). Of these options Allison (2002) suggests that listwise removal will introduce the least bias. When using listwise deletion, if a subject is missing data for one variable, then that case is removed from the dataset. One drawback to listwise deletion is that a large proportion of the original sample can be lost.

Extensive analysis of the missing data was performed to determine how much data would be lost if listwise deletion were used. An approach was sought that would be a fair compromise between the removal of excess data, and overreliance on the estimation of missing values. Since there were some complete years of missing data, listwise deletion based on this missing data would have resulted in the removal of all cases. Particular attention was paid to the loss of any award recipients, since the number of cases was quite low to start with. The comparison group however, was large and this was less of a concern. Listwise deletion was then applied to the remaining values by removing any case missing values on any variable. The resulting data set contained 916 institutions, of which 58 were award recipients.

Assumptions

Hypotheses were tested using MANOVA and MANCOVA procedures in SPSS, version 19 because these procedures accommodate the analysis of several continuous dependent variables at the same time. This is particularly appropriate when the variables share a common meaning or concept (Stevens, 2009). In this study, the common meaning was found in the theoretical framework and in the constructs of cost, accountability, and access.

MANOVA and MANCOVA rely on four main assumptions for validity. MANOVA and MANCOVA assume that observations are independent. Keppel and Zedeck (1989) describe this as the most important and sensitive assumption. Since each institution responds to the IPEDS

surveys separately, and there was no reason to believe there was any interaction between them in this effort, the independence assumption was met.

The second assumption was that a multivariate normal distribution is present in each group. Multivariate normality requires that the data in each variable be normally distributed. Additionally, it requires that all linear combinations and subsets have a normal distribution. Unfortunately, there was not a single test of multivariate normality available in SPSS. However, Stevens (2009) argues that checking univariate and bivariate normality is an adequate test of multivariate normality. Analysis of univariate normality using skewness and kurtosis measures and the Kolmogorov-Smirnov test indicate that all of the dependent variables for both groups violated the normality assumption. Non-normality in these measures stemmed from two conditions. The first was that the data were moderately skewed. This was due in part to some extreme values to the right in the distribution, but also because the distribution for some variables was truncated at zero on the left. The greater violation appeared to be kurtosis. Stevens (2009) argued that platykurtosis attenuates power in these procedures. However, the data in this study was leptokurtotic instead. Stevens (2009) and others (Olson, 1974) indicate that effects of non-normality are similar to those in ANOVA. They cite only a small effect on type I error. Although the distributions of the variables violate the normality assumption, skew was moderate, and leptokurtosis appeared to be less problematic than platykurtosis. ANOVA related procedures are thought to be quite robust to these violations. Keppel & Zedeck (1989) argued that even sizable violations of assumptions of normality and homogeneity do not seriously distort the distribution of the f statistic in ANOVA procedures.

The next assumption that must be met was the homogeneity of variance assumption. In the case of MANOVA and MANCOVA, this requires that the covariance matrices are equal.

This is a very restrictive test, and is not likely to be met in practice (Stevens, 2009).

Heterogeneity of variance is a minor problem when group sizes are equal. As group size becomes more unequal, heterogeneity increasingly distorts the alpha level. MANOVA is robust to violations of normality and homogeneity, if imbalance is not too severe. Stevens (2009), recommends that the largest group be no more than 1.5 times the size of the smaller group. Since the data for this study contained 916 cases, 58 of which were award recipients, and 858 which were non-recipients, this imbalance represented a problem which is addressed in the next section of this research.

In MANOVA, the linearity assumption means that all pairs of dependent variables, and covariate dependent variable pairs have linear relationships. Linearity is not strictly required for accurate inference (Spicer, 2005), but deviation from linearity will reduce power. There were 12 dependent variables and one covariate in this study. This yielded 78 possible pairs. Scatterplots of all 78 pairs were analyzed for indications of non-linearity. No clear evidence of non-linearity was found. MANOVA works best when there is moderate correlation among the dependent variables. Multicollinearity should also be avoided (Spicer, 2005). Of the 78 pairs, seven were strongly correlated. The correlation in the rest of the pairs was weak to moderate.

Creating a Matched Sample

To partially mitigate the problems associated with an unbalanced design, matched samples were used for the analysis. For each award recipient, a list was generated of non-recipients sharing the same characteristics for Carnegie Code, locale, and region. Where these criteria were too restrictive to generate suitable matches, region was expanded to include adjacent regions. The result was a list of non-recipients matched with each award recipient. From the non-recipient list, one institution was selected at random using the random number

generator in Excel. Data for the performance year (highest award year minus one) and the base year (highest award year minus six) for the recipient was compiled. Data for the matched cases was compiled for the corresponding years. The resulting data set for analysis consists of 116 cases; 58 award recipients and 58 non-recipients. Imputed values using the institutional mean method accounted for 368 of 2,784 cells, or approximately 13% of the data.

Selecting Factors

Previously, a number of possible configurations of award, our factor of interest, were identified. Additional factors which might have been used to mitigate differences in size, mission, and type of institution were also identified. Preliminary analysis was performed to make a final decision about which factors to include.

Three alternative factors for award status were identified; award, highest award level, and award status. Because highest award level had six levels, analysis using this factor resulted in some groups with an extremely small n . For this reason, highest award level was not considered further for analysis. A preliminary test was performed on the factor award, using MANOVA. The result of the multivariate test for award resulted in a p -value of .855 for this factor. No significant difference between award recipients and non-recipients was found at $\alpha = .05$, based on this model.

It has been noted that the two lowest levels of recognition reward interest and commitment, rather than performance. The factor award status collapsed the top three award recipients into one group, and grouped recipients that had received the two lowest award levels with the non-recipients. The remainder of this analysis focused on award status as the factor of interest. This factor separated the top three award levels into one group, and the bottom two award levels and non-recipients into a second group.

MANOVA analysis was performed using award status as a fixed factor. In this analysis, the p -value for award status was .319. This multivariate test was still not significant, but the p -value for factor award status, was much lower than the p -value for award had been in the first analysis, suggesting that award status comes closer to representing groups with different performance. This was consistent with the concept that only the top three awards reflected performance. Award status was selected as the primary factor of interest for use in the analysis.

Other factors, which might confound the results were then considered. The first was size of the institution. Analysis of bivariate correlation was performed to determine how much size affects the dependent variables. This test showed that size was significantly correlated with all but three of the 12 dependent variables at the .05 level, as shown in Table 17. Size was added to the model as a covariate, to mitigate the confounding effect of size differences between institutions.

Table 17

Correlation Table For Size and All Dependent Variables

Variables	Size		N
	Pearson Correlation	Sig. (2-tailed)	
Tuition and Fees	.303**	.001	116
Graduation Rates	-.168	.072	116
General & Educational Spending	.397**	.000	116
Direct Spending	.378**	.000	116
Federal Grants	-.183*	.050	116
Scholarship Spending	.317**	.001	116
Tuition Funding	-.108	.247	116

Table 17 (continued)

Variables	Size		N
	Pearson Correlation	Sig. (2-tailed)	
Minority Completion	.266**	.004	116
Retention	.251**	.007	116
Minority Enrollment	-.110	.238	116
Minority Success	.013	.892	116
Completions	.894**	.000	116

Note. ** Correlation was significant at the 0.01 level (2-tailed); *Correlation was significant at the 0.05 level (2-tailed).

In order to mitigate differences in performance that could be due to the type and mission of institutions, type was considered as a second factor. Type was added to the model as a fixed factor, and the MANCOVA analysis was run again. The multivariate test resulted in a p -value of .221 for size, .008 for type, and .377 for award status. At $\alpha = .05$ type was significant, but size and award status were not. Type was considered an important factor and was added to the model.

The model then had two factors; award status and type, and one covariate, size. Although size became non-significant when type was added to the model, the significant correlation between size and nine of the dependent variables suggested that size should remain in the model. Having considered the size and the type of institution, the potential remaining concern was geographic region. This concern would be addressed by adding either state or region (obereg) as an additional factor. State had 50 levels, and region (obereg) had eight. Either of these factors resulted in groups for analysis that were much too small, and region was already used in creating

the matched sample. No further changes to the model were considered. The final model selected for analysis included award status, which was the factor of primary interest for this study. Type was an additional factor in the model, and size was a covariate. These factors and the covariate were used exclusively from this point forward.

Results

Analysis for this study addressed the two research questions and was done at three increasing levels of specificity. The first question was whether award recipients outperformed similar institutions. The second question was whether performance changed between a base year and a performance year was different for award recipients and non-recipients. Both questions were examined first with a multivariate test of the theoretical framework. Second, each question was examined at a construct level (cost, accountability, and access) with a multivariate test of the dependent variables aligned with each construct. Third, univariate analysis was conducted for all 12 dependent variables for each of the two research questions. The results for the theoretical framework, the three constructs, and the dependent variables were then presented for research question one, followed by the same sequence for research question two.

Research Question 1

The first research question asked: Do public HEIs which have successfully implemented the Malcolm Baldrige National Quality Award criteria and process perform differently from similar institutions on key measures of cost, accountability, and access? Based on this question, a theoretical framework, constructed from measures related to the challenges of cost, accountability, and access was tested for differences between award recipients and non-recipients in the performance year. Multivariate tests were conducted on the complete model, and on each

of the three constructs, followed by univariate analysis of each dependent variable. These three analyses in combination address the first research question posed in this study.

Theoretical framework analysis. The multivariate hypotheses were tested using MANOVA and MANCOVA procedures in SPSS, version 19. Corresponding univariate hypotheses related to each of the specific measures were tested using the univariate results from the same procedures. The theoretical framework hypothesis to be tested for the theoretical framework was presented in chapter 3 and repeated here for convenience.

H₀1: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access.

H_a1: There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access.

The factors identified previously for use in the multivariate analysis included award status, which was the factor of interest. Type was identified as an additional important factor, and size was determined to be an important covariate.

MANCOVA analysis was run to test for differences between award recipients and non-recipients in the performance year, based on the theoretical framework. The multivariate test resulted in *p*-values of .221 for size, .377 for award status, and .008 for type. The interaction of award status and type had a *p*-value of .302. These results are presented in Table 18. SPSS multivariate test provide four different measures for determining significance, Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root. Since Pillai's Trace is thought to be more robust to violations of assumptions (Olson, 1974) than other multivariate tests, it was presented here. However, the same *f* value and level of significance was found on all four multivariate tests. Only the effects of the factor type were found to be significant at $\alpha = .05$.

The effects of award status were not significant. As a result of the MANCOVA multivariate test, the study failed to reject the first null hypothesis; H_{01} : There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access.

Table 18

Theoretical Framework, Multivariate Analysis – RQ1

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Size	12	1.316	.136	.221
Award status	12	1.090	.116	.377
Type	12	2.446*	.227	.008
Award status X type	12	1.188	.125	.302

Note. * $p < .05$

Construct analysis. The second level of analysis addressed constructs. The three constructs for the study; cost, accountability, and access were analyzed, independent of the theoretical framework, using the dependent variables associated with each. The factors of award status and type were used for each of these analyses, as was the covariate size. Each of the constructs was tested using MANCOVA procedures.

Cost. The hypotheses, related to research question one, which were tested for the cost construct are presented below.

$H_{01.1}$: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost.

H_a1.1: There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost.

The cost construct was aligned with dependent variables tuition and fees, general and educational spending, direct spending, scholarship spending, and tuition funding. Multivariate analysis of the cost construct resulted in *p*-values of .103 for size, .128 for type, .060 for award status, as shown in Table 19. The effects of award status were not significant for the cost construct at alpha = .05, nor were those of type and size.

Table 19

Cost Construct, Multivariate Analysis – RQ1

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Size	5	1.887	.081	.103
Award status	5	2.199	.093	.060
Type	5	1.755	.076	.128
Award status X Type	5	.890	.040	.491

Note. * *p* < .05

As a result of the multivariate analysis of the cost construct, the study failed to reject the null hypothesis H₀1.1: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost.

Accountability. The hypotheses, related to research question one, which were tested for the accountability construct are presented below.

H₀1.2: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of accountability.

H_a1.2: There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of accountability.

The accountability construct was aligned with the dependent variables; graduation rate, minority completions, retention, minority success and completions. Multivariate analysis of the accountability construct resulted in *p*-values of .051 for size, .001 for type, and .567 for award status. Although the effect of type on accountability was significant at $\alpha = .05$, the effects of award status and size were not. Results of this multivariate analysis are shown in Table 20.

Table 20

Accountability Construct, Multivariate Analysis – RQ1

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Size	5	2.285	.096	.051
Award status	5	.779	.035	.567
Type	5	4.798*	.183	.001
Award status X Type	5	1.432	.063	.219

Note. * $p < .05$

As a result of the multivariate analysis of the accountability construct, the study failed to reject the null hypothesis H₀1.2: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of accountability.

Access. The hypotheses, related to research question one, which were tested for the access construct are presented below.

H₀1.3: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of access.

H_a1.3: There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of access.

The access construct was aligned with the dependent variables federal grants and minority enrollment. Multivariate analysis of the access construct resulted in p -values of .017 for size, .075 for type, and .951 for award status, as shown in Table 21. Although size was significant at $\alpha = .05$, the small partial eta squared values suggested that much of the variation in the access construct was due to factors not included in this study. Based on the multivariate analysis of the access construct, the study failed to reject the null hypothesis H₀1.3: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of access.

Table 21

Access Construct, Multivariate Analysis – RQ1

Source	df	F	η_p^2	p
Size	2	4.251*	.072	.017
Award status	2	.050	.001	.951
Type	2	2.647	.046	.075
Award status X Type	2	.548	.010	.580

Note. * $p < .05$

Four multivariate tests were performed in an effort to answer research question one. The first tested whether there were any significant performance differences between award recipients and non-recipients relative to the theoretical framework in the performance year. No significant differences related to award status were found. Multivariate tests were then used to test the three

constructs of cost, accountability, and access for performance differences between award recipients and non-recipients in the performance year. No significant differences between these groups were found for the cost, accountability, and access constructs.

Univariate analysis by construct. The MANCOVA process used for the multivariate analysis of the theoretical framework and the constructs of cost, accountability, and access also produced univariate analysis. Again, the same configuration of factors and covariates as the theoretical framework analysis was used. Award status was the factor of interest, and type was used as an additional factor. Size was used as a covariate. The following sections evaluate these variables individually, grouped for convenience by construct.

Cost variables. The five dependent variables associated with the cost construct were analyzed using the univariate tables generated from the multivariate tests. These dependent variables were tuition and fees, general and educational spending, direct spending, scholarship and fellowship spending, and tuition funding. The hypotheses based on these variables, related to research question one are presented in Table 22.

Table 22

Univariate Hypotheses – Cost

	Univariate Null Hypotheses	Univariate Alternative Hypotheses
Cost dependent variables	$H_{01.1.1}: t_{f_{AR}} = t_{f_{NR}}$	$H_{11.1.1}: t_{f_{AR}} \neq t_{f_{NR}}$
	$H_{01.1.2}: spnd1_{AR} = spnd1_{NR}$	$H_{11.1.2}: spnd1_{AR} \neq spnd1_{NR}$
	$H_{01.1.3}: spnd2_{AR} = spnd2_{NR}$	$H_{11.1.3}: spnd2_{AR} \neq spnd2_{NR}$
	$H_{01.1.4}: faid2_{AR} = faid2_{NR}$	$H_{11.1.4}: faid2_{AR} \neq faid2_{NR}$
	$H_{01.1.5}: faid3_{AR} = faid3_{NR}$	$H_{11.1.5}: faid3_{AR} \neq faid3_{NR}$

Note. AR = award recipients, NR = non-recipients, t_f = tuition and fees, spnd1 = general and educational spending, spnd2 = direct spending, faid2 = scholarship and fellowship spending, faid3 = tuition funding.

The univariate tests for tuition and fees did not reveal any significant differences between award recipients and non-recipients in the performance year. The p -value for the effect of award status on tuition and fees was .550, not significant at $\alpha = .05$, as shown in Table 23. There was a significant difference based on type, with a p -value of .030. As a result of the univariate analysis, the study failed to reject the null hypothesis $H_{01.1.1}$: $t_{fAR} = t_{fNR}$.

Table 23

Const Construct Variables, Univariate Analysis – RQ1

Source	Variable	df	F	η_p^2	p
Award status	Tuition & fees	1	.359	.003	.550
	Gen and educ spending	1	2.145	.021	.123
	Direct spending	1	3.893	.034	.051
	Schl & flwshp spending	1	4.470*	.039	.037
	Tuition funding	1	3.111	.027	.081
Type	Tuition & fees	1	4.823*	.042	.030
	Schl & flwshp spending	1	4.474*	.039	.037

Note. * $p < .05$; the complete table is available in Appendix D.

The general and educational spending variable included spending on instruction, institutional support, academic support, student services, scholarship and fellowship, and operations. These spending categories represented money spent for relatively direct student benefit and the operation of the institution. The univariate analysis resulted in a p -value of .123 for the effect of award status on general and educational spending. This value fell above the

designated threshold of .05 for significance (Table 23). Based on the results of this univariate analysis, the study failed to reject the null hypothesis $H_{01.1.2}: \text{spnd1}_{\text{AR}} = \text{spnd1}_{\text{NR}}$.

Direct spending was defined as per student spending on only those categories most directly affecting students; instructional spending, student services and scholarship and fellowship spending. The univariate analysis of the effect of award status on direct spending resulted in a p -value of .051, which was above the significance threshold of $\alpha = .05$, as seen in Table 23. Based on this univariate analysis, the study failed to reject the null hypothesis $H_{01.1.3}: \text{spnd2}_{\text{AR}} = \text{spnd2}_{\text{NR}}$. There appeared to be no statistically significant difference in direct spending between award recipients and non-recipients.

Scholarship and fellowship spending was a measure of the amount of money spent per FTE student to help offset the cost of education. The univariate analysis of the effect of award status on scholarship and fellowship spending resulted in a p -value of .037, as shown in Table 23. Based on this univariate analysis, the study rejected the null hypothesis $H_{01.1.4}: \text{faid2}_{\text{AR}} = \text{faid2}_{\text{NR}}$. There appeared to be a statistically significant difference in scholarship and fellowship spending between award recipients and non-recipients at $\alpha = .05$.

Tuition funding was the ratio of scholarship and fellowship spending to tuition and fees. Univariate analysis of the effect of award status on tuition funding resulted in a p -value of .080 as shown in Table 23. Again, this is above the significance threshold. Based on this univariate analysis, the study failed to reject the null hypothesis $H_{01.1.5}: \text{faid3}_{\text{AR}} = \text{faid3}_{\text{NR}}$ at $\alpha = .05$.

The analysis of cost related variables found significant differences between award recipients and non-recipients only for the dependent variable scholarship and fellowship spending. Results for general and educational spending, direct spending, and tuition funding

were slightly above the threshold for significance. The tuition and fees variable stood out in this group, having a p -value that did not approach significance.

Having identified significant differences in one of the five variables associated with the cost construct, estimates of the means (Table 24) were examined to determine the direction of these differences. This comparison of means revealed that the differences, including those not found to be significant were all favorable to award recipients. Specifically, the estimated mean of tuition and fees was lower for award recipients, and general and educational spending, direct spending, scholarships and fellowships and tuition funding means were all higher for award recipients.

Table 24

Pairwise Comparisons – Cost Variables

Dependent Variable	Award Status	Mean	SE	95% Confidence Interval	
				Lower Bound	Upper Bound
Tuition and fees	Non-recipient	3091.433 ^a	210.380	2674.550	3508.315
	Award recipient	2833.288 ^a	375.286	2089.633	3576.943
General and educational spending	Non-recipient	11863.633 ^a	819.050	10240.632	13486.635
	Award recipient	14469.404 ^a	1461.060	11574.215	17364.592
Direct Spending	Non-recipient	7801.881 ^a	574.140	6664.184	8939.579
	Award recipient	10121.029 ^a	1024.179	8091.549	12150.509
Scholarships and Fellowships	Non-recipient	1146.370 ^a	97.979	952.219	1340.521
	Award recipient	1570.451 ^a	174.779	1224.115	1916.757
Tuition funding	Non-recipient	.495 ^a	.063	.369	.621
	Award recipient	.724 ^a	.113	.500	.948

Note. ^a Covariates appearing in the model are evaluated at the following values: size = 12518.29.

Accountability variables. The five dependent variables associated with the accountability construct were analyzed using the univariate tables generated in the multivariate tests. The dependent variables associated with accountability were graduation rate, minority completion, minority success, retention and completions. The hypotheses based on these variables, related to research question one are presented in Table 25.

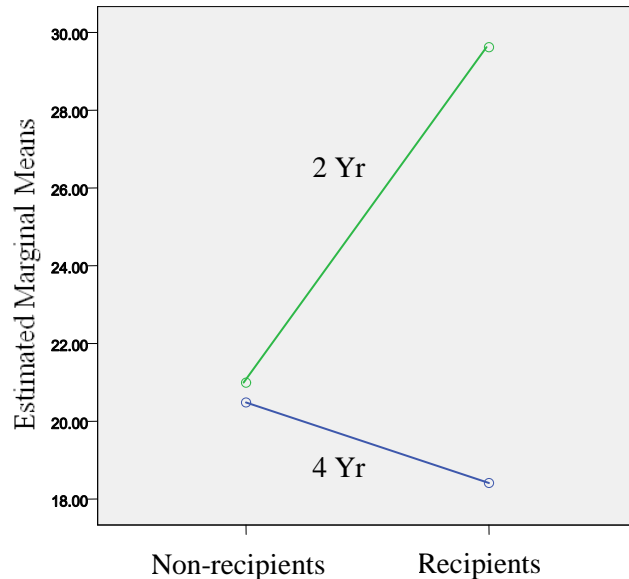
Table 25

Univariate Hypotheses – Accountability

	Univariate Null Hypotheses	Univariate Alternative Hypotheses
Accountability dependent variables	H ₀ 1.2.1: $gr_{AR} = gr_{NR}$	H ₁ 1.2.1: $gr_{AR} \neq gr_{NR}$
	H ₀ 1.2.2: $mcmp_{AR} = mcmp_{NR}$	H ₁ 1.2.2: $mcmp_{AR} \neq mcmp_{NR}$
	H ₀ 1.2.3: $msuc_{AR} = msuc_{NR}$	H ₁ 1.2.3: $msuc_{AR} \neq msuc_{NR}$
	H ₀ 1.2.4: $ret_{AR} = ret_{NR}$	H ₁ 1.2.4: $ret_{AR} \neq ret_{NR}$
	H ₀ 1.2.5: $cmp_{AR} = cmp_{NR}$	H ₁ 1.2.5: $cmp_{AR} \neq cmp_{NR}$

Note. AR = award recipients, NR = non-recipients, gr = graduation rate, mcmp = minority completions, msuc = minority success, ret = retention, cmp = completions.

The univariate test for graduation rate resulted in a *p*-value of .148, above the significance threshold of alpha = .05. However, Profile plots (Figure 1) of the estimated marginal means of graduation rate, for award status and type, indicate important interactions.



Covariates appearing in the model are evaluated at the following values: size = 12518.29

Figure 1. Graduation rate differences between two-year and four-year institutions

Analysis of the confidence intervals for graduation rate for the interaction of award status and type in Table 26 confirmed this. The confidence intervals for graduation rate for two-year institutions that were non-recipients do not overlap with the confidence intervals for two-year institutions that were award recipients. This suggested that there was a difference between the graduation rates for award recipients and non-recipients, but only for two-year institutions.

Table 26

Pairwise Comparison – Award Status, Type Interaction

Dependent Variable	Award Status	Type	Mean	95% Confidence Interval	
				Lower Bound	Upper Bound
Graduation rate	Non-recipient	4 yr.	20.483 ^a	17.056	23.910
		2 yr.	20.991 ^a	18.136	23.847
	Recipient	4 yr.	18.412 ^a	12.280	24.544
		2 yr.	29.621 ^a	24.615	34.626
Minority success	Non-recipient	4 yr.	.143 ^a	.111	.175
		2 yr.	.118 ^a	.091	.144
	Recipient	4 yr.	.146 ^a	.090	.203
		2 yr.	.187 ^a	.141	.233

Note. ^a Covariates appearing in the model are evaluated at the following values: size = 12863.19.

Examination of the tests of between subject effects revealed a p -value of .019 for the effect of the interaction of award status and type on the graduation rate variable (Table 27). Based on this univariate analysis, the study partially rejected the null hypothesis $H_{01.2.1}$: $gr_{AR} = gr_{NR}$. Award status had a significant relationship with graduation rate at $\alpha = .05$, but only for two-year institutions.

Minority completions was the ratio of minority completions to total completions. The univariate test for minority completions resulted in a p -value of .892 as reflected in Table 27. This was above the significance threshold of $\alpha = .05$. Based on this univariate analysis, the study failed to reject the null hypothesis: $H_{01.2.2}$: $mcmp_{AR} = mcmp_{NR}$.

Table 27

Accountability Construct Variables, Univariate Analysis – RQ1

Source	Variables	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Award status	Graduation Rate	1	2.118	.019	.148
	Minority completions	1	.019	.000	.892
	Retention	1	.833	.007	.363
	Completions	1	1.156	.010	.285
	Minority success	1	3.096	.027	.081
Type	Graduation Rate	1	5.901*	.050	.017
	Minority success	1	.120	.001	.729
Award status X Type	Graduation Rate	1	5.636*	.048	.019
	Minority success	1	2.528	.022	.115

Note. * $p < .05$; the complete table is available in Appendix D.

Minority success was the ratio of minority completions to the minority undergraduate enrollment. The univariate test for minority completions resulted in a p -value of .081 as shown in Table 27. Based on the univariate analysis, the study failed to reject the null hypothesis $H_{01.2.3}$: $msuc_{AR} = msuc_{NR}$. There was no statistically significant difference between award recipients and non-recipients for the dependent variable minority success. Analysis of the plots of estimated means suggested that there was also an interaction between award status and type for minority success. Analysis of the confidence intervals for minority success in Table 26 supported this. The confidence intervals for minority success for two-year institutions that were non-recipients only slightly overlap with the confidence intervals for two-year institutions that

were award recipients. This suggested that while the overall difference in minority success between award recipients and non-recipients was not found to be significant, the interaction might be. However, the p -value of .115 for the effect of the award status and type interaction on minority success also fell above the significance threshold

The retention rate variable was intended to measure of the proportion of students that returned compared with the number of students that might have returned. This measure did not have the level of precision desired, as there was no allowance for transfers in and out of institutions. The univariate analysis of the dependent variable retention resulted in a p -value of .363 as shown in Table 27, which was not significant for $\alpha = .05$. Based on this univariate analysis, the study failed to reject the null hypothesis $H_{01.2.4}: \text{ret}_{\text{AR}} = \text{ret}_{\text{NR}}$. No statistically significant differences could be found between the retention rates of award recipients and non-recipients.

The analysis of accountability related variables found significant differences between award recipients and non-recipients only for the variable minority success. No significant differences between award recipients and non-recipients for the dependent variables minority completions, minority success, retention, and completions. A significant interaction between award status and type was found for graduation rate. There was a significant difference in graduation rates between award recipients and non-recipients, but only for two-year institutions. A similar interaction was noted for minority success, but this interaction was above the threshold for significance.

Access variables. The access construct had only two dependent variables associated with it; minority enrollment and federal grants. These were intended to be indicators of access for minorities and economically disadvantaged students. The univariate hypotheses related to these

variables are presented in Table 28. These two dependent variables are discussed separately in this section.

Table 28

Univariate Hypotheses – Access

	Univariate Null Hypotheses	Univariate Alternative Hypotheses
Access dependent variables	$H_{01.3.1}: \text{faid1}_{AR} = \text{faid1}_{NR}$ $H_{01.3.2}: \text{menrl}_{AR} = \text{menrl}_{NR}$	$H_{11.3.1}: \text{faid1}_{AR} \neq \text{faid1}_{NR}$ $H_{11.3.2}: \text{menrl}_{AR} \neq \text{menrl}_{NR}$

Note. AR = award recipients, NR = non-recipients, faid1 = federal grants, menrl = minority enrollment.

The univariate analysis for federal grants revealed no significant difference between the performance of award recipients and non-recipients in receiving federal grants. The p -value for federal grants was .893, which was not significant at $\alpha = .05$. Based on this univariate analysis, the study failed to reject the null hypothesis $H_{01.3.1}: \text{faid1}_{AR} = \text{faid1}_{NR}$. No significant differences in federal grants were found between award recipients and non-recipients in the performance year.

The minority enrollment variable was the ratio of minority enrollment to total enrollment. The univariate analysis of minority enrollment returned a p -value of .782, which was not significant at $\alpha = .05$, as shown in Table 29. Based on this univariate analysis, the study failed to reject the null hypothesis $H_{01.3.2}: \text{menrl}_{AR} = \text{menrl}_{NR}$. No significant differences in minority enrollment were found between award recipients and non-recipients in the performance year.

Table 29

Access Construct Variables, Univariate Analysis – RQ1

Source	Variable	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Award status	Federal grants	1	.018	.000	.893
	Minority enrollment	1	.077	.001	.782

Note. * $p < .05$; the complete table is available in Appendix D.

The univariate analysis did not find any differences between award recipients and non-recipients for either of the dependent variables associated with the access construct, consistent with the multivariate analysis. Univariate analysis of the first research question found significant relationships between the factor of interest, award status, and some of the dependent variables. One significant interaction was also found.

Summary – Research Question One

Analysis of research question one and testing of the theoretical framework, the three constructs of cost, accountability and access, and the 12 dependent variables found few significant differences between award recipients and non-recipients. No significant difference was found in multivariate analysis of the theoretical framework. Analysis of the three constructs found no significant difference between award recipients and non-recipients for the cost, accountability, and access constructs. Univariate analysis revealed that award status had no significant effect at $\alpha = .05$ for the dependent variables tuition and fees, general and educational spending, direct spending, tuition funding, federal grants, minority completions, retention, minority enrollment or completions. Significant differences between award recipients and non-recipients were found for the dependent variable scholarship and fellowship spending.

A significant interaction between award status and type was found for the dependent variable graduation rate. A significant difference in graduation rates was found, but only for two-year institutions.

Research Question Two

Repeated measures analysis for this study was done at the same three levels of increasing specificity used to analyze research question one. First, the full multivariate theoretical framework was examined with a multivariate test using MANCOVA repeated measures to test for differences between base years and performance years for award recipients and non-recipients. Second, each of the three primary constructs of cost, accountability, and access were tested using the dependent variables associated with each. Third, each dependent variable was tested with univariate analyses (12 univariate analyses in all) to determine if the performance of award recipients and non-recipients differed from the base year to the performance year for the dependent variables. These three analyses in combination address the second research question posed in this study.

For the repeated measures analysis, the years of interest were the year before the award, which was identified as the performance year, and the year six years before the award, which was identified as the base year. The purpose of this analysis was to determine if the change in performance between the base year and the performance year differed for recipients and non-recipients. Since performance comparisons between these subjects were performed in the previous analysis, the focus here was within subject effects. Complete tables for the repeated measures multivariate analysis are available in appendix C. The within subjects interaction between years (base year and performance year) and award status, indicated whether there were

significant differences between recipients and non-recipients in the changes from base year to performance year

The second multivariate research question was: Do performance changes on key measures of cost, accountability and access in the period preceding a quality award differ between award recipients and non-recipients?

H₀2: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from the base year to the performance year.

H_a2: There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from the base year to the performance year.

Theoretical framework analysis – repeated measures. The factors identified in the analysis of the first research question were also used in the repeated measures analysis. Award status was the factor of interest in the study, and was categorical with two levels. Type was an additional factor with two levels, and size was a covariate. The within subjects variable added for repeated measures was years. This was categorical with two levels, which represented the base year and the performance year.

Repeated measures MANCOVA analysis was run to test for differences between award recipients and non-recipients in the change from base year to performance year. The repeated measures multivariate test of the theoretical framework resulted in a *p*-value of .180 for the interaction between years and award status (Table 30). The interaction of award status and the base year to performance year changes (years) did not have a significant relationship with the multivariate theoretical framework at $\alpha = .05$. It is worth noting, however, that the *p*-value

of .180 was much smaller than the p -value of .377 found for award status in the theoretical framework analysis for research question one. Based on the results of this multivariate test, the study failed to reject the null hypothesis Ho2: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from a base year to a performance year.

Table 30

Theoretical Framework, Repeated Measures Multivariate Analysis – RQ2 (within subjects)

Source	df	F	η_p^2	p
Years	12	8.132*	.494	.000
Years X size	12	.887	.096	.563
Years X award status	12	1.396	.143	.180
Years X type	12	1.214	.127	.284
Years X award status X type	12	.590	.066	.846

Note. * $p < .05$; the complete table is available in Appendix C.

Construct analysis – repeated measures. The subsequent repeated measures multivariate test addressed the constructs. The three constructs for the study; cost, accountability, and access were analyzed using repeated measures and the dependent variables associated with each. The within subjects interaction between award status and years was the primary area of interest.

Cost. The hypotheses, related to research question two, which were tested for the cost construct are presented below.

H₀2.1: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost from the base year to the performance year.

H_a2.1: There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost from the base year to the performance year.

The cost construct was aligned with dependent variables tuition and fees, general and educational spending, direct spending, scholarship and fellowship spending, and tuition funding. The repeated measures multivariate test for the cost construct resulted in a *p*-value of .158 (Table 31). The effect of the interaction of award status and years was not significant for the cost construct at alpha = .05. As a result of the repeated measures multivariate analysis, the study failed to reject the null hypothesis H₀2.1: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost from the base year to the performance year.

Table 31

Cost Construct, Repeated Measures Multivariate Analysis – RQ2 (within subjects)

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Years	5	9.192*	.300	.000
Years X size	5	.795	.036	.556
Years X award status	5	1.630	.071	.158
Years X type	5	1.104	.049	.363
Years X award status X type	5	.314	.014	.904

Note. **p* < .05; the complete table is available in Appendix C.

Accountability. The hypotheses, related to research question two, which were tested for the accountability construct are presented below.

H₀2.2: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of accountability from the base year to the performance year.

H_a2.2: There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of accountability from the base year to the performance year.

The accountability construct was aligned with the dependent variables; graduation rate, minority completions, retention, minority success and completions. The repeated measures multivariate test for the effects of the award status and years interaction on the accountability construct resulted in a *p*-value of .141 (Table 32). The interaction of award status and years did not have a significant effect on the accountability construct at $\alpha = .05$.

Table 32

Accountability Construct, Repeated Measures Multivariate Analysis – RQ2 (within subjects)

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Years	5	1.852	.080	.109
Years X size	5	1.442	.063	.215
Years X award status	5	1.701	.074	.141
Years X type	5	1.156	.051	.336
Years X award status X type	5	.800	.036	.552

Note. * $p < .05$; the complete table is available in Appendix C.

As a result of the repeated measures multivariate analysis, the study failed to reject the null hypothesis $H_{02.2}$: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of accountability from the base year to the performance year.

Access. The hypotheses, related to research question two, which were tested for the access construct are presented below.

$H_{02.3}$: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of access from the base year to the performance year.

$H_{a2.3}$: There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of access from the base year to the performance year.

The access construct was aligned with the dependent variables; federal grants, and minority enrollment. The repeated measures multivariate test for the access construct resulted in a p -value of .351 (Table 33). The interaction of award status and years did not have a significant effect on the access construct at $\alpha = .05$. Based on the repeated measures multivariate analysis of access, the study failed to reject the null hypothesis $H_{02.3}$: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of access from the base year to the performance year.

Table 33

Access Construct, Repeated Measures Multivariate Analysis – RQ2 (within subjects)

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Years	2	9.954	.153	.000
Years X size	2	.008	.000	.992
Years X award status	2	1.056	.019	.351
Years X type	2	.540	.010	.585
Years X award status X type	2	1.301	.023	.276

Note. * $p < .05$; the complete table is available in Appendix C.

Four multivariate repeated measures tests were performed in an attempt to answer research question two. The first tested whether there were any significant differences between award recipients and non-recipients from the base year to the performance year, relative to the theoretical framework. No significant differences were found. Multivariate repeated measures tests were then used to test the three constructs of cost, accountability, and access for differences between award recipients and non-recipients performance change from the base year to the performance year. No significant differences in performance changes were found for any of the three constructs; cost, accountability, and access.

Univariate analysis by construct – repeated measures. Through the multivariate repeated measures analyses, univariate analyses were also generated. There were 12 dependent variables in the study. These univariate analyses tested whether the performance change between the base year and the performance year on each of the 12 dependent variables differed between recipients and non-recipients. The repeated measures univariate test produced results

from four tests: Sphericity Assumed, Greenhouse-Geisser, Huynh-Feldt, and Lower-Bound. The results from each of these tests were identical. Only results from the Sphericity Assumed test are shown. Again, the same configuration of factors and covariates as the theoretical framework analysis was used. The interaction of years and award status was the factor of interest, and type was used as an additional factor. Size was used as a covariate. The following sections evaluate these variables individually, grouped for convenience by construct.

Cost variables. The five dependent variables associated with the cost construct were analyzed using the univariate tables generated in the repeated measures multivariate tests. These dependent variables were tuition and fees, general and educational spending, scholarship and fellowship spending, and tuition funding. The hypotheses based on these variables, related to research question two are presented in Table 34.

Table 34

Univariate Hypotheses – Cost, Repeated Measures

	Univariate Null Hypotheses	Univariate Alternative Hypotheses
Cost dependent variables	$H_{02.1.1}: t_f_{ARchg} = t_f_{NRchg}$	$H_{12.1.1}: t_f_{ARchg} \neq t_f_{NRchg}$
	$H_{02.1.2}: spnd1_{ARchg} = spnd1_{NRchg}$	$H_{12.1.2}: spnd1_{ARchg} \neq spnd1_{NRchg}$
	$H_{02.1.3}: spnd2_{ARchg} = spnd2_{NRchg}$	$H_{12.1.3}: spnd2_{ARchg} \neq spnd2_{NRchg}$
	$H_{02.1.4}: faid2_{ARchg} = faid2_{NRchg}$	$H_{12.1.4}: faid2_{ARchg} \neq faid2_{NRchg}$
	$H_{02.1.5}: faid3_{ARchg} = faid3_{NRchg}$	$H_{12.1.5}: faid3_{ARchg} \neq faid3_{NRchg}$

Note. AR = award recipient, NR = non-recipient, chg = change, t_f = tuition and fees, spnd1 = general and educational spending, spnd2 = direct spending, faid2 = scholarship and fellowship spending, faid3 = tuition funding.

The repeated measures univariate test for the effect of the interaction of years and award level on tuition and fees had a p -value of .575 (Table 35), which was not significant at $\alpha = .05$. As in analysis of the first research question, award status was not an important contributor to differences in tuition and fees. When the within subjects factor years was examined, it was found to be a significant contributor to differences between award recipients and non-recipients for tuition and fees having p -value of .000 (Table 35), but its interactions with size and type were not. Based on the univariate repeated measures analysis, the study failed to reject the null hypothesis $H_{02.1.1}: t_{f_{ARchg}} = t_{f_{NRchg}}$. The interaction of award status and years did not have a significant effect on changes in tuition and fees from the base year to the performance year.

The general and educational spending variable included spending on instruction, institutional support, academic support, student services, scholarship and fellowship, and operations. The repeated measures univariate test for the effect of the interaction of years and award level on general and educational spending had a p -value of .107 (Table 35), above the .05 threshold for significance. The factor years had a p -value of .000 (Table 35), which was significant at $\alpha = .05$. Based on the univariate repeated measures analysis, the study failed to reject the null hypothesis $H_{02.1.2}: spnd1_{ARchg} = spnd1_{NRchg}$.

Table 35

Cost Construct Variables, Repeated Measures Univariate Analysis – RQ2 (within subjects)

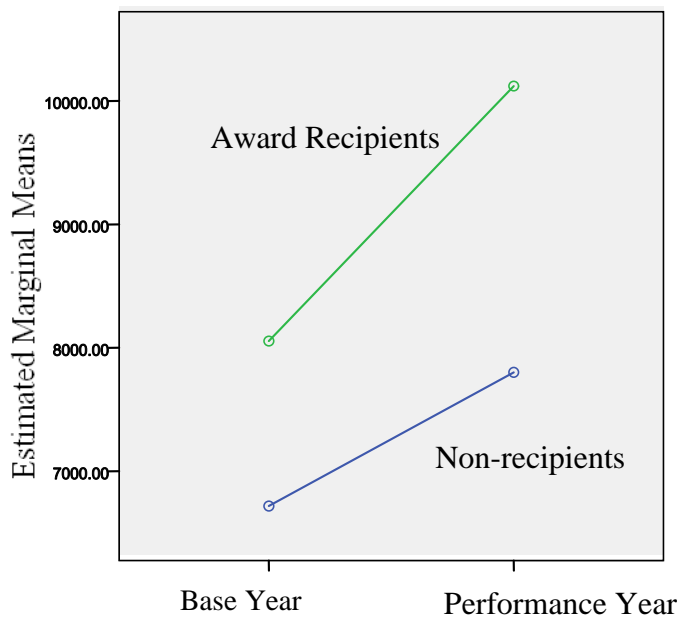
Source	Variable	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Years	Tuition & fees	1	33.531*	.232	.000
	Gen and educ. spending	1	20.756*	.158	.000
	Direct spending	1	13.540*	.109	.000
	Schl. & flwshp. spending	1	.137	.001	.712
	Tuition funding	1	1.642	.015	.203
Years X award status	Tuition & fees	1	.315	.003	.575
	Gen and educ. spending	1	2.634	.023	.107
	Direct spending	1	4.511*	.039	.036
	Schl. & flwshp. spending	1	4.771*	.041	.031
	Tuition funding	1	3.486	.030	.065

Note. * $p < .05$; the complete within subjects table is available in Appendix E.

The direct spending variable included spending on instruction, student services, and scholarship and fellowships. The repeated measures univariate test for the effect of the interaction of years and award level on direct spending had a p -value of .036 (Table 35). The effect of the interaction on direct spending was significant at $\alpha = .05$. The factor years had a p -value of .000 (Table 39), which was also significant at $\alpha = .05$. Based on the univariate repeated measures analysis, the study rejected the null hypothesis $H_{02.1.3}$: $\text{spnd2}_{\text{ARchg}} = \text{spnd2}_{\text{NRchg}}$. Both years, and its interaction with award status had a statistically significant effect changes in direct spending from base year to performance year. This was apparent in the plot of

the estimated marginal means (Figure 2). Although award recipients spent more than non-recipients on direct spending in the base year, this spending also increased at a greater rate for award recipients than non-recipients.

Scholarship and fellowship spending was a measure of the amount of money spent per FTE student to help offset the cost of education. The repeated measures univariate test for the effect of the interaction of years and award level on scholarship and fellowship spending had a p -value of .031 (Table 35). The effect of this interaction on scholarship and fellowship spending was significant at $\alpha = .05$. The factor years had a p -value of .712 (Table 35), which was not significant at $\alpha = .05$. Based on the univariate repeated measures analysis, the study rejected the null hypothesis $H_{02.1.4}$: $\text{faid2}_{\text{ARchg}} = \text{faid2}_{\text{NRchg}}$. Scholarship and fellowship spending did not appear to change significantly from the base year to the performance year.



Covariates appearing in the model are evaluated at the following values: size = 12518.29

Figure 2. Estimated marginal means of direct spending – comparison of award recipients and non-recipients

Tuition funding was the ratio of scholarship and fellowship spending to tuition and fees. The repeated measures univariate test for the effect of the interaction of years and award level on tuition funding had a p -value of .065 (Table 35). The effect of the interaction on scholarship and fellowship spending was not significant at $\alpha = .05$. The factor years had a p -value of .203 (Table 39), which was not significant at $\alpha = .05$. Based on the univariate repeated measures analysis, the study failed to reject the null hypothesis $H_{02.1.5}: \text{faid3}_{\text{ARchg}} = \text{faid3}_{\text{NRchg}}$. Tuition funding did not appear to change significantly from the base year to the performance year. The difference in change between award recipients and non-recipients fell above our significance threshold. The plot of the estimated marginal means (Figure 3) of tuition funding revealed an interesting effect. Award recipients funded tuition at a higher rate in the base year, and increased that rate by the performance year. Funding of tuition by non-recipients declined over this same period.

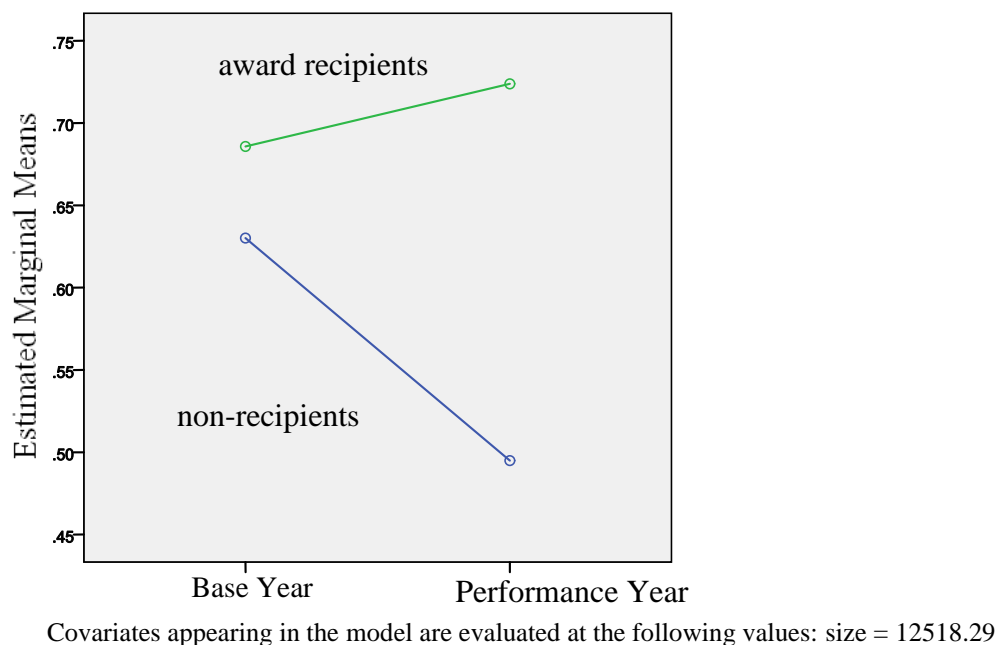


Figure 3. Estimated marginal means of tuition funding – comparison of award recipients and non-recipients.

The repeated measures analysis of cost related variables found significant differences in the base year to performance year changes between award recipients and non-recipients for the dependent variables direct spending and scholarship and fellowship spending. Results for general and educational spending and tuition funding were slightly above our threshold for significance. As in the analysis for research question one the tuition and fees variable stood out in this group, having a p -value that did not approach significance.

Having identified significant differences in two of the five variables associated with the cost construct, estimates of the means (Table 36) were examined to determine the direction of these differences. This comparison of means revealed that the differences, including those not found to be significant, were all favorable to award recipients.

Table 36

*Pairwise Comparisons – Cost Variables, Years * Award Status*

Measure	Award Status	Years	Mean	SE	95% Confidence Interval	
					Lower Bound	Upper Bound
Tuition and Fees	Non-recipient	Base Year	2243.938 ^a	140.698	1965.135	2522.740
		Perf. Year	3091.433 ^a	210.380	2674.550	3508.315
	Recipient	Base Year	2082.354 ^a	250.984	1585.013	2579.696
		Perf. Year	2833.288 ^a	375.286	2089.633	3576.943
General and Educational Spending	Non-recipient	Base Year	10013.934 ^a	651.367	8723.207	11304.662
		Perf. Year	11863.633 ^a	819.050	10240.632	13486.635
	Recipient	Base Year	11634.967 ^a	1161.940	9332.505	13937.429
		Perf. Year	14469.404 ^a	1461.060	11574.215	17364.592

Table 36 (continued)

Measure	Award Status	Years	Mean	SE	95% Confidence Interval	
					Lower Bound	Upper Bound
Direct Spending	Non-recipient	Base Year	6718.794 ^a	445.947	5835.121	7602.468
		Perf. Year	7801.881 ^a	574.140	6664.184	8939.579
	Recipient	Base Year	8055.276 ^a	795.501	6478.184	9631.615
		Perf. Year	10121.029 ^a	1024.179	8091.549	12150.509
Scholarship & Fellowship Spending	Non-recipient	Base Year	1157.266 ^a	78.018	1002.668	1311.865
		Perf. Year	1146.370 ^a	97.979	952.219	1340.521
	Recipient	Base Year	1241.027 ^a	139.173	965.247	1516.807
		Perf. Year	1570.451 ^a	174.779	1224.115	1916.787
Tuition Funding	Non-recipient	Base Year	.630 ^a	.048	.534	.726
		Perf. Year	.495 ^a	.063	.369	.621
	Recipient	Base Year	.686 ^a	.087	.514	.857
		Perf. Year	.724 ^a	.113	.500	.948

Note. ^a Covariates appearing in the model were evaluated at the following values: size = 12518.29.

Accountability variables. The five dependent variables associated with the accountability construct were analyzed using the univariate tables generated in the multivariate tests. The dependent variables associated with accountability were graduation rate, minority completion, minority success, retention and completions. The hypotheses based on these variables, related to research question one are presented in Table 37.

Table 37

Univariate Hypotheses – Accountability

	Univariate Null Hypotheses	Univariate Alternative Hypotheses
Accountability dependent variables	H ₀ 2.2.1: $gr_{ARchg} = gr_{NRchg}$	H ₁ 2.2.1: $gr_{ARchg} \neq gr_{NRchg}$
	H ₀ 2.2.2: $mcmp_{ARchg} = mcmp_{NRchg}$	H ₁ 2.2.2: $mcmp_{ARchg} \neq mcmp_{NRchg}$
	H ₀ 2.2.3: $ret_{ARchg} = ret_{NRchg}$	H ₁ 2.2.3: $ret_{ARchg} \neq ret_{NRchg}$
	H ₀ 2.2.4: $msuc_{ARchg} = msuc_{NRchg}$	H ₁ 2.2.4: $msuc_{ARchg} \neq msuc_{NRchg}$
	H ₀ 2.2.5: $cmp_{ARchg} = cmp_{NRchg}$	H ₁ 2.2.5: $cmp_{ARchg} \neq cmp_{NRchg}$

Note. AR = award recipient, NR = non-recipient, chg = change, gr = graduation rate, mcmp = minority completions, ret = retention, msuc = minority success, cmp = completions

The effect of the within groups factor years, taken by itself did not contribute significantly to changes in any of the dependent variables associated with accountability. The effect on graduation rate of the interaction of years with award status was also not significant, with a *p*-value of .213 (Table 38). However, in the performance year analysis for research question one, a significant interaction between award status and type was discovered that affected graduation rates. In order to determine if a similar effect might be found in the repeated measures analysis, further analysis was performed. Univariate repeated measures analysis

revealed a significant effect on graduation rates from the three way interaction of years, award status, and type. This interaction yielded a p -value of .098 (Table 38), which was above the significance threshold of $\alpha = .05$.

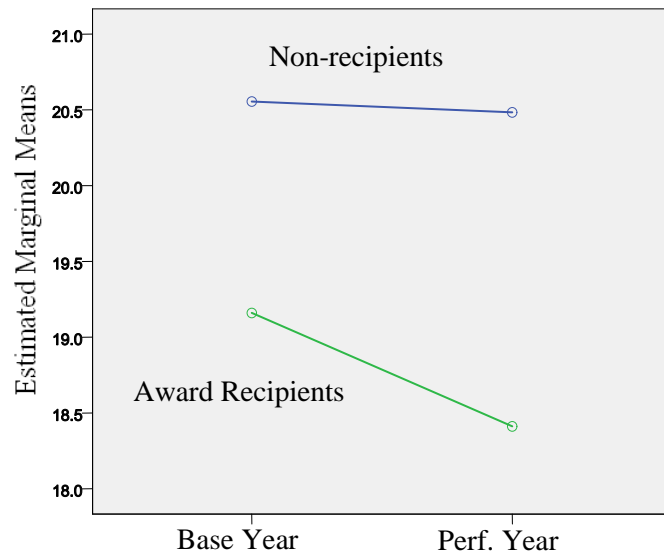
Table 38

Accountability Construct Variables, Repeated Measures Univariate Analysis – RQ2 (within subjects)

Source	Variable	df	F	η_p^2	p
Years X award status	Graduation rate	1	1.570	.014	.213
	Minority completions	1	.626	.006	.431
	Retention	1	.584	.005	.446
	Completions	1	.174	.010	.281
	Minority success	1	7.569*	.064	.007
Years X type	Graduation rate	1	4.494*	.039	.036
Years X award status X type	Graduation rate	1	2.790	.025	.098

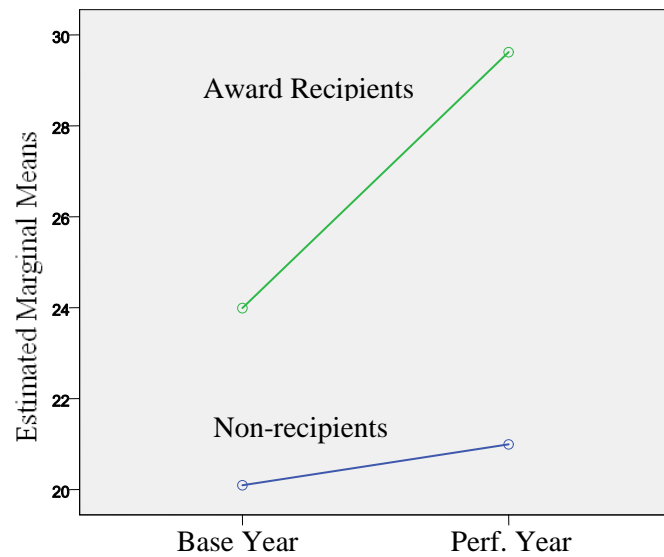
Note. * $p < .05$; the complete within subjects table is available in Appendix E.

Plots of the estimated marginal means showed that graduation rate performance of both award recipients and non-recipients declined at four year, institutions (Figure 4). These plots also show that graduation rate increased for both award recipients and non-recipients at two-year institutions (Figure 5). However, the increase in graduation rates of award recipients improved at a greater rate, although not statistically significant. These findings were generally consistent with those from the performance year analysis performed for research question one. As a result of the univariate analysis, the study failed to reject the null hypothesis $H_{02.2.1}: gr_{ARchg} = gr_{NRchg}$.



Covariates appearing in the model are evaluated at the following values: size = 12518.29

Figure 4. Estimated marginal means of graduation rate at 4-yr institutions



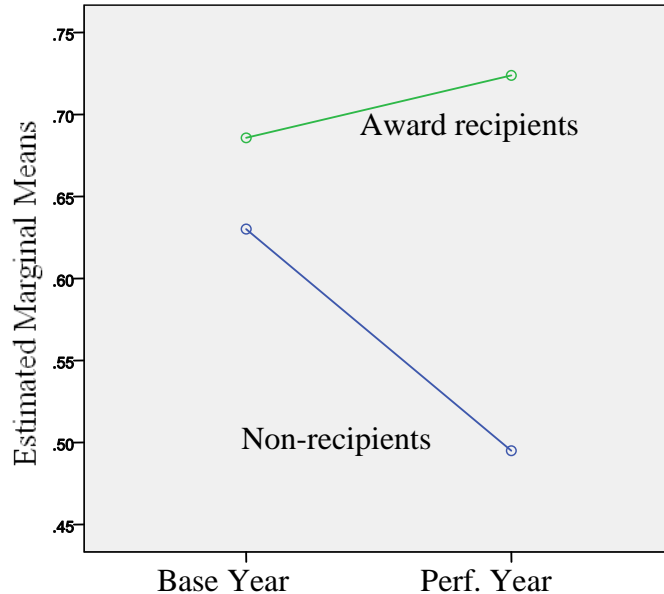
Covariates appearing in the model are evaluated at the following values: size = 12518.29

Figure 5. Estimated marginal means of graduation rate for 2-yr institutions

Minority completions was the ratio of minority completions to total completions. The repeated measures univariate test for the effect of the interaction of years and award level on minority completions had a p -value of .431 (Table 38). The effect of the interaction on minority completions was not significant at $\alpha = .05$. Based on the univariate repeated measures analysis, the study failed to reject the null hypothesis $H_{02.2.2}: mcmp_{ARchg} = mcmp_{NRchg}$. Award status did not have a significant effect on changes in minority completions from the base year to the performance year.

The retention rate variable was intended to measure of the proportion of students that returned compared with the number of students that might have returned. This measure did not have the level of precision desired, as there was no allowance for transfers in and out of institutions. The repeated measures univariate test for the effect of the interaction of years and award level on retention had a p -value of .446 (Table 38). The effect of the interaction on retention was not significant at $\alpha = .05$. Based on the univariate repeated measures analysis, the study failed to reject the null hypothesis $H_{02.2.3}: ret_{ARchg} = ret_{NRchg}$. Award status did not have a significant effect on changes in retention rates from the base year to the performance year.

Minority success was the ratio of minority completions to the minority undergraduate enrollment. The repeated measures univariate test for the effect of the interaction of years and award level on retention had a p -value of .007 (Table 38). The effect of the interaction on minority success was significant at $\alpha = .05$. Based on the univariate repeated measures analysis, the study rejected the null hypothesis $H_{02.2.4}: msuc_{ARchg} = msuc_{NRchg}$. Award status had a statistically significant effect on changes in minority success rates from the base year to the performance year. A plot of the estimated marginal means (Figure 6) clearly illustrates this difference.



Covariates appearing in the model are evaluated at the following values: size = 12518.29

Figure 6. Estimated marginal means of minority success – comparison of award recipients and non-recipients

The completions variable was the ratio of total undergraduate enrollment to total completions. The repeated measures univariate test for the effect of the interaction of years and award level on completions had a p -value of .281 (Table 38). The effect of the interaction on completions was not significant at $\alpha = .05$. Based on the univariate repeated measures analysis, the study failed to reject the null hypothesis $H_{02.2.5}: \text{cmp}_{\text{ARchg}} = \text{cmp}_{\text{NRchg}}$. Award status did not have a significant effect on changes in completions from the base year to the performance year.

The repeated measures analysis of cost related variables found significant differences in the base year to performance year changes between award recipients and non-recipients only for the variable minority success. No significant differences between award recipients and non-recipients for the dependent variables graduation rate, minority completions, retention, and

completions. An interaction between year, award status and type was investigated for graduation rate. There was not a significant difference in changes in graduation rates between award recipients and non-recipients, but the difference was positive for award recipients which were two-year institutions and negative for award recipients which were four-year institutions.

Access variables. The access construct had only two dependent variables associated with it; minority enrollment and federal grants. These were intended to be indicators of access for minorities and economically disadvantaged students. The univariate hypotheses related to these variables are presented in Table 39.

Table 39

Univariate Hypotheses – Access, Repeated Measures

	Univariate Null Hypotheses	Univariate Alternative Hypotheses
Access dependent variables	H ₀ 2.3.1: $\text{faid1}_{\text{ARchg}} = \text{faid1}_{\text{NRchg}}$ H ₀ 2.3.2: $\text{menrl}_{\text{ARchg}} = \text{menrl}_{\text{NRchg}}$	H ₁ 2.3.1: $\text{faid1}_{\text{ARchg}} \neq \text{faid1}_{\text{NRchg}}$ H ₁ 2.3.2: $\text{menrl}_{\text{ARchg}} \neq \text{menrl}_{\text{NRchg}}$
<i>Note.</i> AR = award recipient, NR = non-recipient, chg = change, faid1 = federal grants, menrl = minority enrollment.		

The repeated measures univariate analysis for federal grants revealed no significant difference in base year to performance year changes between the performance of award recipients and non-recipients. The *p*-value for federal grants was .986 (Table 40), which was not significant at $\alpha = .05$. Based on this univariate analysis, the study failed to reject the null hypothesis H₀2.3.1: $\text{faid1}_{\text{ARchg}} = \text{faid1}_{\text{NRchg}}$. No differences were found between the completion rates of award recipients and non-recipients.

Minority enrollment was the ratio of minority enrollment to total enrollment. The repeated measures univariate analysis of the effects of the interaction of years and award level on minority enrollment returned a p -value of .148 (Table 40), which was not significant at $\alpha = .05$. However, this was much different than the p -value of .782 from the performance year analysis. The univariate repeated measures analysis did not find any significant differences in base year to performance year changes between award recipients and non-recipients for either dependent variable associated with the access construct.

Table 40

Access Construct Variables, Repeated Measures Univariate Analysis – RQ2 (within subjects)

Source	Variable	df	F	η_p^2	p
Years	Federal grants	1	12.816*	.104	.001
	Minority enrollment	1	6.002*	.051	.016
Years X award status	Federal grants	1	.000	.000	.986
	Minority enrollment	1	2.125	.019	.148

*Note. * $p < .05$; the complete within subjects table is available in Appendix E.*

Summary – Research Question Two

Analysis of research question two and testing of the theoretical framework, the three constructs of cost, accountability, and access, and the 12 dependent variables found some significant differences between award recipients and non-recipients. These results were mostly consistent with the findings from research question one. No significant difference was found in multivariate analysis of the theoretical framework. Analysis of the three constructs found no

significant differences between award recipients and non-recipients for any of the three constructs; cost, accountability and access.

Univariate repeated measures analysis of the interaction of years and award status found no significant differences between award recipients and non-recipients at $\alpha = .05$ for the dependent variables tuition and fees, general and educational spending, tuition funding, graduation rate, federal grants, minority completions, retention, minority enrollment or completions. Significant differences were found for the dependent variables, direct spending, scholarship spending, and minority success (Table 35) consistent with the results from research question one. A non-significant interaction between year, award status and type was found for the dependent variable graduation rate. This indicated a difference in graduation rates was found, but only for two-year institutions. This was consistent with the findings from research question one.

Chapter Summary

In this chapter, data preparation, statistical methods for the analysis of the two research questions, and findings from those analyses were discussed. Data preparation included the identification, refinement, and construction of variables aligned with the theoretical framework and the three constructs of cost, accountability, and access. MANCOVA and repeated measures MANCOVA procedures were described and discussed relevant to the two research questions. Analysis for each question was performed at the multivariate level for the theoretical framework and each of the three constructs, and univariate results were analyzed for each dependent variable. Thirty two hypotheses were tested through eight multivariate analyses and 24 univariate analyses.

CHAPTER 5

Conclusions and Recommendations

Chapter Overview

The purpose of this chapter is to draw conclusions based on the findings from this study, and to discuss possible implications and future research. The discussion followed research question one in its entirety, through conclusions and implications regarding the theoretical framework, the three constructs and the 12 dependent variables. The second research question was then addressed in a similar manner. This was followed by a more general and summary discussion of the study, its implications, limitations, and possibilities for future research.

This study was undertaken to explore what differences might exist between quality award recipients and non-recipients in performance related to major challenges shared by other public institutions which provide undergraduate education. A review of the literature identified major challenges that have persisted for 30 years. These challenges were cost, accountability, and access. Together these challenges represent the constructs for a theoretical framework. Twelve dependent variables were selected and were collectively used to test the theoretical framework. Smaller groups of these variables were used to test the three constructs. The variables associated with the cost challenge were tuition and fees, general and educational spending, direct spending, scholarship and fellowship spending, and tuition funding. Accountability was measured by graduation rates, minority completions, retention, minority success and completions. Minority

enrollment and federal grants were used to measure access. MANCOVA analysis procedures were used to test the variables as a set (theoretical framework) and by construct (cost, access, and accountability) followed by univariate analysis to test the dependent variables individually.

Two major research questions were examined. The first question concerned the performance of award recipients against that of a matched set of non-recipients in the year before the recognition award, referred to as the performance year. The second question was related to changes in performance for these same two groups over a five-year period preceding the recognition award. In total, 58 award recipients were matched with 58 non-recipients on the basis of size, region and degree of urbanization. The first research question was analyzed at three levels (theoretical framework, construct, and dependent variable) using MANCOVA with the type of institution as an additional factor, and size as a covariate. Institutions that received the three highest levels of recognition were compared with those receiving lower levels or no recognition. The second research question was analyzed using the same model, but with repeated measures MANCOVA to compare changes in performance from the base year to the performance year.

The remainder of this chapter discusses the results of those analyses, followed by a discussion of their implications both for public higher education and for the MBNQA process. Study limitations, conclusions and possibilities for future research, and general observations from this researcher are also discussed.

Research Question One

The first research question asked: Do public HEIs which have successfully implemented the Malcolm Baldrige National Quality Award criteria and process perform differently from similar institutions on key measures of cost, accountability and access? Based on this question, a

theoretical framework, constructed from measures related to the challenges of cost, accountability, and access was tested for differences between award recipients and non-recipients in the performance year. Multivariate tests were conducted on the complete model, and on each of the three constructs, followed by univariate analysis of each independent variable.

Theoretical framework. The hypotheses related to the theoretical framework were presented in Chapters 3 and 4 and are repeated here for convenience.

H₀1: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access.

H_a1: There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost, accountability, and access.

These hypotheses were tested using MANCOVA procedures in SPSS. Award status was the factor of interest. Type of institution was included as an additional factor, and size was used as a covariate. The multivariate analysis of the theoretical framework returned *p*-values of .221 for the size covariate and .377 for the factor of interest, award status. The additional factor type, had a *p*-value of .008, but the *p*-value for the interaction of award status and type was .302. From this analysis, only the institution type was significant at alpha .05. Award status was not significant, therefore, at the theoretical framework level; no significant differences were found between recipients and non-recipients in the performance year.

There were several possible implications from this finding. One possible conclusion is that there was no performance advantage in adopting the MBNQA criteria and process. Another possible explanation is that this model was influenced by too many other factors such as public policy, culture, and individual actions for us to find the effects of management actions, particularly with a small sample size. The implication that the theoretical framework was

insufficient or inadequate was explored by performing additional multivariate analysis on each of the constructs; cost, accountability and access and on the individual dependent variables.

Constructs. Three constructs, derived from the three major challenges of cost, accountability, and access were used to create the theoretical framework. Since no significant differences were found in the theoretical framework, each of the constructs was tested separately using MANCOVA. This analysis used the same configuration of factors and covariates as the theoretical framework analysis. Award status was the factor of interest, and type was used as an additional factor. Size was used as a covariate. In the following sections each of the three constructs were evaluated independently from the theoretical framework and from each other.

Cost. The cost construct was composed of five of the 12 dependent variables, which were related to the cost to students, or the benefits of spending that was directed at students. These measures were tuition and fees, general and educational spending, direct spending, scholarship and fellowship spending, and scholarship funding. The hypotheses related to the cost construct were presented in Chapters 3 and 4 and are repeated here for convenience.

H₀1.1: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost.

H_a1.1: There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of cost.

The multivariate analysis revealed no significant differences between award recipients and non-recipients on the cost construct in the performance year. The *p*-value for award status was .060, not a significant value with alpha set at .05. The factor type was above the significance threshold with a *p*-value of .128. The covariate size was also above the significance

threshold with a p -value of .103. The interaction of award status and type was not significant, with a p -value of .491

These findings led to the conclusion that award recipients did not perform differently than non-recipients on the cost construct in the performance year. While differences were not statistically significant at $\alpha = .05$, the p -value of .060, and the significance of two of the dependent variables suggested further exploration. In order to determine if these differences were favorable, the study examined the estimated means for the cost construct variables for award recipients and non-recipients displayed in Table 24. This comparison of means revealed that the differences were all favorable to award recipients. Specifically, the estimated mean of tuition and fees was lower for award recipients, and general and educational spending, direct spending, scholarships and fellowships and tuition funding were all higher for award recipients. Although differences at the construct level were not significant, the directional differences were of interest.

The findings of no significant differences between award recipients and non-recipients on the cost construct in the performance year led to a refinement of conclusions regarding the theoretical framework. The first suggested implication of the theoretical framework analysis was that there was no performance advantage in adopting the MBNQA criteria and process. Because award recipients performed better on some of the dependent variables in the cost construct than non-recipients, this idea was not fully supported. It was, therefore, concluded that the theoretical framework should be refined for future research. It was noted that the dependent variables in the cost construct were all, with the possible exception of tuition and fees, subject to the direct influence of management actions. Therefore, it was also concluded that performance on the cost construct may be amenable to improvement through the use of the MBNQA criteria and process.

Accountability. The accountability construct was composed of five of the 12 dependent variables which reflect outcomes from the educational process. These variables were graduation rates, retention, minority completions, minority success and completions. As outcomes of the educational process, it was thought that these variables would be indirectly influenced by management actions. The hypotheses related to the accountability construct were presented in Chapters 3 and 4 and are repeated here for convenience.

H₀1.2: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of accountability.

H_a1.2: There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of accountability.

The multivariate analysis of the accountability construct revealed no significant differences between award recipients and non-recipients in the performance year. The *p*-value for award status was .567 and was not significant at alpha .05. However, size had a *p*-value of .051, and type had a *p*-value of .001, therefore, both were significant. Additionally, the partial eta squared values for size and type were .096 and .183 respectively. A *p*-value of .219 was found for the interaction of award status and type.

From this analysis it was concluded that award status made no difference in performance on the accountability construct in the performance year. It was also concluded that size and type were more important contributors to performance differences on the accountability construct. Together, size and type accounted for approximately 28% of the performance difference in the performance year. The implications of these conclusions raised additional questions about the efficacy of the MBNQA criteria and process, since it was thought that the measures in this construct would be influenced, albeit indirectly, by management actions. Possibly,

accountability effects take more time because they are indirect. Perhaps all or part of this construct was inadequate or inappropriate for the model. This issue was explored in more depth in the univariate analysis that follows.

Access. The access construct was composed of only two of the 12 dependent variables. These were the variables that might be indicators of the ability of disadvantaged students to attend public higher education institutions. One of these variables was an input into the educational process, and the other was an output. The first of these variables was federal grants, which was an input into the process. Since a significant portion of federal grants were Pell grants which were based on need, this was selected as a proxy for need-based financial aid. The second variable associated with access was minority enrollment, which represents an outcome of the process of providing access. The hypotheses related to the access construct were presented in Chapters 3 and 4 and are repeated here for convenience.

H₀1.3: There is no statistically significant difference between award recipients and non-recipients in institutional performance on key measures of access.

H_a1.3: There is a statistically significant difference between award recipients and non-recipients in institutional performance on key measures of access.

The multivariate analysis of the access construct revealed no significant differences between award recipients and non-recipients in the performance year. The *p*-value for award was .951, and was not significant at alpha .05. As with the accountability construct size, with a *p*-value of .017 was significant. Type, with a *p*-value of .075 fell above the significance threshold. However, the related partial eta squared values were smaller; .072 for size, and .046 for type.

As a result of this analysis, it was concluded that award status made no difference in performance on the access construct in the performance year. Size and type although significant, accounted for only about 13% of the performance difference. As a result, it was concluded that factors other than those examined in this study were probably responsible for most of the differences on the access construct. As with the accountability construct, this was explored further through univariate analysis.

Univariate analysis by construct. The MANCOVA procedures used for the multivariate analysis of the theoretical framework and the constructs of cost, accountability, and access also produced univariate analysis. The univariate analysis of each dependent variable was used to explore some of the issues left unanswered in the multivariate analysis. Again, the same configuration of factors and covariates as the theoretical framework analysis was used. Award status was the factor of interest, and type was used as an additional factor. Size was used as a covariate. The following sections evaluate these variables individually, grouped for convenience by construct.

Cost variables. The five dependent variables associated with the cost construct were discussed in this section. These variables were tuition and fees, general and educational spending, direct spending, scholarships and fellowships, and tuition funding. The tuition and fees variable is discussed by itself. General and educational spending and direct spending are discussed together, because they were different variations of the spending variable. Similarly, scholarship and fellowships were discussed together because they both represented the efforts of an institution to help students pay for their education.

The univariate tests for tuition and fees did not reveal any significant differences between award recipients and non-recipients in the performance year. The *p*-value for the effect of award

status on tuition and fees was .550, not significant at $\alpha = .05$. There was a significant difference based on type, which had a p -value of .030. This was expected, since type simply separated two-year institutions from four-year institutions. Even though the earlier comparison of the estimated means of the cost construct showed that the estimated mean of tuition and fees was lower for award recipients than non-recipients this difference was not statistically significant. It was concluded that award status did not affect tuition and fees. It seems likely that tuition and fees was to a large extent influenced by factors other than management actions.

The general and educational spending variable included spending on instruction, institutional support, academic support, student services, scholarship and fellowship, and operations. These spending categories represented money spent for relatively direct student benefit and the operation of the institution. The p -value for the effect of award status on general and educational spending was .123 above the threshold of .05 for significance. When spending for the benefit of students was defined more strictly, as it was in the direct spending variable, a slightly different result was found. Direct spending was defined as per student spending on only those categories most directly affecting students; instructional spending, student services and scholarship and fellowship spending. The p -value for direct spending was .051 just above the significance threshold.

It was concluded that neither general and educational spending, nor direct spending were different at award recipients than non-recipients in the performance year, but the result for direct spending was intriguing. This difference may indicate that some of the components of general and educational spending were less responsive to management actions. A difference in direct spending would have suggested that award recipients have shifted more of their resources into spending areas that directly affect students. Because the spending variables were composed of a

number of spending categories, it may be useful in future research to test each of these elements (instructional spending, student services, etc.) separately to learn more about how sensitive each was to changes in management approach.

The final two cost variables were scholarship and fellowship spending, and tuition funding. Scholarship and fellowship spending was a measure of the amount of money spent per FTE student to help offset the cost of education. Tuition funding was the ratio of scholarship and fellowship spending to tuition and fees. Both of these variables were thought to reflect institutional efforts to help offset the cost of education. The effect of award status on scholarship and fellowship spending was significant at $\alpha = .05$, while the p -value for tuition funding fell above the significance threshold.

It was concluded that award recipients performed differently from non-recipients on some measures that reflect efforts to help students offset the cost of education. The comparison of estimated means in Table 24 confirmed that the direction of the differences was favorable for award recipients, so it was further concluded that award recipients performed better on these measures.

In this section the effects of award status on dependent variables related to cost were evaluated. It was concluded that tuition and fees was probably influenced most by factors other than management actions. It may be desirable, in future research on institutional performance to exclude this variable. It did appear that management actions may have had an effect on spending, more so when only spending most directly related to students was considered. Finally, it was concluded that award recipients performed better on some measures of their efforts to help students offset the cost of education. The tuition funding measure especially might be

noteworthy, because it related scholarship and fellowship spending, which was different for award recipients, to tuition and fees which was not.

Accountability variables. The five dependent variables associated with the accountability construct are discussed in this section. These variables were graduation rate, minority completion, retention, minority success, and completions. The graduation rate variable is discussed by itself. Minority completions and minority success were variations of the minority completions variable and are discussed together. Completions and retention are discussed separately.

The univariate tests for graduation rate resulted in a p -value of .148 above the threshold value of .05 for significance. Further analysis revealed a significant interaction between award status and type when graduation rate was the dependent variable. This was first identified through analysis of plots of the estimated marginal means, and the 95% confidence intervals. A univariate analysis to test the significance of the interaction of award status and type resulted in a p -value of .019, which was significant at $\alpha = .05$. Analysis of the pairwise comparisons revealed that most of the difference between award recipients and non-recipients occurred at two-year institutions. This interaction was not significant for the construct, only for the dependent variable graduation rate.

It was concluded that award status affects graduation rates, but only at two-year institutions. This finding may have important implications in two ways. First, it gives some credence to the idea that award recipients may perform better on outcome measures than non-recipients. Secondly, it suggests that there may be some difference in the effects of MBNQA adoption in two-year institutions compared to four-year institutions. This result may be of interest to leaders of two-year institutions, and may be a useful topic for future research.

Minority completions and minority success were variations of measures of the number of completions by minorities. Minority completions was the ratio of minority completions to total completions. Minority success was the ratio of minority completions to the minority undergraduate enrollment. The minority completions variable reflects the proportion of total completions that belong to minorities, while the minority success variable reflects the proportion of minority students who complete. The findings for these two variables yielded very different results. The univariate test for minority completions resulted in a p -value of .892, not significant at $\alpha = .05$. The univariate test for minority success resulted in a p -value of .081. Although not significant at $\alpha = .05$, this suggests a very different outcome.

The result led to the conclusion that there was no difference between award recipients and non-recipients in the proportion of completions by minorities to total completions nor for the proportion of minorities who complete to total minorities. The large difference in p -values appears contradictory, but can be explained by looking at an example. If an institution had 4,928 undergraduates in the year 2000, and 214 of them were minorities, the minority enrollment was just over 4%. If this same institution had 1,215 completions in 2000, and 46 of them were minority completions, the minority completion rate was just under 4%, while the minority success rate was approximately 21.5%. If enrollment, minority enrollment and total completions stayed the same for 2001, but minority completions increased by 10, then the minority completion rate would increase by less than 1%, while the minority success rate would increase by approximately 4.5%. The numerator was the same for both formulas; the number of completions by minorities. However, the denominator for the minority completions variable was total completions, which was a relatively large number, while the denominator for minority

success was minority enrollment, which was a much smaller number. This difference made the minority success measure more sensitive to changes in the number of completions by minorities.

This difference had potentially useful implications. The minority success measure may be a better measure in future studies were sensitivity in detecting small changes in the completion rate of minorities is desirable. It also suggests that for this study the minority success measure may be more meaningful than the minority completions measure as one tries to detect differences between award recipients and non-recipients. By extension, this also suggests that there may be some other variables in this study, which might be reconstructed in a different ways to make differences more detectible.

The retention rate variable was intended to measure of the proportion of students that returned compared with the number of students that might have returned. This measure did not have the level of precision desired, as there was no allowance for transfers in and out of institutions. The univariate analysis of the dependent variable retention resulted in a p -value of .363, not significant for $\alpha = .05$.

A difference between award recipients and non-recipients was expected, but none was found. It was concluded that there was no difference between the retention rates of award recipients and non-recipients. This may have been due in part to the coarseness of the measure. A more complete and precise measure may be available through other data sources, or for future studies.

The final dependent variable associated with accountability was completions. This variable was the ratio of total undergraduate enrollment to total completions. The univariate tests for completions resulted in a p -value of .285, which was not significant at $\alpha = .05$. It

was concluded that although a difference between award recipients and non-recipients was expected, none was found.

Access variables. The access construct had only two dependent variables associated with it; minority enrollment and federal grants. These were intended to be indicators of access for minorities and economically disadvantaged students. These two dependent variables are discussed separately in this section.

The univariate analysis for federal grants revealed no significant difference between the performance of award recipients and non-recipients in receiving federal grants. The p -value for federal grants was .893, which was not significant at $\alpha = .05$. This variable was meant to be a proxy for need-based aid. It was thought that award recipients might recruit more students that qualify for federal grants, and thereby increase access for economically disadvantaged students.

It was concluded that there was no difference in the performance of award recipients and non-recipients for federal grants. Because the federal grant measure included other grants besides those that were need-based, and because there may be other sources of need-based aid, it was concluded that this measure was an inadequate proxy for need-based aid. It was also concluded that changes in the amount of federal grants may have been mostly beyond the influence of management actions, and may have been influenced more by public policy or other factors.

The second and last dependent variable for the access construct was minority enrollment. This measure was the ratio of minority enrollment to total enrollment. An increase in minority enrollment in award recipients might have indicated these institutions had found ways to provide better access to minority students, but no difference was found. The univariate analysis of minority enrollment returned a p -value of .782, which was not significant at $\alpha = .05$.

Analysis of pairwise comparisons for award status revealed that the estimated mean of minority enrollment was slightly lower for award recipients than non-recipients. Further analysis of the effect of the interaction of award status and type on minority enrollment revealed that estimated minority enrollment means were slightly lower at two year institutions which were award recipients, compared to non-recipients. The estimated means of minority enrollment were slightly higher at four-year institutions which were award recipients, compared to non-recipients. None of the differences in minority enrollment were statistically significant.

Research Question One Summary

The first research question asked, Do public HEIs which have successfully implemented the Malcolm Baldrige National Quality Award criteria and process perform differently from similar institutions on key measures of cost, accountability and access? The multivariate findings related to the theoretical framework and the three constructs of cost, accountability, and access, and the univariate findings related to the individual dependent variables were discussed and conclusions drawn. Implications regarding this study and possibilities for future studies were also identified.

Research Question Two

The second research question asked, Do performance changes on key measures of cost, accountability, and access in the period preceding a quality award differ between award recipients and non-recipients? The same theoretical framework used in research question one, constructed from measures related to the challenges of cost, accountability, and access was tested for differences in the performance changes from base year to performance year, between award recipients and non-recipients. Repeated measures multivariate tests were conducted on the

complete model, and on each of the three constructs, followed by univariate analysis each dependent variable.

Theoretical framework. The hypotheses for repeated measures, related to the theoretical framework were presented in Chapters 3 and 4 and are repeated here for convenience.

H₀2: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from the base year to the performance year.

H_a2: There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost, accountability, and access from the base year to the performance year.

These hypotheses were tested using repeated measures MANCOVA procedures in SPSS. The same model used for the first research question was used for this question. Award status and type were used as factors, and size was used as a covariate. Research question one analyzed differences in performance between award recipients and non-recipients in the performance year. Research question two analyzed differences between award recipients and non-recipients in the performance changes from the base year to the performance year. The within subjects variable added for repeated measure was years, representing the base year and the performance year. Since the focus of research question two was the difference between award recipients and non-recipients in performance changes from the base year to the performance year, the area of interest for the repeated measures analysis was the interaction of award status and years. This interaction reflected the differences in performance change between award recipients and non-recipients. Other differences between the base year and award year are also noted.

The repeated measures multivariate analysis of the theoretical framework resulted in a p -value of .180 for the interaction between award status and years. The differences in performance change between award recipients and non-recipients was not significant at $\alpha = .05$. Although not statistically significant, the p -value for this interaction was smaller than the p -values for the interactions of years with size, .563, and with type, .284. The award status and years interaction also had a larger partial eta squared value than these other interactions. The interactions of years with size and with type accounted for approximately 10% and 12% of the differences. The award status and years interaction accounted for approximately 14% of the differences.

This difference was deemed important for two reasons even though it was not significant. First, it differed from the findings for the first research question, where both size and type accounted for more of the variation than award status. Secondly, it has been suggested that significance in secondary effects like these interactions is more difficult to detect than in first order effects. It has also been suggested (Singh, 1996) that the alpha level should be doubled when testing interactions so differences can be more readily identified. That approach was not taken in this study, but in this light these differences were worth noting. Even though the evidence for differences between award recipients and non-recipients on the theoretical framework was stronger than it was for the first research question, it was concluded that no difference between award-recipients and non-recipients regarding the complete theoretical framework was found.

There were several implications from this finding. In the analysis of the first research question, the possibility was presented that there was no performance advantage in adopting MBNQA criteria and process. Subsequent analysis of the constructs and the individual dependent variables led to the rejection of that idea, and to the conclusion that there were instead

inadequacies in the model and in some of the dependent variables. The evidence from this repeated measures analysis of the theoretical framework supported that conclusion. Although evidence was not strong enough to conclude a difference in performance changes, it suggested that those differences may exist. This issue was revisited in the subsequent repeated measures analysis of the three constructs of cost, accountability, and access, and the individual variables.

Constructs. Since no significant differences were found in repeated measures analysis of the theoretical framework, each of the constructs was tested separately. This analysis used the same configuration of factors and covariates as the theoretical framework analysis. Award status and type were used as factors. Size was used as a covariate. The interaction of award status and year was of primary interest. In the following sections each of the three constructs were evaluated independently from each other and from the theoretical framework using the same repeated measures multivariate procedures.

Cost. The cost construct was composed of five of the 12 dependent variables, which were related to the cost to students, or the benefits of spending that was directed at students. These measures were tuition and fees, general and educational spending, direct spending, scholarship and fellowship spending, and scholarship funding. The hypotheses related to the cost construct were presented in Chapters 3 and 4 and are repeated here for convenience.

H₀2.1: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost from the base year to the performance year.

H_a2.1: There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of cost from the base year to the performance year.

The repeated measures multivariate analysis for the construct cost resulted in a p -value of .158 for the interaction of award status and years. The effect of the interaction of award status and years was not significant at $\alpha = .05$. Although this finding was not significant, the difficulty in finding significant results when analyzing interactions is again worth noting. The interactions of years with size and type were not significant either. The within subject factor years was significant with a p -value at zero through three decimal places. The partial eta squared values indicate that the year's difference, base year to performance year accounted for 30% of the difference. Of course, years alone do not cause changes, but this finding suggests that other factors which were affected by the passage of time were responsible for an appreciable amount of the differences.

These findings led to the conclusion that the performance changes from base year to performance year on the cost construct were not different between award recipients and non-recipients. This difference in p -values, and partial eta squared from the first research question could be because award recipients already performed better than non-recipients in the base year, so that the change from base year to performance year was not significantly different from non-recipients. A MANCOVA analysis of the cost construct in the base year found no significant differences between award recipients and non-recipients for the construct and none for any of the dependent variables, so the previous performance idea is not supported. Alternatively, it could be that the difficulty in finding significant results in secondary effects was at least in part to blame. Univariate repeated measures analysis of the individual dependent variables in a following section sheds more light on this issue.

Accountability. The accountability construct was composed of five of the 12 dependent variables which reflected outcomes from the educational process. These variables were

graduation rates, minority enrollment, retention, minority success and completions. As outcomes of the educational process, it was thought that these variables would be indirectly influenced by management actions. The hypotheses related to the accountability construct were presented in Chapters 3 and 4 and are repeated here for convenience.

H₀2.2: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of accountability from the base year to the performance year.

H_a2.2: There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of accountability from the base year to the performance year.

The repeated measures multivariate analysis for the accountability construct resulted in a *p*-value of .141 for the interaction of award status and years. The effect of the interaction of award status and years was not significant at $\alpha = .05$. The within subjects factor years, as well as was interactions with the factor type and the covariate size were all non-significant.

It was concluded that there were no significant changes in the accountability construct between the base year and the performance year. None of the interactions of years with award status, type, and size were important contributors the differences in this construct. It was expected that the performance change for award recipients would be different from that of non-recipients on this construct. As with the analysis in research question one, it appeared that the measures used here for accountability were not as responsive as expected to changes in management actions stemming from MBNQA adoption. Again, this could indicate that effects on outcome measures, being indirect, may take more time. It also again raised the possibility that all or part of this construct was inadequate or inappropriate for the theoretical framework.

As with research question one, this issue was explored in more depth in the univariate analysis that follows.

Access. The access construct was composed of only two of the 12 dependent variables. These were the variables that might be indicators of the ability of disadvantaged students to attend a public higher education institutions. One of these variables was an input into the educational process, and the other was an outcome. The first of these variables was federal grants, which was an input into the process. Since a significant portion of federal grants were Pell grants, which were based on need, this was selected as a proxy for need-based financial aid. The second variable associated with access was minority enrollment, which represents an output of the process of providing access. The hypotheses related to the cost construct were presented in Chapters 3 and 4 and are repeated here for convenience.

H₀2.3: There is no statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of access from the base year to the performance year.

H_a2.3: There is a statistically significant difference between award recipients and non-recipients in changes to institutional performance on key measures of access from the base year to the performance year.

The repeated measures multivariate analysis of the access construct found no significant differences in performance changes between award recipients and non-recipients between the base year and the performance year. The interaction of years and award status had a *p*-value of .351, which was not significant at alpha .05. This finding was consistent with the analysis of the access construct for research question one.

It was notable that the changes in the access construct between the base year and the performance year were significant but not associated with award status, size, or type. The implications of this change and its direction were explored further through univariate analysis in a following section.

Univariate Analysis Within Constructs. The repeated measures multivariate procedures used for analysis of the changes in the theoretical framework and the three constructs of cost, accountability, and access also produced univariate analysis including estimated means and confidence intervals. The univariate repeated measures analysis of each independent variable, and related estimations of means were used to explore issues left unanswered in the repeated measures multivariate analysis. Again, the same configuration of factors and covariates as the theoretical framework analysis was used. Award status and type were used as additional factors. Size was used as a covariate. Since the researcher was interested primarily in performance changes from the base year to the performance year due to award status, the interaction of years and award status was the focus of this analysis. Other changes from the base year to the performance year were noted as well. The following sections evaluate changes in these dependent variables individually, grouped for convenience by construct.

Cost variables. The five dependent variables associated with the cost construct are discussed in this section. These variables were tuition and fees, general and educational spending, direct spending, scholarships and fellowships, and tuition funding. The tuition and fees variable is discussed by itself. General and educational spending and direct spending are discussed together because they were different variations of the spending variable. Similarly, scholarship and fellowships are discussed together because they both represented the efforts of an institution to help students pay for their education.

The repeated measures univariate test for the effect of the interaction of years and award level on tuition and fees had a p -value of .575. As in analysis of the first research question, award status was not an important contributor to differences in tuition and fees. When the within subjects factor years was examined, it was found to be a significant contributor to differences in tuition and fees, but its interactions with size and type were not.

From this analysis, it was concluded that tuition and fees changed significantly over the time periods studied, but not because of size, type, or award status. Other factors outside this study have had much greater affect on tuition and fees.

The general and educational spending variable included spending on instruction, institutional support, academic support, student services, scholarship and fellowship, and operations. Direct spending included only instruction, student services, and scholarship and fellowship spending. These spending categories represented money spent for relatively direct student benefit and the operation of the institution. Both of these variables changed significantly over the time periods studied based on the significance of the within subjects factor years. The interaction of years and award status also significantly affected direct spending which had a p -value of .036, but not general and educational spending, which had a p -value of .107. These findings were consistent with the study's previous analysis of the performance year. Changes in direct spending for award recipients were different from that of non-recipients from the base year to the performance year. The analysis of the effects of general and educational spending in the performance year, and between the base year and the performance year, both resulted in a p -value slightly above the significance threshold. It was concluded that there was no difference between award recipients and non-recipients, in performance changes from the base year to the performance year. Analysis of the estimated means for both of these variables indicated that the

differences were favorable to award recipients, even though those differences were not statistically significant for general and educational spending. The difference in changes in direct spending from the base year to the performance year supports the conclusion from the analysis of the first research question, that award recipients directed more of their resources into spending areas that directly affect students. The difference in performance changes on direct spending from the base year to the performance years was illustrated in Figure 2 in Chapter 4.

The final two cost variables were scholarship and fellowship spending and tuition funding. Scholarship and fellowship spending was a measure of the amount of money spent per FTE student to help offset the cost of education. Tuition funding was the ratio of scholarship and fellowship spending to tuition and fees. Both of these measures were thought to reflect institutional efforts to help offset the cost of education. Years alone did not contribute significantly to variation in either of these variables. The interaction between years and award status was significant for scholarship and fellowship spending, while the effect on tuition funding was slightly above our significance threshold. Univariate repeated measures analysis produced a *p*-value of .031 for scholarship and fellowship spending, and .065 for tuition funding. Analysis of the estimated means found that the differences in both were favorable to award recipients.

As a result of this analysis, it was concluded that award recipients performed better on the measure of scholarship and fellowship spending and tuition funding than non-recipients. The efforts by award recipients to help students offset the costs of education appeared to be more effective than that of non-recipients. An interesting performance change on tuition funding can be seen in Figure 3 in Chapter 4. From the base year to the performance year, tuition funding increased modestly at award recipient institutions, while it declined rather dramatically at non-recipient institutions.

In this section the effects of the interaction of years and award status on dependent variables related to cost were discussed. This interaction was an indicator of differences in performance changes from the base year to the performance year between award recipients and non-recipients. Findings and conclusions from repeated measures analysis support those from the performance year analysis in research question one. It was concluded that tuition and fees was probably influenced most by factors other than management actions. It may be desirable, in future research on institutional performance to exclude this variable, or treat it in some other way. It appeared that management actions had an effect on spending, more so when only spending most directly related to students was considered. Finally, it was concluded that award recipients performed better in efforts to help students offset the cost of education. The tuition funding measure especially might be noteworthy, because it related scholarship and fellowship spending, which was different for award recipients, to tuition and fees which was not. Together, these two measures represent educational funding by the institution per student, and as a proportion of tuition and fees. The tuition funding formula may be a more meaningful way to express cost than the tuition and fees measure.

Accountability variables. The five dependent variables associated with the accountability construct are discussed in this section. These variables were graduation rate, minority completion, retention, minority success, and completions. The graduation rate variable is discussed by itself. Minority completions and minority success were variations of the minority completions variable and are discussed together. Completions and retention are discussed separately.

The effects of the within groups factor years, taken by itself did not contribute significantly to changes in any of the dependent variables associated with accountability. The

effect of the interaction of years with graduation rate was also not significant for the construct, with a p -value of .213. However, in the performance year analysis for research question one, a significant interaction between award status and type was discovered that affected graduation rates. In order to determine if a similar effect might be found in the repeated measures analysis, further analysis was performed. Univariate repeated measures analysis was used to examine the effect on graduation rates from the three way interaction of years, award status, and type. This interaction yielded a p -value of .098 which was not significant at $\alpha = .05$.

Plots of the estimated marginal means showed that graduation rate performance of both award recipients and non-recipients declined at four-year institutions. These plots also show that graduation rate increased for both award recipients and non-recipients at two-year institutions. However, the increase in graduation rates of award recipients improved more, changing from a mean of approximately 24% in the base year to nearly 30% in the performance year, while the rate for non-recipients increased less than 1%.

These findings and conclusions were consistent with those from the performance year analysis performed for research question one. It was concluded that award status affected graduation rates, but only at two-year institutions. This provides further evidence for the implications identified in the performance year analysis; that award recipients may perform better on some outcome measures than non-recipients, and that there may be some difference in the effects of MBNQA adoption in two-year institutions compared to four-year institutions. This result may be of interest to leaders of two-year institutions, and may be a useful topic for future research.

Minority completions and minority success were variations of measures of the number of completions by minorities. Minority completions was the ratio of minority completions to total

completions. Minority success was the ratio of minority completions to the minority undergraduate enrollment. So, the minority completions variable reflects the proportion of total completions that belong to minorities to total completions, while the minority success variable reflects the proportion of minority students who complete to minority enrollment. The findings from the repeated measures analysis for these two variables yielded very different results. The repeated measures univariate test for the effect of the year and award status interaction on minority completions resulted in a p -value of .431, not significant at $\alpha = .05$. The repeated measures univariate test for this effect on minority success resulted in a p -value of .007, which was significant at $\alpha = .05$. The reason for the very different results on these two related measure was explained in the univariate analysis section of the performance year analysis for the first research question.

Although minority success results from the analysis for research question one fell above our significance threshold, the change from base year to performance year leads the researcher to conclude that award recipients are improving more on this measure. The other implication supported here was that the minority success measure is more sensitive to changes in the number of completions by minorities than the minority completion measure.

The retention rate variable was intended to measure the proportion of students that returned compared with the number of students that might have returned. This measure did not have the level of precision desired, as there was no allowance for transfers in and out of institutions. The repeated measures univariate analysis of the effect of the interaction of year and award status on the dependent variable retention resulted in a p -value of .446, not significant for $\alpha = .05$.

This finding was consistent with the performance year analysis performed for research question one. It was concluded that there were no effects on retention rates from the interaction of years and award status. It also added weight to concerns about the coarseness of this measure.

The final dependent variable associated with accountability was completions. This variable was the ratio of total undergraduate enrollment to total completions. The repeated measures univariate tests for the effects of the interaction of years and award level on completions resulted in a p -value of .281, which was not significant at $\alpha = .05$.

As a result of this analysis, it was concluded that there was no effect from the interaction of years and award status on completions. That is, the performance of award recipients did not change at a rate that was different from non-recipients.

In this section the findings for the repeated measures univariate measures associated with accountability were evaluated. It was concluded that the change in performance from the base year to the performance year of award recipients was different than non-recipients for the dependent variable minority success. The p -value for graduation rates fell above the significance threshold, but profile plots confirmed patterns similar to those in the analysis for research question one. That is, two-year and four-year institutions behave very differently on this measure. This was congruent with previous conclusions in this study and suggests that different management actions, as represented by the MBNQA criteria and process, may influence outcomes at least in some situations, or at least in part. Although differences in performance changes were expected between award recipients and non-recipients for the measures retention, completions, and minority completions, none were found. It may, of course, be that there were no differences. It is also possible that this study was not adequate to detect them. Future studies might examine the sensitivity of the measures used, as in the case of the minority success

variable. It may also be that outcome performance differences take longer to come to fruition, since the influence of management actions is relatively indirect.

Access variables. The access construct had only two dependent variables associated with it; minority enrollment and federal grants. These were intended to be indicators of access for minorities and economically disadvantaged students. These two dependent variables are discussed separately in this section.

The repeated measures univariate analysis for federal grants revealed no significant difference in base year to performance year changes between the performance of award recipients and non-recipients. The p -value for federal grants was .986, which was not significant at $\alpha = .05$. This variable was meant to be a proxy for need-based aid. It was thought that award recipients might recruit more students that qualify for federal grants, and thereby increase access for economically disadvantaged students. No evidence to support this was found.

It was concluded that base year to performance year changes were no different for award recipients and non-recipients for federal grants. These findings and conclusions were consistent with those from the performance year analysis performed for the first research question, and support the conclusions that the federal grant measure was an inadequate proxy for need-based aid. It was also concluded that changes in the amount of federal grants may have been mostly beyond the influence of management actions, and may have been influenced more by public policy or other factors.

The second and last dependent variable for the access construct was minority enrollment. This measure was the ratio of minority enrollment to total enrollment. An increase in minority enrollment in award recipients that was different from non-recipients might have indicated these institutions had found ways to provide better access to minority students, but no difference was

found. The repeated measures univariate analysis of the effects of the interaction of years and award level on minority enrollment returned a p -value of .148, which was not significant at $\alpha = .05$. However, this was much different than the p -value of .782 from the performance year analysis. Further review of the estimated means revealed that from the base year to the performance year, minority enrollment at award recipients decreased slightly while minority enrollment at non-recipients increased slightly. Neither change was significant, but this was the only measure where differences, significant or not, were found to be unfavorable for award recipients.

In this section, the effects of award status on changes in dependent variables related to access were evaluated. The findings and conclusions regarding federal grants and minority enrollment support previous conclusions in this study that both of these dependent variables were relatively immune to management actions. It seems likely that the federal grants variable was not a good choice for the study. Minority enrollment was probably a logical choice, but it appears likely that this variable was influenced much more by a variety of other factors, than by any management actions.

Research Question Two Summary

The second research question asked, Do performance changes on key measures of cost, accountability, and access in the period preceding a quality award differ between award recipients and non-recipients? The repeated measures multivariate findings related to the theoretical framework and the three constructs of cost, accountability, and access, and the univariate findings related to the individual dependent variables were discussed and conclusions drawn. Implications regarding this study and possibilities for future studies were also identified.

Implications of Results

This study may help to inform both administrators and policy makers regarding the efficacy of management solutions such as the MBNQA process. What did this study mean in regards to the broad challenges of cost, accountability, and access facing public higher education? The lack of significant results for the framework, for the constructs, and for several of the dependent variables suggests that management solutions alone will not solve these problems. It will probably surprise very few administrators to suggest that the solutions, at least in part, lie in societal remedies. However, the study identified several areas related to these challenges that are amenable to management actions.

Higher education. The intractability of some of these challenges may be illustrated by examining trends in tuition and fees (Figure 6). As funding from states has been reduced, tuition and fees have increased steadily for over 20 years. Given the funding structure of most public higher education institutions, management approaches may have had little effect in restraining these increases. This finding lends support to statements by Canesale (2000), Kane & Orszag (2003), Rosenstone (2004), and Zumeta (2005), which suggest that institutions have limited control over tuition and fees. The most immediate effects of changes in management approach were apparent in spending. Since spending decisions are directly controlled by administrators, one would expect spending to be most amenable to management solutions. The findings in this study support that expectation. While tuition and fees did not appear to respond to new management approaches which are represented by the implementation of the MBNQA process, direct spending on students did. Award recipients appear to spend more money directly on students (on a per student basis), than non-recipients. Award recipients were found to spend more on students through direct spending, and scholarship and fellowship spending, than non-

recipients. Changes in spending from the base year to the performance year also indicated better performance on the part of award recipients.

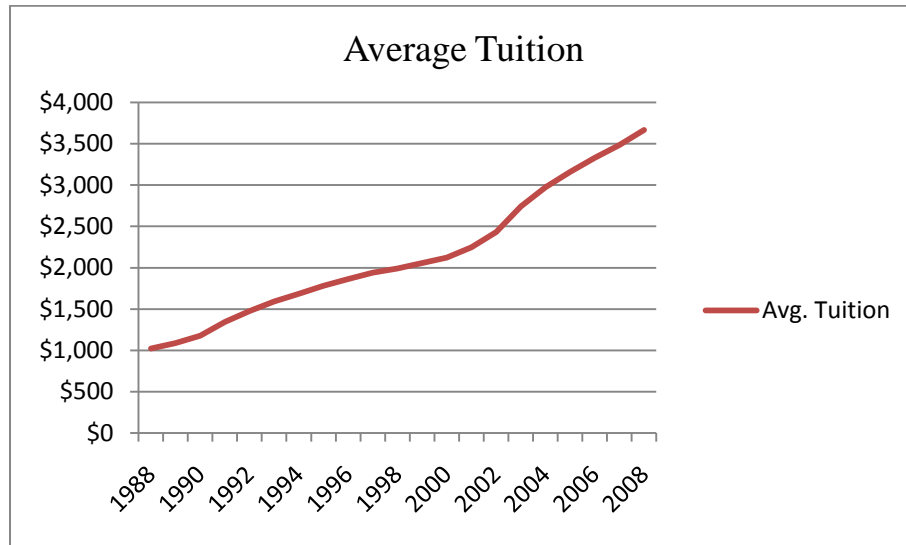


Figure 7. Growth of average tuition, 1988 – 2008

The effect of new management approaches on accountability measures was less clear. Administrative policies and decisions can clearly influence these outcomes, but the effect is not direct. Since these effects are indirect, it may take more time for them to become apparent. Administrators have some direct control over spending which is an input into the process. Accountability, which is a process outcome can only be influenced rather than controlled. Accountability results may be confounded by the personal situations and decisions of students, by changes in the job market, and by public policy decisions. It may also be of interest to community college administrators that two-year institutions which were award recipients outperformed the comparison group on graduation rates, while four-year institutions did not.

The issue of access was even cloudier. It was not clear that different management approaches affect access. It appears that issues such as income, culture, and public policy weigh

more heavily than the actions of administrators in ensuring broad access. In this study, issues of access appeared to be immune to, or unaddressed by management actions.

Quality award programs. Award recipients receive awards because they have managed their organizations in ways that are noteworthy. A significant part of MBNQA evaluation is dependent on the results that an organization demonstrates. This was logically extended to apply the three major challenges facing public higher education institutions; cost, accountability, and access. If institutions that have received awards perform better on measures selected in their individual award applications, perhaps they will perform better on these broader challenges as well.

This research found this to be partially true. Public institutions of higher education operate in a complex environment. Performance against these challenges is subject to the influence of a number of factors. This research demonstrated that this performance is to some degree influenced by its size, the type of institution, how urban or rural it is, what region of the country it is in, public policy, culture, and management actions. Many of these factors have a larger influence than management actions. In fact, award recipients perform better than non-recipients on measures related to cost and spending where management actions have a more direct influence. Measures of accountability are thought to be only indirectly influenced by management actions. Award recipients perform better than non-recipients on some of the accountability measures and no differently on others. This may be because the influence is diluted or attenuated more by other factors, and the indirect nature of the influence of management actions, or that these differences take more time to develop. Finally, measures of access appear to either be immune to management actions, or not addressed by management actions.

One might conclude from this that award recipients made better management decisions regarding these challenges than non-recipients, even though the desired outcomes were not always achieved. It should be noted again, that although performance differences were found in some areas, the effect sizes were small. This may be a reflection of the magnitude of influence that management decisions have in this complex environment.

Recommendations for future research.

The MBNQA was originally limited to manufacturing organizations. The effectiveness of the process was studied in the 1990s, particularly in articles by Hendricks and Singhal (1996, 1997). In the last 15 years, manufacturing participation has declined. Healthcare organizations and educational institutions (the cases in this study were a subset of these institutions) now account for the vast majority of participants. However, MBNQA efficacy in these sectors has not been the focus of very much research. The effectiveness of the MBNQA process in higher education has had very little study.

There are a number of future efforts that could expand on this study. There appear to be some performance differences between four-year institutions and two-year institutions and the number of two-year institutions that were award recipients was much greater. Two-year institutions might, therefore, be a focus for future research. There is also need for study of other educational subsets, such as K-12 education or for profit institutions.

This study was a first attempt to construct a theoretical framework reflecting the three major challenges facing higher education. Having learned something about the performance against the selected measures, it might be useful to refine this framework into a performance model. The framework examined in the study was purposely expansive. Three constructs and 12 dependent variables were tested for effects of award status. Based on the results of this

analysis, a model can be proposed which might reflect performance differences between award recipients and non-recipients resulting from changes in management actions.

Some differences were found in dependent variables in both the cost and the accountability construct, while none were found in the access construct. It was concluded that the access construct was not amenable to changes in management actions, and was primarily responsive to other factors. The access construct and its dependent variables then, are not an adequate reflection of organizational performance, and are not included in the proposed model.

The proposed model contains only two constructs; value and accountability. Two to four dependent variables aligned with each construct might be included. This would create a much simpler model than the framework tested in this study.

The cost construct in this study was aligned with five dependent variables; tuition and fees, general and educational spending, direct spending, scholarship and fellowship spending, and tuition funding. It was concluded that tuition and fees was not strongly affected by management actions. Both general and educational spending, and direct spending were measures of spending closely related to student success. The direct spending variable is more closely related to student success, and appears slightly more amenable to management actions. Scholarship and fellowship spending and tuition funding are also closely related. Although scholarship and fellowship spending was more responsive in this study, tuition funding may be the preferable variable, since it relates scholarship and fellowship spending to tuition and fees. The new construct should reflect both cost and spending for the benefit of students. As such, it might be more appropriately named the value construct.

The value construct (formerly cost), might include a measure of spending closely related to student success, such as direct spending. It might also include a measure that reflects efforts

by the institution to offset increases in tuition and fees, such as the tuition funding variable in this study.

The accountability construct in this study was aligned with five dependent variables; graduation rates, minority completions, retention, completions, and minority success. All but retention are related to the number of completions per 100 students. Retention was a comparison of actual returning students to expected returning students. Minority success was found to be a more sensitive indicator of change than minority completions.

The accountability construct might include a measure of completions such as graduation rate. If additional sources of data are used, a measure that includes the rate of graduation within 150% of scheduled time by cohort would be an improvement. A measure of completions focused on minorities would be useful, since completion by this group is particularly challenging. Of the measures used in this study, minority success would be more sensitive. Also requiring additional data, a good measure of retention would include transfers in and out, and other exceptions. Finally, a measure of classroom learning such as the standardized Student Learning Assessment might be desirable if data is available.

Table 41

Performance Model

Value Construct	Accountability Construct
Direct spending	Graduation rates
Tuition funding	Retention
	Minority success
	Learning Measure

A change in the timeframes tested might also be useful. For this exploratory study a five year timeframe was used for repeated measures, based on Hendricks and Singhal (1996). Since effects on accountability may take more time to become apparent, the use of various timeframes should be considered. Since all but one of the dependent variables used in this study changed in a favorable direction for award recipients, even though most were non-significant, the use of a six, seven, and eight year timeframe might be considered. This proposed model (Table 41) is not meant to be limiting. There may be many other variables that reflect organizational performance in useful ways, which could be included in further refinement.

Researcher observations. Are the challenges of cost, accountability, and access responsive to changes in management approach? It would appear that they were, but with limitations. Clearly, some of the variables tested here were amenable to changes in management approach. Others may, to a much greater extent, be influenced by factors outside of management control, such as public policy, culture and economics. Up to this point, discussion focused mostly on results that were significant, and the implications of those results. It may be useful to discuss performance changes over time that did not meet the study's level of significance but may be of interest. A few of the more intriguing differences are presented in Table 42. While the differences between award recipients and non-recipients on these measures cannot be stated with enough confidence to satisfy research purposes, they may help to inform management decisions. While significance was not established for many of the variables, the direction of difference was favorable for award recipients for 11 of the 12 dependent variables.

Table 42

Performance Change From Base Year to Performance Year

	Award recipients	Non-recipients
General and educational spending	Increased 24%	Increased 18%
Minority completions	Increased 15%	Increased 10%
Retention	Increased 3%	Decreased 2%
Completions	Increased 8%	Unchanged
Minority enrollment	Increased 5%	Increased 12%
Tuition funding	Increased 44%	Increased 9%

Summary

This study began with the purpose of exploring performance effects of MBNQA type award in public higher education institutions. Measures related to three major, long term challenges were analyzed. A comparison was made of the performance of award recipients and non-recipients in the year before the award. This study also compared change in performance between award recipients and non-recipients over the five year period leading up to the award. No significant differences were found in the analysis of the framework or at the construct level. There were some important differences in performance among some of the dependent variables.

This researcher concludes that MBNQA recipients perform better than the comparison group of non-recipients on some measures related to cost; notably direct spending on students, and the ability to help students pay for tuition. It was noted that this represents inputs into the system rather than outcomes. Outcomes were represented by measures of accountability. The results for accountability were mixed. Minority students who attend award recipient institutions

succeeded at a higher rate than those at non-recipient institutions. Graduation rates were higher at two-year institutions for award recipients, but not at four-year institutions. For other accountability measures, such as retention and completions, this study found no significant differences. Performance on measures for access, the third major challenge, showed no difference between award recipients and non-recipients.

This study may shed insight on both the efficacy of the MBNQA process, and its limitations. As would be expected, efficacy was greater where administrative decisions had a direct effect, such as spending. Efficacy was muted or absent where the effects of administrative decisions appear to be indirect, or confounded by external economic and policy factors.

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APPENDIX A: LIST OF ACRONYMS

CY	Current Year
FTE	Full Time Equivalents
FTUG	Full Time Undergraduates
HEIs	Higher Education Institutions
IPEDS	Integrated Postsecondary Education Data System
MBNQA	Malcolm Baldrige National Quality Award process and criteria
NIST	National Institute for Science and Technology
PTUG	Part Time Undergraduates
PY	Previous Year
RQ	Research Question
TQM	Total Quality Management
USDOE	United States Department of Education

APPENDIX B: MULTIVARIATE TABLES FOR RESEARCH QUESTION ONE

Table B1

Theoretical framework, Multivariate Analysis - RQ1

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Size	12	1.316	.136	.221
Award status	12	1.090	.116	.377
Type	12	2.446*	.227	.008
Award status X Type	12	1.188	.125	.302

* $p < .05$

Table B2

Cost Construct, Multivariate Analysis - RQ1

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Size	5	1.887	.081	.103
Award status	5	2.199	.093	.060
Type	5	1.755	.076	.128
Award status X Type	5	.890	.040	.491

* $p < .05$

Table B3

Accountability Construct, Multivariate Analysis - RQ1

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Size	5	2.285	.096	.051
Award status	5	.779	.035	.567
Type	5	4.798*	.183	.001
Award status X Type	5	1.432	.063	.219

* $p < .05$

Table B4

Access Construct, Multivariate Analysis - RQ1

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Size	2	4.251*	.072	.017
Award status	2	.050	.001	.951
Type	2	2.647*	.046	.075
Award status X Type	2	.548	.010	.580

* $p < .05$

APPENDIX C: MULTIVARIATE TABLES FOR RESEARCH QUESTION TWO

Table C1

Theoretical framework, Repeated Measures Multivariate Analysis - RQ2

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Between subjects				
Size	12	1.748*	.173	.068
Award status	12	.861	.094	.588
Type	12	2.306*	.217	.012
Award status X Type	12	.872	.095	.577
Within subjects				
Years	12	8.132	.494	.000
Years X size	12	.887	.096	.563
Years X award status	12	1.396	.143	.180
Years X type	12	1.214	.127	.284
Years X award status X type	12	.590	.066	.846

* $p < .05$

Table C2

Cost Construct, Repeated Measures Multivariate Analysis - RQ2

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Between subjects				
Size	5	2.287	.097	.051
Award status	5	1.862	.080	.107
Type	5	1.584	.069	.171
Award status X Type	5	.822	.037	.537
Within subjects				
Years	5	9.192*	.300	.000
Years X size	5	.795	.036	.556
Years X award status	5	1.630	.071	.158
Years X type	5	1.104	.049	.363
Years X award status X type	5	.314	.014	.904

* $p < .05$

Table C3

Accountability Construct, Repeated Measures Multivariate Analysis - RQ2

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Between subjects				
Size	5	1.694	.073	.142
Award status	5	.382	.018	.860
Type	5	5.164*	.194	.000
Award status X Type	5	1.237	.055	.297
Within subjects				
Years	5	1.852	.080	.109
Years X size	5	1.442	.063	.215
Years X award status	5	1.701	.074	.141
Years X type	5	1.156	.051	.336
Years X award status X type	5	.800	.036	.552

* $p < .05$

Table C4

Access Construct, Repeated Measures Multivariate Analysis - RQ2

Source	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Between subjects				
Size	2	4.536*	.076	.013
Award status	2	.012	.000	.988
Type	2	2.373*	.041	.098
Award status X Type	2	.623	.011	.538
Within subjects				
Years	2	9.954	.153	.000
Years X size	2	.008	.000	.992
Years X award status	2	1.056	.019	.351
Years X type	2	.540	.010	.585
Years X award status X type	2	1.301	.023	.276

* $p < .05$

APPENDIX D: UNIVARIATE TABLES FOR RESEARCH QUESTION ONE

Table D1

Cost Construct Variables, Univariate Analysis - RQ1

Source	Variable	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Size	Tuition & fees	1	.052	.000	.820
	Gen and educ spending	1	2.820*	.025	.096
	Direct spending	1	2.930*	.026	.090
	Schl & flwshp spending	1	6.953*	.059	.010
	Tuition funding	1	3.110	.027	.081
Award status	Tuition & fees	1	.359	.003	.550
	Gen and educ spending	1	2.145	.021	.123
	Direct spending	1	3.893	.034	.051
	Schl & flwshp spending	1	4.470*	.039	.037
	Tuition funding	1	3.111	.027	.080
Type	Tuition & fees	1	4.823*	.042	.030
	Gen and educ spending	1	2.484	.022	.118
	Direct spending	1	2.354	.021	.128
	Schl & flwshp spending	1	4.474*	.039	.037
	Tuition funding	1	.356	.003	.552
Award status X Type	Tuition & fees	1	.073	.001	.788
	Gen and educ spending	1	.715	.006	.400
	Direct spending	1	.769	.007	.382
	Schl & flwshp spending	1	3.573	.031	.061
	Tuition funding	1	1.968	.017	.163

* $p < .05$

Table D2

Accountability Construct Variables, Univariate Analysis - RQ1

Source	Variable	df	F	η^2	p
Size	Graduation Rate	1	.365	.003	.547
	Minority completions	1	8.304*	.070	.005
	Retention	1	2.387	.021	.125
	Completions	1	.391	.004	.533
	Minority success	1	.457	.004	.501
Award status	Graduation Rate	1	2.118	.019	.148
	Minority completions	1	.019	.000	.892
	Retention	1	.833	.007	.363
	Completions	1	1.156	.010	.285
	Minority success	1	3.096	.027	.081
Type	Graduation Rate	1	5.901*	.050	.017
	Minority completions	1	2.237	.020	.138
	Retention	1	.266	.002	.607
	Completions	1	.002	.000	.961
	Minority success	1	.120	.001	.729
Award status X Type	Graduation rate	1	5.636*	.048	.019
	Minority completions	1	.451	.004	.503
	Retention	1	.402	.004	.527
	Completions	1	1.864	.017	.175
	Minority success	1	2.528	.022	.115

* $p < .05$

Table D3

Access Construct Variables, Univariate Analysis - RQ1

Source	Variable	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Size	Federal grants	1	.080	.001	.778
	Minority enrollment	1	8.572*	.072	.004
Award status	Federal grants	1	.018	.000	.893
	Minority enrollment	1	.077	.001	.782
Type	Federal grants	1	2.484	.022	.118
	Minority enrollment	1	2.486	.022	.118
Award status X Type	Federal grants	1	.189	.002	.665
	Minority enrollment	1	.971	.009	.327

**p* < .05

APPENDIX E - UNIVARIATE TABLES FOR RESEARCH QUESTION TWO

Table E1

Cost Construct Variables, Repeated Measures Univariate Analysis - RQ2

Source	Variable	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Within subjects					
Years	Tuition & fees	1	33.531*	.232	.000
	Gen and educ. spending	1	20.756*	.158	.000
	Direct spending	1	13.540*	.109	.000
	Schl. & flwshp. spending	1	.137	.001	.712
	Tuition funding	1	1.642	.015	.203
Years X size	Tuition & fees	1	.597	.005	.441
	Gen and educ. spending	1	.987	.009	.323
	Direct spending	1	1.815	.016	.181
	Schl. & flwshp. spending	1	2.049	.018	.155
	Tuition funding	1	.629	.006	.429
Years X award status	Tuition & fees	1	.315	.003	.575
	Gen and educ. spending	1	2.634	.023	.107
	Direct spending	1	4.511*	.039	.036
	Schl. & flwshp. spending	1	4.771*	.041	.031
	Tuition funding	1	3.486*	.030	.065
Years X type	Tuition & fees	1	1.896	.017	.171
	Gen and educ. spending	1	.335	.003	.564
	Direct spending	1	.966	.009	.328
	Schl. & flwshp. spending	1	1.371	.012	.244
	Tuition funding	1	.034	.000	.853
Years X award status X type	Tuition & fees	1	.104	.001	.748
	Gen and educ. spending	1	.2878	.003	.593
	Direct spending	1	.494	.004	.484
	Schl. & flwshp. spending	1	1.387	.012	.241
	Tuition funding	1	.394	.004	.532

* $p < .05$

Table E2

Accountability Construct Variables, Repeated Measures Univariate Analysis - RQ2

Source	Variable	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Within subjects					
Years	Graduation rate	1	.197	.002	.658
	Minority completions	1	4.084*	.035	.046
	Retention	1	.623	.006	.432
	Completions	1	.111	.001	.740
	Minority success	1	1.919	.015	.203
Years X size	Graduation rate	1	1.128	.010	.291
	Minority completions	1	1.795	.013	.183
	Retention	1	1.592	.014	.210
	Completions	1	2.485	.022	.118
	Minority success	1	1.143	.010	.287
Years X award status	Graduation rate	1	1.570	.014	.213
	Minority completions	1	.626	.006	.431
	Retention	1	.584	.005	.446
	Completions	1	1.174	.010	.281
	Minority success	1	7.569*	.064	.007
Years X type	Graduation rate	1	4.494*	.039	.036
	Minority completions	1	.142	.001	.707
	Retention	1	.818	.007	.368
	Completions	1	2.453	.022	.120
	Minority success	1	1.588	.014	.210
Years X award status X type	Graduation rate	1	2.790	.025	.098
	Minority completions	1	.007	.000	.935
	Retention	1	.702	.006	.404
	Completions	1	1.352	.012	.247
	Minority success	1	1.639	.015	.203

Table E2

Accountability Construct Variables, Repeated Measures Univariate Analysis - RQ2

Source	Variable	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Within subjects					

**p* < .05

Table E3

Access Construct Variables, Repeated Measures Univariate Analysis - RQ2

Source	Variable	<i>df</i>	<i>F</i>	η_p^2	<i>p</i>
Within subjects					
Years	Federal grants	1	12.816*	.104	.001
	Minority enrollment	1	6.002*	.051	.016
Years X size	Federal grants	1	.013	.000	.911
	Minority enrollment	1	.005	.000	.942
Years X award status	Federal grants	1	.000	.000	.986
	Minority enrollment	1	2.125	.019	.148
Years X type	Federal grants	1	.105	.001	.747
	Minority enrollment	1	.937	.008	.335
Years X award status X type	Federal grants	1	2.2387	.020	.138
	Minority enrollment	1	.231	.002	.603

**p* < .05

APPENDIX F -SUMMARY HYPOTHESES AND FINDINGS TABLES

Table F1

Summary Hypotheses and Findings Tables

Research Question	Table	Hypotheses Through Findings
Research Question #1	Table F1	Theoretical framework and Constructs
Research Question #2	Table F2	Theoretical framework and Constructs
Research Question #1	Table F3	Cost Variables
Research Question #2	Table F4	Cost Variables - Repeated Measures
Research Question #1	Table F5	Accountability Variables
Research Question #2	Table F6	Accountability Variables - Repeated Measures
Research Question #1	Table F7	Access Variables
Research Question #2	Table F8	Access Variables - Repeated Measures

Table F2

RQ1 Hypotheses – Findings, Theoretical Framework, and Constructs

RQ1 – Do public HEIs that have successfully implemented the Malcolm Baldrige National Quality Award criteria and process perform differently from similar situations on key measures of cost, accountability, and access?

	Null Hypotheses	Statistical Tests	Findings			
			Size	Award Status	Type	Award * Type
Theoretical framework	H ₀ 1: Perf _{AR} = Perf _{NR}	Multivariate <i>f</i> test for significance	$p = .221$ $\eta_p^2 = .136$	$p = .377$ $\eta_p^2 = .116$	$p = .008^*$ $\eta_p^2 = .227$	$p = .302$ $\eta_p^2 = .125$
	H ₁ 1: Perf _{AR} ≠ Perf _{NR}					
Cost Construct	H ₀ 1.1: Cost _{AR} = Cost _{NR}	Multivariate <i>f</i> test for significance	$p = .103$ $\eta_p^2 = .081$	$p = .060$ $\eta_p^2 = .093$	$p = .128$ $\eta_p^2 = .076$	$p = .491$ $\eta_p^2 = .040$
	H ₁ 1.1: Cost _{AR} ≠ Cost _{NR}					
Accountability Construct	H ₀ 1.2: Accnt _{AR} = Accnt _{NR}	Multivariate <i>f</i> test for significance	$p = .051^*$ $\eta_p^2 = .096$	$p = .567$ $\eta_p^2 = .035$	$p = .001^*$ $\eta_p^2 = .183$	$p = .219$ $\eta_p^2 = .063$
	H ₁ 1.2: Accnt _{AR} ≠ Accnt _{NR}					
Access Construct	H ₀ 1.3: Access _{AR} = Access _{NR}	Multivariate <i>f</i> test for significance	$p = .017^*$ $\eta_p^2 = .072$	$p = .951$ $\eta_p^2 = .001$	$p = .075$ $\eta_p^2 = .046$	$p = .580$ $\eta_p^2 = .010$
	H ₁ 1.3: Access _{AR} ≠ Access _{NR}					

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year, η_p^2 = partial eta squared. The theoretical framework and constructs were tested using MANCOVA procedures in SPSS. * $p < .05$

Table F3

RQ2 Hypotheses – Findings, Theoretical Framework & Constructs – Repeated Measures

RQ2 – Do performance changes on key measures of cost, accountability, and access in the period preceding a quality award differ for award recipients and non-recipients?

	Null Hypotheses	Statistical Tests	Within Subjects Findings			
			Years * Size	Years * Award Status	Years * Type	Years * Award * Type
Theoretical framework	H ₀ 2: Perf _{ARchg} = Perf _{NRchg} H ₁ 2: Perf _{ARchg} ≠ Perf _{NRchg}	Multivariate <i>f</i> test for significance	$p = .563$ $\eta_p^2 = .096$	$p = .180$ $\eta_p^2 = .143$	$p = .284$ $\eta_p^2 = .127$	$p = .846$ $\eta_p^2 = .066$
Cost Construct	H ₀ 2.1: Cost _{ARchg} = Cost _{NRchg} H ₁ 2.1: Cost _{ARchg} ≠ Cost _{NRchg}	Multivariate <i>f</i> test for significance	$p = .556$ $\eta_p^2 = .036$	$p = .158$ $\eta_p^2 = .071$	$p = .363$ $\eta_p^2 = .049$	$p = .904$ $\eta_p^2 = .014$
Accountability Construct	H ₀ 2.2: Accnt _{ARchg} = Accnt _{NRchg} H ₁ 2.2: Accnt _{ARchg} ≠ Accnt _{NRchg}	Multivariate <i>f</i> test for significance	$p = .215$ $\eta_p^2 = .063$	$p = .141$ $\eta_p^2 = .074$	$p = .325$ $\eta_p^2 = .051$	$p = .552$ $\eta_p^2 = .036$
Access Construct	H ₀ 2.3: Access _{ARchg} = Access _{NRchg} H ₁ 2.3: Access _{ARchg} ≠ Access _{NRchg}	Multivariate <i>f</i> test for significance	$p = .992$ $\eta_p^2 = .000$	$p = .351$ $\eta_p^2 = .019$	$p = .585$ $\eta_p^2 = .010$	$p = .276$ $\eta_p^2 = .023$

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year, η_p^2 = partial eta squared. The theoretical framework and constructs were tested using repeated measures MANCOVA procedures in SPSS. * $p < .05$

Table F4

RQ1 Hypotheses - Findings, Cost Variables

Cost Variables	Null Hypotheses	Statistical Tests	Findings			
			Size	Award Status	Type	Award * Type
Tuition & fees	H ₀ 1.1.1: t _f AR = t _f NR H ₁ 1.1.1: t _f AR ≠ t _f NR	Univariate <i>f</i> test for significance	$p = .820$ $\eta_p^2 = .000$	$p = .550$ $\eta_p^2 = .003$	$p = .030^*$ $\eta_p^2 = .042$	$p = .788$ $\eta_p^2 = .001$
Gen & ed. spending	H ₀ 1.1.2: spnd1 _{AR} = spnd1 _{NR} H ₁ 1.1.2: spnd1 _{AR} ≠ spnd1 _{NR}	Univariate <i>f</i> test for significance	$p = .096$ $\eta_p^2 = .025$	$p = .123$ $\eta_p^2 = .021$	$p = .118$ $\eta_p^2 = .022$	$p = .400$ $\eta_p^2 = .006$
Direct spending	H ₀ 1.1.3: spnd2 _{AR} = spnd2 _{NR} H ₁ 1.1.3: spnd2 _{AR} ≠ spnd2 _{NR}	Univariate <i>f</i> test for significance	$p = .090$ $\eta_p^2 = .026$	$p = .051$ $\eta_p^2 = .034$	$p = .128$ $\eta_p^2 = .021$	$p = .382$ $\eta_p^2 = .007$
Schl & Flwshp spending	H ₀ 1.1.4: faid2 _{AR} = faid2 _{NR} H ₁ 1.1.4: faid2 _{AR} ≠ faid2 _{NR}	Univariate <i>f</i> test for significance	$p = .010^*$ $\eta_p^2 = .059$	$p = .037$ $\eta_p^2 = .039$	$p = .037^*$ $\eta_p^2 = .039$	$p = .061$ $\eta_p^2 = .031$
Tuition Funding	H ₀ 1.1.5: faid3 _{AR} = faid3 _{NR} H ₁ 1.1.5: faid3 _{AR} ≠ faid3 _{NR}	Univariate <i>f</i> test for significance	$p = .081$ $\eta_p^2 = .027$	$p = .080$ $\eta_p^2 = .027$	$p = .552$ $\eta_p^2 = .003$	$p = .163$ $\eta_p^2 = .017$

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year, η_p^2 = partial eta squared. The theoretical framework and constructs were tested using repeated measures MANCOVA procedures in SPSS.

* $p < .05$

Table F5

RQ2 Hypotheses - Findings, Cost Variables - Repeated Measures

Cost Variables – Repeated Measures	Null Hypotheses	Statistical Tests	Within Subjects Findings			
			Years * Size	Years * Award Status	Years * Type	Years * Award * Type
Tuition & Fees	H ₀ 2.1.1: $t_{fARchg} = t_{fNRchg}$ H ₁ 2.1.1: $t_{fARchg} \neq t_{fNRchg}$	Univariate <i>f</i> test for significance	$p = .441$ $\eta_p^2 = .005$	$p = .575$ $\eta_p^2 = .003$	$p = .171$ $\eta_p^2 = .017$	$p = .748$ $\eta_p^2 = .001$
Gen & ed. spending	H ₀ 2.1.2: $spnd1_{ARchg} = spnd1_{NRchg}$ H ₁ 2.1.2: $spnd1_{ARchg} \neq spnd1_{NRchg}$	Univariate <i>f</i> test for significance	$p = .323$ $\eta_p^2 = .009$	$p = .107$ $\eta_p^2 = .023$	$p = .564$ $\eta_p^2 = .003$	$p = .593$ $\eta_p^2 = .003$
Direct spending	H ₀ 2.1.3: $spnd2_{ARchg} = spnd2_{NRchg}$ H ₁ 2.1.3: $spnd2_{ARchg} \neq spnd2_{NRchg}$	Univariate <i>f</i> test for significance	$p = .181$ $\eta_p^2 = .016$	$p = .036^*$ $\eta_p^2 = .039$	$p = .328$ $\eta_p^2 = .009$	$p = .484$ $\eta_p^2 = .004$
Schl & Flwshp spending	H ₀ 2.1.4: $faid2_{ARchg} = faid2_{NRchg}$ H ₁ 2.1.4: $faid2_{ARchg} \neq faid2_{NRchg}$	Univariate <i>f</i> test for significance	$p = .155$ $\eta_p^2 = .018$	$p = .031^*$ $\eta_p^2 = .041$	$p = .244$ $\eta_p^2 = .012$	$p = .241$ $\eta_p^2 = .012$
Tuition Funding	H ₀ 2.1.5: $faid3_{ARchg} = faid3_{NRchg}$ H ₁ 2.1.5: $faid3_{ARchg} \neq faid3_{NRchg}$	Univariate <i>f</i> test for significance	$p = .429$ $\eta_p^2 = .006$	$p = .065$ $\eta_p^2 = .030$	$p = .853$ $\eta_p^2 = .000$	$p = .532$ $\eta_p^2 = .004$

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year, η_p^2 = partial eta squared. The theoretical framework and constructs were tested using repeated measures MANCOVA procedures in SPSS. * $p < .05$

Table F6

RQ1 Hypotheses - Findings, Accountability Variables

Accountability Variables	Null Hypotheses	Statistical Tests	Findings			
			Size	Award Status	Type	Award * Type
Graduation Rate	H ₀ 1.2.1: $gr_{AR} = gr_{NR}$ H ₁ 1.2.1: $gr_{AR} \neq gr_{NR}$	Univariate <i>f</i> test for significance	$p = .547$ $\eta_p^2 = .003$	$p = .148$ $\eta_p^2 = .019$	$p = .017^*$ $\eta_p^2 = .050$	$p = .019^*$ $\eta_p^2 = .048$
Minority Completions	H ₀ 1.2.2: $mcmp_{AR} = mcmp_{NR}$ H ₁ 1.2.2: $mcmp_{AR} \neq mcmp_{NR}$	Univariate <i>f</i> test for significance	$p = .005^*$ $\eta_p^2 = .125$	$p = .892$ $\eta_p^2 = .000$	$p = .138$ $\eta_p^2 = .020$	$p = .503$ $\eta_p^2 = .004$
Minority Success	H ₀ 1.2.3: $msuc_{AR} = msuc_{NR}$ H ₁ 1.2.3: $msuc_{AR} \neq msuc_{NR}$	Univariate <i>f</i> test for significance	$p = .501$ $\eta_p^2 = .004$	$p = .081$ $\eta_p^2 = .027$	$p = .729$ $\eta_p^2 = .001$	$p = .115$ $\eta_p^2 = .022$
Retention	H ₀ 1.2.4: $ret_{AR} = ret_{NR}$ H ₁ 1.2.4: $ret_{AR} \neq ret_{NR}$	Univariate <i>f</i> test for significance	$p = .125$ $\eta_p^2 = .021$	$p = .363$ $\eta_p^2 = .007$	$p = .607$ $\eta_p^2 = .002$	$p = .527$ $\eta_p^2 = .004$
Completions	H ₀ 1.2.5: $cmp_{AR} = cmp_{NR}$ H ₁ 1.2.5: $cmp_{AR} \neq cmp_{NR}$	Univariate <i>f</i> test for significance	$p = .533$ $\eta_p^2 = .004$	$p = .285$ $\eta_p^2 = .010$	$p = .961$ $\eta_p^2 = .000$	$p = .175$ $\eta_p^2 = .017$

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year, η_p^2 = partial eta squared. The theoretical framework and constructs were tested using MANCOVA procedures in SPSS. * $p < .05$

Table F7

RQ2 Hypotheses - Findings, Accountability Variables - Repeated Measures

	Null Hypotheses	Statistical Tests	Within Subjects Findings			
Accountability Variables – Repeated Measures			Years * Size	Years * Award Status	Years * Type	Years * Award * Type
Graduation Rate	H ₀ 2.2.1: $gr_{ARchg} = gr_{NRchg}$ H ₁ 2.2.1: $gr_{ARchg} \neq gr_{NRchg}$	Univariate <i>f</i> test for significance	$p = .291$ $\eta_p^2 = .010$	$p = .213$ $\eta_p^2 = .014$	$p = .036^*$ $\eta_p^2 = .039$	$p = .098$ $\eta_p^2 = .025$
Minority Completions	H ₀ 2.2.2: $mcmp_{ARchg} = mcmp_{NRchg}$ H ₁ 2.2.2: $mcmp_{ARchg} \neq mcmp_{NRchg}$	Univariate <i>f</i> test for significance	$p = .183$ $\eta_p^2 = .016$	$p = .431$ $\eta_p^2 = .006$	$p = .707$ $\eta_p^2 = .001$	$p = .935$ $\eta_p^2 = .000$
Retention	H ₀ 2.2.3: $ret_{ARchg} = ret_{NRchg}$ H ₁ 2.2.3: $ret_{ARchg} \neq ret_{NRchg}$	Univariate <i>f</i> test for significance	$p = .210$ $\eta_p^2 = .014$	$p = .446$ $\eta_p^2 = .005$	$p = .368$ $\eta_p^2 = .007$	$p = .404$ $\eta_p^2 = .006$
Minority Success	H ₀ 2.2.4: $msuc_{ARchg} = msuc_{NRchg}$ H ₁ 2.2.4: $msuc_{ARchg} \neq msuc_{NRchg}$	Univariate <i>f</i> test for significance	$p = .287$ $\eta_p^2 = .010$	$p = .007^*$ $\eta_p^2 = .064$	$p = .210$ $\eta_p^2 = .014$	$p = .247$ $\eta_p^2 = .012$
Completions	H ₀ 2.2.5: $cmp_{ARchg} = cmp_{NRchg}$ H ₁ 2.2.5: $cmp_{ARchg} \neq cmp_{NRchg}$	Univariate <i>f</i> test for significance	$p = .118$ $\eta_p^2 = .022$	$p = .281$ $\eta_p^2 = .010$	$p = .120$ $\eta_p^2 = .022$	$p = .247$ $\eta_p^2 = .012$

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year, η_p^2 = partial eta squared. The theoretical framework and constructs were tested using repeated measures MANCOVA procedures in SPSS. * $p < .05$

Table F8

RQ1 Hypotheses - Findings, Access Variables

Access Variables	Null Hypotheses	Statistical Tests	Findings			
			Size	Award Status	Type	Award * Type
Federal Grants	H ₀ 1.3.1: faidl _{AR} = faidl _{NR} H ₁ 1.3. 1: faidl _{AR} ≠ faidl _{NR}	Univariate <i>f</i> test for significance	$p = .778$ $\eta_p^2 = .001$	$p = .893$ $\eta_p^2 = .000$	$p = .118$ $\eta_p^2 = .022$	$p = .665$ $\eta_p^2 = .002$
Minority Enrollment	H ₀ 1.3.2: menrl _{AR} = menrl _{NR} H ₁ 1.3.2: menrl _{AR} ≠ menrl _{NR}	Univariate <i>f</i> test for significance	$p = .004$ $\eta_p^2 = .072$	$p = .782$ $\eta_p^2 = .001$	$p = .118$ $\eta_p^2 = .022$	$p = .327$ $\eta_p^2 = .009$

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year, η_p^2 = partial eta squared. The theoretical framework and constructs were tested using MANCOVA procedures in SPSS. * $p < .05$

Table F9

RQ2 Hypotheses - Findings, Access variables - repeated measures

Access Variables – Repeated Measures	Null Hypotheses	Statistical Tests	Within Subjects Findings			
			Years * Size	Years * Award Status	Years * Type	Years * Award * Type
Federal Grants	H ₀ 2.3.1: faid1 _{ARchg} = faid1 _{NRchg} H ₁ 2.3.1: faid1 _{ARchg} ≠ faid1 _{NRchg}	Univariate <i>f</i> test for significance	$p = .911$ $\eta_p^2 = .000$	$p = .986$ $\eta_p^2 = .000$	$p = .747$ $\eta_p^2 = .001$	$p = .138$ $\eta_p^2 = .020$
Minority Enrollment	H ₀ 2.3.2: menrl _{ARchg} = menrl _{NRchg} H ₁ 2.3.2: menrl _{ARchg} ≠ menrl _{NRchg}	Univariate <i>f</i> test for significance	$p = .942$ $\eta_p^2 = .000$	$p = .148$ $\eta_p^2 = .019$	$p = .335$ $\eta_p^2 = .008$	$p = .603$ $\eta_p^2 = .002$

Note. AR = award recipients, NR - non-recipients, chg = change from base year to performance year, η_p^2 = partial eta squared. The theoretical framework and constructs were tested using repeated measures MANCOVA procedures in SPSS. * $p < .05$