

**A STRUCTURAL MODEL ANALYSIS OF THE
MALCOLM BALDRIGE NATIONAL QUALITY AWARD FRAMEWORK**

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Revised manuscript prepared for publication in:
International Journal of Management and Decision Making

October 30, 2002

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A STRUCTURAL MODEL ANALYSIS OF THE MALCOLM BALDRIGE NATIONAL QUALITY AWARD FRAMEWORK

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Abstract

The Malcolm Baldrige National Quality Award (MBNQA) has become a model for the deployment of quality programs. While the framework underlying the award has been used extensively by organizations, both for award and self-assessment purposes, little empirical evidence exists regarding its validity as a predictor of organizational performance. This research presents a structural equation model that explicitly tests the relationships between strategic and operational quality planning implied by the framework, and their impact on performance. Results support the theory underlying the Baldrige award. Specifically, the strategic quality planning process, mediated by the effective use of information and analysis, is the driver of operational quality planning. Positive business results are the outcome of this planning process. Results also show that customer and market focus is a crucial input to strategic quality planning, the commitment of senior leadership is critical in securing a customer and market focus, and operational level business processes are driven by a strategic commitment to human resource management.

Keywords: Malcolm Baldrige National Quality Award, Structural Equation Model, Empirical Survey.

Biographical Notes

Soumen Ghosh is a Professor of Operations Management in the DuPree College of Management at Georgia Institute of Technology. His research and teaching interests are in the areas of global operations and supply chain strategy, product development and supply chain interface, quality management, and manufacturing planning and control. His research has been published in several scholarly journals, and he has received research funding from the *National Science Foundation*, *Sloan Foundation*, *American Society for Quality*, and the *CIBER Centers* at two schools. He is a recipient (co-author) of two Best Paper awards from the Decision Sciences Institute. He is an Associate Editor for *Decision Sciences*, and the *Journal of Operations Management*, and also serves on the Editorial Review Boards of *Production and Operations Management*, *IEEE Transactions on Engineering Management*, and the *Quality Management Journal*.

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Decision Science, Journal of Supply Chain Management, Journal of Business Logistics, and IEEE Transactions in Engineering Management. Handfield serves as Editor-in-Chief of the *Journal of Operations Management*, SCM Columnist for *APICS: The Performance Advantage*, and serves on the Editorial Board of the *Supply Chain Management Review, Decision Sciences* and the *Journal of Supply Chain Management*. He is the author of five books on strategic sourcing and supply chain management, including the recently published book *Supply Chain Re-Design* (co-authored with Ernest L. Nichols, Jr., Prentice Hall, 2002).

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1. Introduction

Organizations, faced with increasing global competition, shorter product life cycles, and increasingly sophisticated customers, have in recent years experimented with an array of programs and initiatives in an attempt to enhance their competitiveness. At the forefront of these initiatives have been those aimed at improving product and process quality. Quality management has received substantial attention in business circles. Such has been the interest that Total Quality Management (TQM) is considered by manufacturing executives to be one of their top strategic issues [1]. In the last decade alone, between seventy-five and eighty percent of large companies have adopted TQM programs [2]. Unfortunately however, while quality management efforts at some companies have been successful [3], they have not been uniformly so [4].

One of the reasons for the inconsistent results of quality programs has been uncertainty over what works and how quality programs should be implemented [5]. While numerous case studies and anecdotal evidence of success stories and failures exist [6, 7], only in recent years have attempts been made to objectively assess how to achieve higher levels of quality. These attempts fall into two categories, those that identify the underlying elements of quality, and those that explore the relationships between quality and performance. The former category includes studies by [8, 9], while the latter includes studies by [7, 10, 11].

Given the paucity, until recent years, of evidence suggesting what the elements of effective quality management programs are, the Malcolm Baldrige National Quality Award (MBNQA) has been used by many organizations in the U.S. as a framework for developing quality initiatives and awards. This award was instituted by the United State Department of Commerce in 1987 with the goals of stimulating awareness of quality by business organizations, providing a framework which organizations could use to evaluate quality improvement efforts, and rewarding and publicizing the efforts of successful organizations. The award assesses an organization’s quality management efforts in seven areas (Figure 1) using a comprehensive evaluation process [12]. Up to five awards may be given each year in each of five categories: manufacturing companies, service companies, small businesses, educational institutions, and healthcare organizations. The intuitive appeal of the process and of the underlying constructs of quality it examines is such that in addition to award applicants, numerous organizations with no intention of applying for the award have used the award framework for self-assessment purposes [13]. The Baldrige award criteria are in fact now called “The Criteria for Performance Excellence” [12]. Moreover, the dimensions of quality obtained by [9] are derived from components of the MBNQA, and closely resemble dimensions obtained in other studies. This suggests that in the absence of definitive guidelines for implementing quality programs, the MBNQA framework may be an appropriate surrogate.

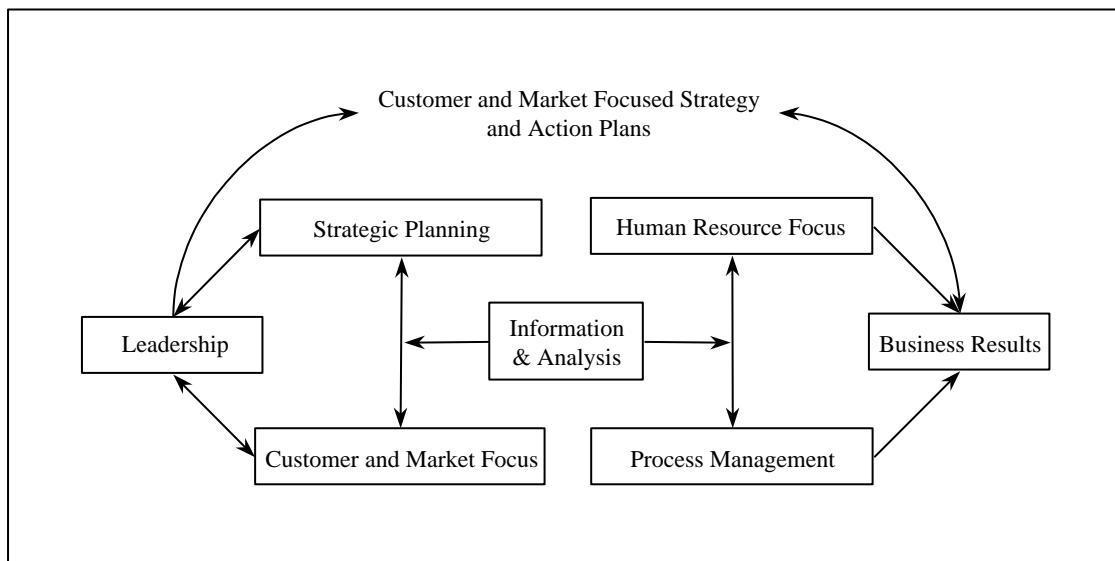


Figure 1: The Baldrige Award Criteria Framework: A Systems Perspective

While the MBNQA continues to be widely used by organizations to plan and implement quality improvement initiatives, no conclusive evidence exists to date of whether the criteria used by the award are in fact directly related to organizational performance. In spite of the award’s popularity, no evidence of empirical testing of the Baldrige framework exists in the literature. The MBNQA framework is not in itself predictive in nature. It merely proposes a framework suggesting what factors play a role in quality improvement. The implication however is that companies that score well on the criteria will perform well in the marketplace.

Five recent studies have examined the relevance of the MBNQA. [14] suggested there is a positive relationship between success in the Baldrige Award and financial performance. [15] surveyed MBNQA applicants and firms using the award framework for self-assessment purposes. While they found that users of the framework considered the evaluation criteria useful for planning quality related initiatives, they did not relate this finding to performance resulting from adopting award criteria. [16] demonstrated that over a three-year period, stock prices of publicly traded MBNQA winners increased faster than those of companies included in the Dow Jones Industrial Index or the Standard and Poor's 500 index. The study did not however isolate price movements attributable directly to performance on MBNQA criteria. Using data from the Arizona Governor's Quality Award, a state award patterned on the MBNQA, [17] demonstrated that the evaluation criteria embodied in the MBNQA are valid and reliable measures of the seven areas of quality underlying the award. They did not however examine whether the underlying components of quality directly impact performance.

While the Baldrige award appears to measure generally accepted constructs of quality and in a rigorous manner, it is not clear whether performance on the evaluation criteria translates into improved performance in the marketplace. This study proposes and tests a structural equation model that empirically validates the underlying premise of the MBNQA, namely that organizational commitment to quality impacts organizational performance. This is accomplished using survey data from a large sample of firms identified through the American Society for Quality (ASQ). Structural equation modeling was used to facilitate large scale empirical testing and to develop a model practicing managers can use as a blueprint for deployment of their continuous improvement initiatives.

The remainder of this paper is organized as follows. Section 2 presents a testable structural model of the Baldrige framework, and develops propositions to test the structural relationships inherent in the framework. Section 3 presents the research design and methodology used and discusses the survey instrument and sample characteristics. The results of the analysis are discussed in depth in Section 4.

2. Development of the Propositions

The Baldrige framework, shown in Figure 1, has sound linkages to management and organizational literature. While the MBNQA system did not actually stem from Deming's work, it is nevertheless grounded in the teachings of Deming, which posit the effect of visionary leadership as a driver of organizational learning and cooperation, leading to process management, process outcomes, and ultimately customer satisfaction [18]. A model based on these teachings was derived in a study by [19], and later empirically tested [10]. In comparing management theory with the Baldrige framework, [20] found that the Baldrige framework areas of Information & Analysis, Strategic Planning, Human Resource Management, and Leadership had relatively high coverage in the literature, while Process Management had moderate coverage and Customer Focus had relatively low coverage. While [20] had the shortcoming of primarily focusing on the management literature, other examinations of the underlying theoretical dimensions of the Baldrige framework can be found in [21] and [22].

2.1 Structural Model Representation of the Baldrige Framework

The Baldrige framework (Figure 1) is not itself a directly testable structural model but a set of core values and concepts embodied in seven categories. Leadership (Category 1), Strategic Planning (Category 2), and Customer and Market Focus (Category 3) represent the leadership triad. These categories are placed together to emphasize the importance of leadership in strategy development and in cultivating a sound understanding of market expectations. Senior management is expected to set organizational direction and seek future opportunities for their organization. Information and Analysis (Category 4) are critical to the effective management of the organization and to a fact-based system for improving performance and competitiveness. They represent the vehicle by which goals and objectives are disseminated throughout the organization, and by which alignment between objectives and capabilities is managed. Moreover, they serve as a foundation for performance management systems. Human Resource Focus (Category 5), Process Management (Category 6), and Business Results (Category 7) represent the results triad. An organization's employees and its key processes accomplish the work of the organization that yields the business results. All actions point toward Business Results, a composite of customer, financial, and operational performance results, including human resource results and public responsibility [12].

The relationships underlying the Baldrige framework can be represented by the model illustrated in Figure 2, which is a directly testable structural equation model. Figure 2 depicts the same relationships as in the Baldrige framework in Figure 1, except that many of the bi-directional arrows present in Figure 1 are omitted or changed to unidirectional arrows. Figure 1 is not directly testable using the structural equation modeling methodology. Moreover, from an implementation standpoint, managers must interpret the MBNQA framework relative to their specific context. The question we are interested in asking here is: Does managerial behavior relate to the Baldrige criteria in a meaningful manner? In other words, do the actions of managers coincide with the specified relationships, indicating that the model is appropriate and a valid predictor of quality related performance? Our intention is to examine whether the "mental model" of the Baldrige framework formulated by managers and enacted in their daily decisions, coincides with the set of implicit hypothesized relationships.

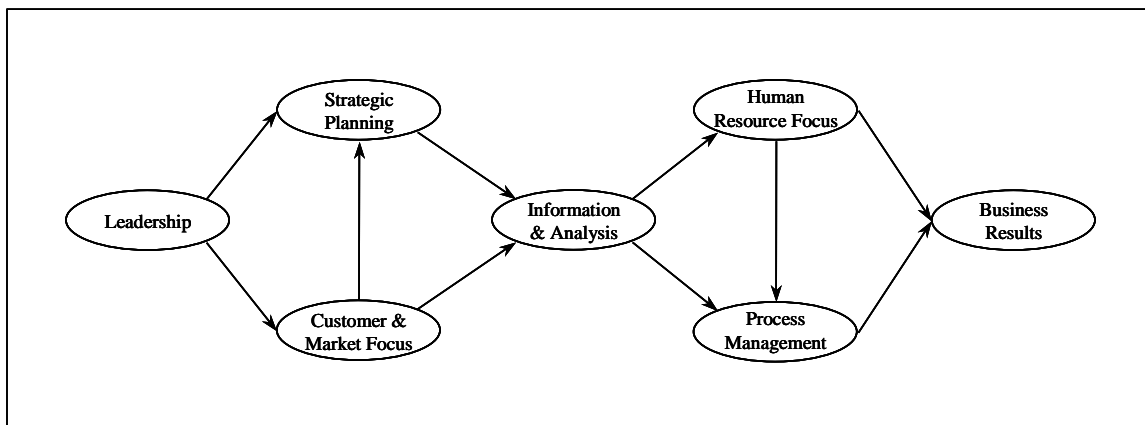


Figure 2: Directly Testable Structural MBNQA Model

2.2 Propositions

A theme common to both the organizational literature and the Baldrige framework [12] is that the primary catalyst for strategic change in organizations is senior executive leadership [23]. Specifically, management leaders enable changes in the systems and infrastructure of the organization through strategic planning and the establishment of clear vision, mission, values, and goals for the organization. The execution of effective leadership leads to permanent changes in all processes within the organization, such that continuous improvement becomes an established objective within each process. Several papers in the literature address the impact of leadership on strategic planning [e.g., 6, 7, 10, 19, 21, 24] and customer focus [e.g., 6, 7, 10, 19, 21, 24, 25, 26]. Based on their findings and the criteria set forth in the Baldrige framework [12], we propose the following:

Proposition 1a: *An organization's customer and market focus is directly impacted by senior management leadership, and by senior management's commitment to understanding and responding to market forces.*

Proposition 1b: *Senior management leadership and its focus on customers, positively influences the organization's strategic planning process.*

The second major element of the quality management model inherent in the Baldrige framework is the existence of a well-managed quality system. The framework posits that human resource focus, process management, and business results represent the results triad. An organization's employees and its key processes accomplish the work of the organization that yields the business results. Several authors have addressed the role of human resources [e.g., 27, 28, 29] and process management [e.g., 20, 30, 31] in the context of quality management, and their impact on performance [e.g., 7, 10, 31]. Recognizing the contribution of human resources and process management to an organization's quality system, we propose the following:

Proposition 2a: *The effective management of an organization's core operational processes is dependent on its policies and practices related to human resource focus and process management.*

Proposition 2b: *An organization's business performance is directly impacted by its focus on its core operational processes (human resource focus and process management).*

The third key element of the Baldrige framework is information and analysis. Information and analysis is the link between the strategic process and an organization's core operational processes. The strategic plan embodies top management's vision for delivering products in the marketplace. This must be communicated effectively throughout the organization in order for appropriate decisions to be made regarding the design of processes and the deployment of resources. Furthermore, information and analysis represents the mechanism by which the need for continuous improvement is identified, feedback is generated and communicated, and performance is measured and evaluated in line with stated goals and objectives. In the context of the Baldrige framework, Information and Analysis is viewed as a strategic rather than an operational element of the quality system. The role of information in quality systems has been examined by a number of authors [32, 33]. The role of information and analysis as a driver of the deployment of the strategic plan via core operational processes leads to the following proposition:

Proposition 3: *Information and Analysis are critical to the effective management of the firm's quality system by linking the organization's leadership triad (senior leadership, strategic planning, and customer & market focus) to its results triad (human resource focus, process management, and business results).*

Whether senior leadership *directly* impacts business results has been an issue of considerable debate. Deming posited visionary leadership as a driver of organizational learning and cooperation, leading to process management and ultimately customer satisfaction [18]. A model based on this premise was derived by [19] and subsequently empirically tested [10]. Several studies have however questioned whether the relationship between leadership and results is direct or not. [34] found that the effect of leadership on quality results is moderated by the absorptive capacity of people. They showed that human resource training is critical to obtaining results. [35] demonstrated that the effect of leadership on human resource development must be moderated by organizational context (e.g. strategic planning). [36] speculated that transactional leadership may encourage the short-term, individually based goal setting denounced in total quality management, suggesting that effective leadership should not directly influence the specific types of training and results that occur. [37] found that Executive commitment was not significantly related to short-term quality performance, but was significantly correlated to long-term performance. As workers become “defunctionalized” through empowerment, they become less responsible for direct work and more responsible for trouble shooting, debugging, and process improvements. Information and analysis, driven by leadership, thus plays a mediating role on human resource management and hereby results. In light of these inconsistencies, we propose:

Proposition 4: *Leadership is the key driver of organizational performance through the operationalization of its strategic & market plans via its core operational processes (human resource focus, process management).*

3. Research Design

3.1 Survey Design and Data Collection

Data from actual MBNQA evaluations are confidential, thus to test the proposed model, an alternative source of data was required. To obtain this data, a survey instrument was developed that probed a number of quality related issues. Several studies in the literature have developed measurement items for the key concepts of total quality [e.g., 6, 8, 25, 34, 38]. Measurement items in this study were adapted directly from these studies and the official NIST Baldrige Award document [12]. In addition, the survey contained questions regarding the size and nature of the responding organization. Questions were formulated using seven-point Likert scales. Measures were taken to reduce or eliminate risks inherent in survey research. To reduce common respondent bias, the instrument was designed so that not all items were to be answered by all respondents. It was also pre-tested by ten managers/directors of quality. Items were re-worded as appropriate to improve clarity and validity, and in particular to reduce the risk of social desirability bias.

The firms used in the sample were identified through the American Society for Quality (ASQ). A list of 3000 quality directors and vice presidents was obtained, which yielded a sub-sample of 1469 manufacturing firms. These firms represented the automotive, chemical, computer, construction, consumer products, defense, electronics, industrial products, medical device, pharmaceutical, paperboard, semiconductor, and telecommunications industry sectors. Two mailings and one follow-up reminder resulted in 313 returned surveys (21.3% response rate). The firms were located in all fifty states in the United States. Companies responding to the survey ranged in size between

12 and 256,000 employees, and between \$ 1 million to \$ 65 billion in annual sales. Mean size and annual sales were 5,228 employees and \$ 900 million respectively.

3.2 Non-response Bias

To investigate the possibility of non-response bias in the data, responses were tested for statistically significant differences in the responses of early and late waves of returned surveys [39, 40], the last wave of surveys received considered to be representative of non-respondents. Ten of the survey items were randomly selected, the sample was split into two groups on the basis of early and late survey return times, and t-tests were performed on the responses of the two groups. The groups represented the first 227 and last 86 of the 313 responses received. t-tests yielded no statistically significant differences among the ten survey items tested suggesting that non-response bias was not present. In addition, t-tests of total number of employees and total sales between the respondents (as reported by them) and non-respondents (taken from the ASQ database) failed to show any statistically significant differences.

3.3 Model Development

[41] proposed a two-step approach to developing structural equation models that has received support from a number of authors [e.g., 42, 43, 44]. The first step involves analyzing measurement models to assess the construct validity of observed measures used to measure latent variables. Construct validity refers to the degree to which measures of the same trait correlate higher with each other than they do with measures of other traits. This usually takes the form of convergent validity and discriminant validity. Convergent validity identifies the degree to which pre-specified measures correlate with the underlying construct(s) predicted by theory. Discriminant validity is the degree of exclusiveness that can be attained by reflective measures. It is a measure of the absence of incorrect relationships between measured variables and non-hypothesized constructs. If measurable variables do not measure the specified construct adequately, testing of the structural model is meaningless. [43] further recommended testing each measurement model separately, then testing all measurement models simultaneously by allowing constructs to correlate freely among themselves. The latter procedure is commonly known as confirmatory factor analysis (CFA). The second step is to define the structural model specifying direct and indirect relations among the latent variables.

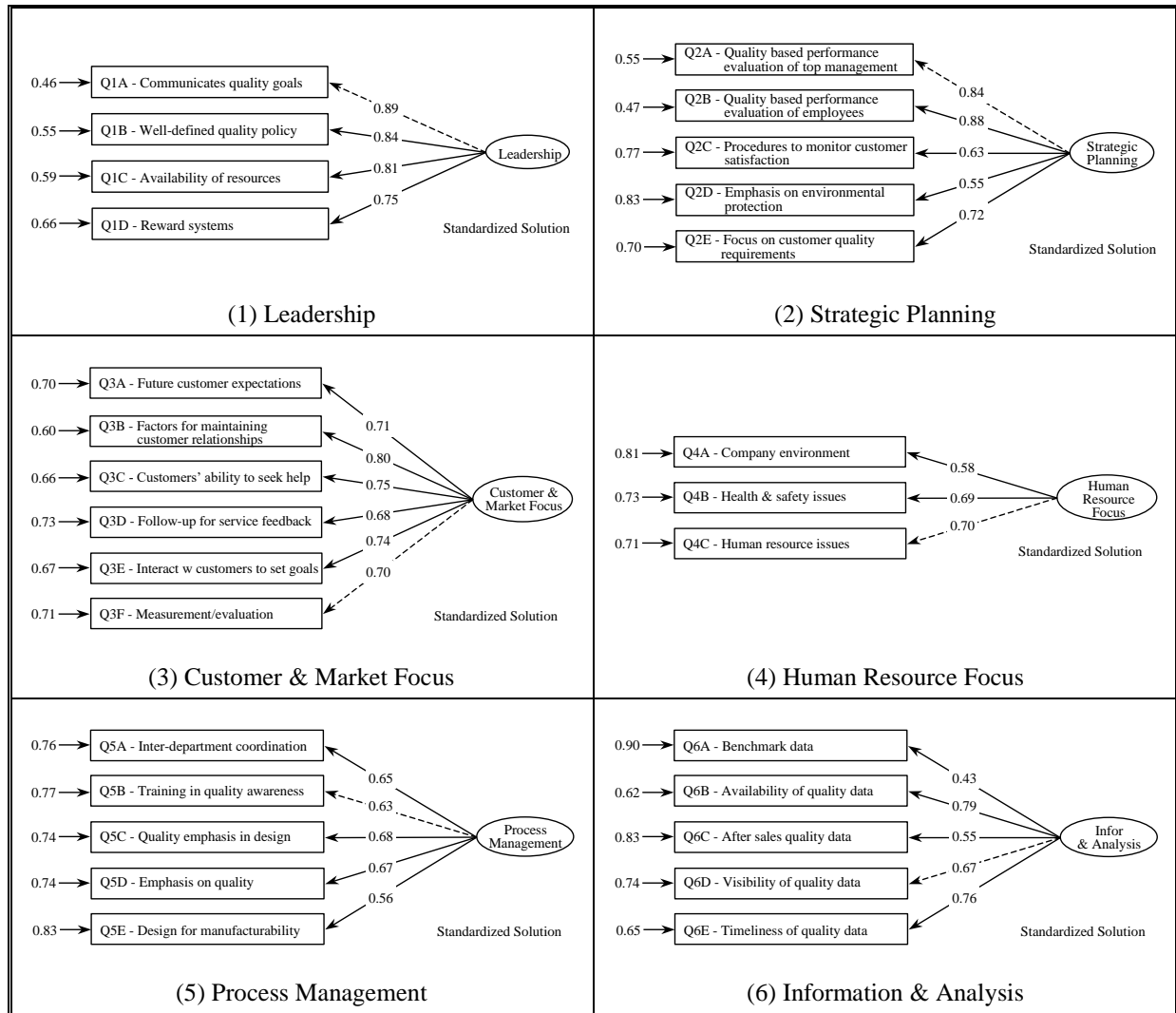
3.4 Measurement Models

Measurement models for each latent variable were developed using the EQS software (Figure 3, dotted arrows indicate fixed regression paths). Each latent variable was assessed by at least three measured variables. Relationships between measured variables and corresponding latent variables are described by factor loadings (parameter estimates) showing the extent to which the measured variable measures the latent variable. Factor loadings serve as a validity coefficient. With one exception (the loading of benchmark data on the Information and Analysis latent variable was 0.43), factor loadings are greater than 0.50. It can therefore be concluded that the measured variables adequately measure the hypothesized latent variables.

Several measures of goodness of fit were evaluated for each measurement model; χ^2 , $\chi^2/\text{degrees of freedom}$, normed fit index (NFI) [45], non-normed fit index (NNFI) [46], and comparative fit index (CFI) [46]. Details are presented in Table 1 along with values for each measure indicative of good fit. While the use of multiple measures of goodness of fit has been supported, NFI and CFI are the preferred measures [47]. Though NNFI, and in particular

NFI and CFI all indicated good fit for each model, the χ^2 ($p < 0.50$ for each model) and $\chi^2/d.f$ measures did not. However, measures involving χ^2 have been shown to be sensitive to sample size [48] particularly for sample sizes in excess of two hundred [49], which was the case here. Given acceptable values for NFI, NNFI, and CFI, each of the models was considered to represent a good fit of the underlying construct.

Confirmatory factor analysis was used subsequently to analyze all measurement models simultaneously. Fit indices are shown in Table 1. The value of $\chi^2/d.f$ is less than 3.0, and the values of NFI, NNFI and CFI are all above 0.90. The analysis thus provides evidence of convergent and discriminant validity.



Note: Dotted arrows indicate fixed regression paths. All paths significant

Figure 3: Measurement Models

Table 1: Goodness of Fit Measures for Measurement Models

Model ¹	χ^2	d.f.	$\chi^2/d.f$	NFI	NNFI	CFI
Leadership	12.473	2	6.237	0.983	0.957	0.986
Strategic Planning	34.936	5	6.987	0.957	0.925	0.963
Customer Focus	73.649	9	8.183	0.927	0.891	0.935
Information and Analysis	35.202	5	7.040	0.933	0.883	0.941
Process Management	21.146	5	4.229	0.954	0.928	0.964
All Measurement Models Simultaneously (CFA)	1220.007	506	2.411	0.945	0.963	0.967
Recommended Value for Good Fit			≤ 3.0	≥ 0.90	≥ 0.90	≥ 0.90

3.5 Structural Equation Models

The validity and fit of the measurement models allow the structural model, specified in Figure 2, to be evaluated. The resulting structural equation model is shown in Figure 4. This is referred to as the initial model. A number of observations can be made regarding this model. First, overall model fit is reasonable, the values of NFI, NNFI, and CFI are all in excess of 0.90 and the value of $\chi^2/d.f$ is less than 3 (Table 2). However, several paths are not statistically significant (at $\alpha = 0.05$). These include paths linking information and analysis with customer and market focus ($\beta = -0.07$) and process management ($\beta = 0.85$). Paths linking process management with human resource focus ($\beta = 0.14$) and business results ($\beta = -0.51$), and human resource focus with business results ($\beta = 0.08$) are also insignificant. This suggests that the data does not completely support the structural model derived directly from the Baldrige framework. This does not imply that the data does not support the Baldrige framework (which is not directly testable), only that it does not support the structural model derived from it.

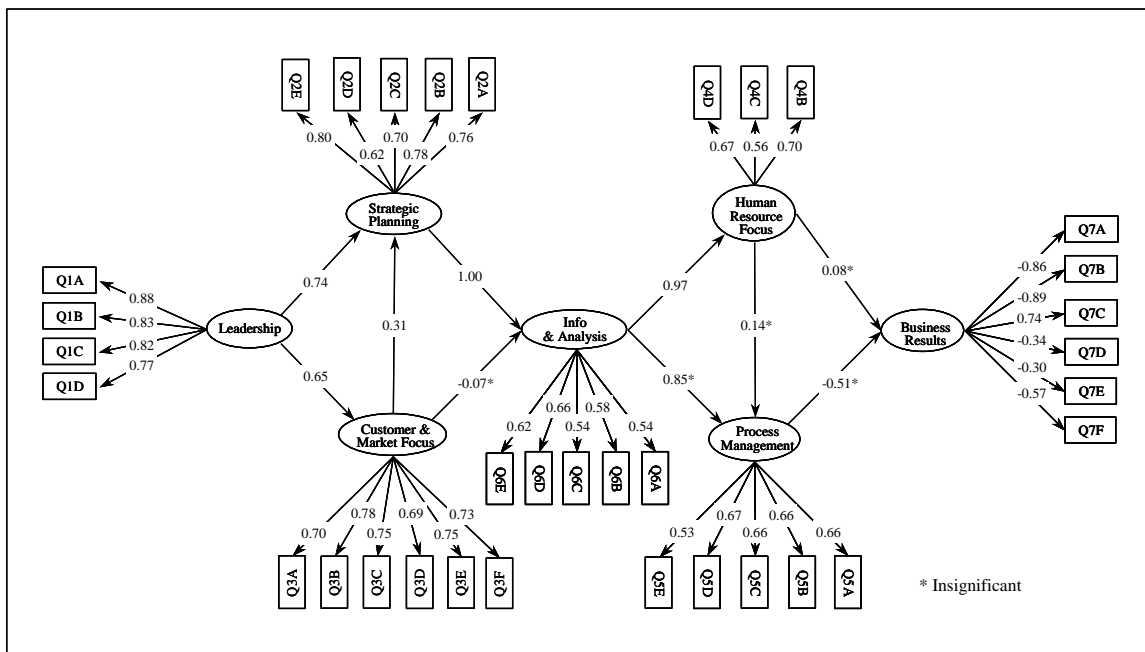


Figure 4: Initial Structural Equation Model

To improve model fit without compromising the model's consistency with the underlying Baldrige framework, insignificant paths were re-evaluated and removed one a time based on the Wald test until no insignificant paths remained. The Wald test indicates the change in χ^2 as a result of re-specifying a parameter. Initially, the path linking customer and market focus with information and analysis was eliminated, followed by the path linking human resource focus with business results. As a result of these modifications, paths linking process management with information and analysis ($\beta = 0.90$), human resource focus ($\beta = 0.39$), and business results ($\beta = 0.37$) became significant. However, the path linking information and analysis with human resource focus, which was significant in the initial model, became insignificant, and was removed. This resulted in the model shown in Figure 5, to be referred to as the intermediate model.

Table 2: Goodness of Fit Measures for Structural Models

Model	χ^2	d.f.	$\chi^2/d.f$	NFI	NNFI	CFI
Initial Model (Figure 4)	1305.62	516	2.53	0.941	0.960	0.963
Intermediate Model (Figure 5)	1421.98	520	2.73	0.936	0.955	0.958
Final Model (Figure 6)	1242.57	519	2.39	0.944	0.964	0.966
Recommended Value for Good Fit			≤ 3.0	≥ 0.90	≥ 0.90	≥ 0.90

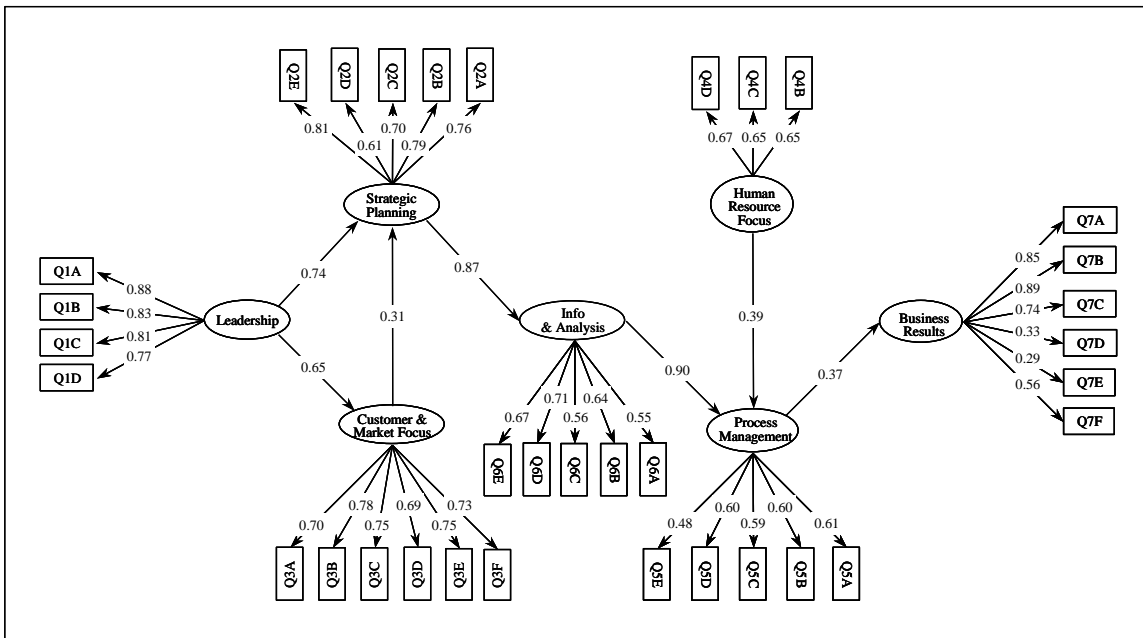


Figure 5: Intermediate Structural Equation Model

Preliminary analysis of the intermediate model revealed that all parameter estimates and error variances were positive and within a reasonable range of values. All measures of fit for this intermediate model exceed recommended acceptable levels (Table 2). The implications of the intermediate model are that while strategic planning is a direct function of leadership ($\beta = 0.74$) and customer and market focus ($\beta = 0.31$), process

management is influenced by information and analysis ($\beta = 0.90$) and human resource focus ($\beta = 0.39$), and business results are directly impacted by process management ($\beta = 0.37$), other relationships within the Baldrige framework are indirect in nature. In particular, customer and market focus affects process management through its impact on strategic planning, via the information and analysis conduit. In addition, human resource focus impacts business results through process management, and information and analysis affects human resources focus in the form of feedback from process management.

While goodness of fit values for the intermediate model are comparable to those for the initial model, the intermediate model does not represent an improved fit with the Baldrige framework. In order to improve the model's overall fit, we explored adding additional paths that are consistent with the Baldrige framework. In particular, the observation that human resource focus is not impacted by any other constructs (suggesting that it acts independently of the planning process) in the intermediate model, appeared inconsistent with the Baldrige framework. Whereas in the initial model human resource focus was linked to the strategic planning process through information and analysis, the intermediate model suggests no such link. One possible explanation is that a human resource focus is a direct outcome of the strategic planning process and of management's understanding that effective deployment and appreciation of human resources is a driver of process performance. The 2000 MBNQA [12] criteria define the human resource focus to examine

“...how your organization enables employees to develop and utilize their full potential, aligned with the organization's objectives.”

This suggests a direct link between an organization's strategic planning process and its human resource management. To test this premise, the intermediate model was revised to include a link between strategic planning and human resource focus. The resulting structural model is presented in Figure 6.

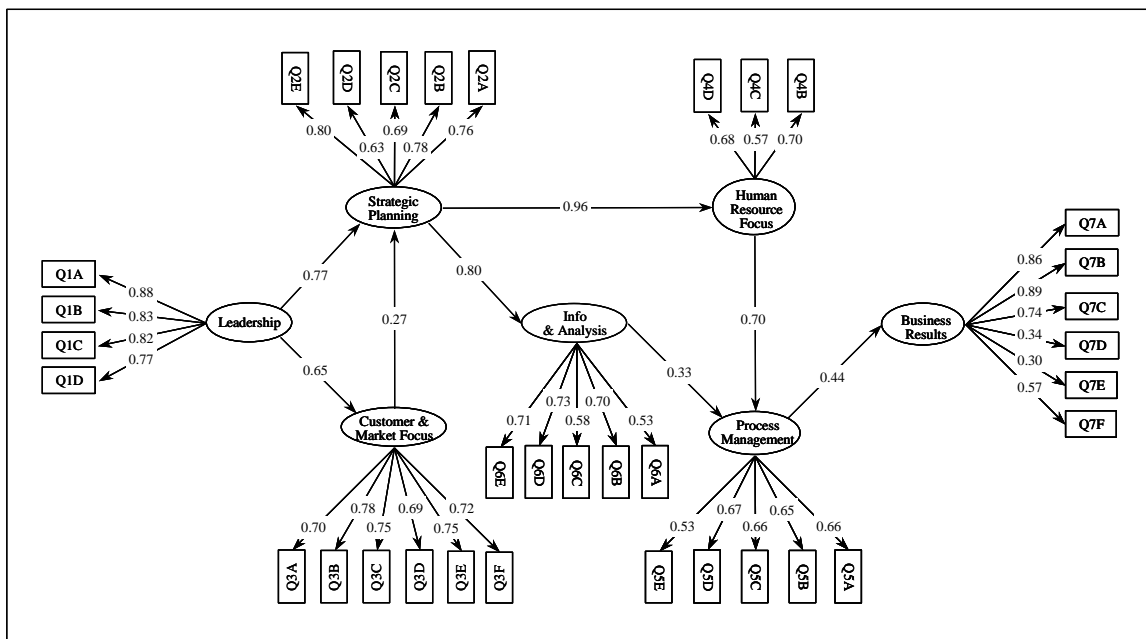


Figure 6: Final Structural Equation Model

As hypothesized, this model yields a significant relationship between an organization's strategic planning process and human resource focus ($\beta = 0.96$). Moreover, for all goodness of fit measures, there is an improvement in the fit of this model compared to the two previous models (Table 2). This model, to be referred as the final model, provides direct validation of many of the relationships inherent in the Baldrige framework.

4. Discussion

As described in the previous section, the final model underlying the Baldrige framework has excellent goodness of fit measures. While this provides valid empirical evidence of the relationships underlying the Baldrige framework, the model also points to a number of other important relationships that are useful in understanding the "mental model", and thus a better managerial understanding of the Baldrige framework. The results of this study are also useful for developing and deploying a quality management system in an organization.

4.1 Propositions 1a and 1b

The results provide support for propositions 1a and 1b regarding the leadership triad. The model indicates that leadership plays a direct and significant role in the strategic planning process, developing and, importantly, communicating a vision for the organization. This is consistent with findings in the literature. Effective leadership has been shown to be a key driver of the successful formulation of a firm strategy [20, 23]. Management's vision however must reflect recognition of the needs of the marketplace, and what it takes to meet those needs. Senior management alone can convey the importance of this recognition of market forces and translate it into a plan of action. The results here are consistent with the strong and positive relationship between leadership and customer focus shown in previous studies [7, 8]. Moreover, they are important from the standpoint of an organization's senior leadership guiding the organization in setting directions. The Baldrige framework explicitly states

"...senior leaders set directions and build and sustain a leadership system conducive to high performance, individual development, initiative, and organizational learning....the category calls for information on the major aspects of leadership – creating values and expectations; setting directions; projecting a strong customer focus; developing and maintaining an effective leadership system; and effectively communicating values, directions, expectations, and a strong customer focus" [12].

4.2 Propositions 2a and 2b

Support is also provided for propositions 2a and 2b regarding the results triad. The results triad addresses how an organization's employees (human resource focus) and its key operational processes (process management) accomplish the work that yields business results. An organization's focus on, and management of its human resources and operational processes constitute its core business processes [12]. Business results, whether financial (e.g., return on assets, sales growth), or non-financial (e.g., market share, customer satisfaction) are the result of a quality system that not only recognizes market expectations, but can convert them into well made, reliable products, in a timely manner. This is facilitated by the organization's operational processes that are consistent with the demands placed on them, are maintained effectively, and are monitored to ensure their ongoing integrity. The

functioning of these processes is in turn dependent on a well-trained workforce that is motivated and committed to achieving high levels of quality. Human resource policies that recognize labor interests are an enabler of this.

The results also suggest that a human resource focus does not directly affect business results as posited by the Baldrige framework. Instead, it is the impact that a human resource focus has on overall process management that affect results. Business results are the outcome of the sale of goods. These goods are the output of an organization's business processes, an input to which is the company's attention to human resource issues. This relationship has intuitive appeal and illustrates the difference between a structural model that attempts to identify causal relationships, and a framework that serves only to identify the underlying determinants of quality performance.

4.3 Proposition 3

Sound business strategies and well designed and managed processes translate to superior business results only if they are aligned with each other. A pre-requisite for this alignment is the effective dissemination of information between the leadership/strategic and operational components of the quality system. The results provide support for proposition 3, that information and analysis is the link between the leadership and results triad of the quality system. Strategic planning is positively related to information and analysis, providing the link from the leadership triad. Without clear, effective communication of an organization's strategic vision, constancy of purpose is difficult to achieve. Not only is this a crucial underpinning of the Baldrige framework, but a direct reflection of one of Deming's fourteen points [18]. Information and analysis is in turn positively related to process management, thereby providing a direct relationship between the strategic plan and its operationalization. This sequential relationship between strategic planning, information and analysis, and process management is consistent with evidence from the strategic management literature [e.g. 50, 51].

Two interesting observations can be made regarding the role of information and analysis. While the Baldrige framework implies that a direct relationship exists between a customer and market focus and information and analysis, results do not support this. Figure 6 suggests that the strategic plan is the sole information output from the leadership triad. This is not inconsistent with the underlying premise of the Baldrige framework that customer and market expectations are incorporated into quality planning. Rather it shows at what level of planning, strategic versus operational, customer input is utilized. Prior studies have alluded to the role of customer input in driving long-term success [7]. Moreover, the Baldrige documentation describes Customer and Market Focus as addressing

“...how your organization determines short and long term requirements, expectations and preferences of customers and markets to ensure the relevance of current products/services and to develop new opportunities” [12], and

“...how your organization determines the satisfaction of customers and builds relationships to retain current business and to develop new opportunities” [12].

While there is certainly an operational element to these issues, they reflect a strategic commitment on the part of senior management to cultivate relationships and to seek out long-term opportunities. This is consistent with a customer and market focus being a driver of strategic rather than operational quality planning. Any apparent inconsistency between the original and final structural models is thus no more than another example of the difficulty inherent in interpreting the Baldrige framework and implementing it in a meaningful manner.

The second observation is that there is no direct relationship between information and analysis and human resource focus, as implied by the Baldrige framework, but a link from strategic planning to human resource focus. While work procedures and policies designed to

“ . . . build and maintain a work environment and an employee support climate conducive to performance excellence, full participation, and personal and organizational growth” [12]

are not themselves strategic in nature, they reflect the recognition by senior management that human resources represent a significant asset to the organization. Further, the ability of the organization to be competitive in the long term depends in large measure on building a workforce that has the motivation and desire to enable the company to achieve its objectives. The alternative is low morale, absenteeism, high turnover, and low productivity, all of which result in compromised quality. Authors from both the quality and strategic management disciplines have addressed the significance of ensuring the workforce has a clear understanding of organizational goals [e.g., 7, 19]. [19] in fact characterize Deming’s vision of leadership as amongst other things “coaching management style, participative change, employee empowerment”. Human resource policies are thus a reflection of management’s strategic commitment to human resources as driven by broader organizational objectives. This is consistent with the Baldrige award guidelines that state that the human resource evaluation category addresses

“ . . . how your organization enables employees to develop and utilize their full potential, *aligned with the organization’s objectives* [12]”.

4.4 Proposition 4

The results support the proposition that an organization’s leadership system is a key driver of organizational performance. The “Leadership System” is a key concept in the Baldrige framework for performance excellence, and is defined as

“...An effective *leadership system* is focused on continuous learning to improve overall performance, creating work processes that support efficient and effective accomplishment of *performance objectives*, and enhancing customer focus.....An effective leadership system creates clear values respecting the requirements of organization stakeholders and sets high expectations for performance and performance improvement” [12].

It is interesting to note how leadership indirectly impacts business results. Figure 6 indicates that leadership does not impact business results directly, but through its direct influence on the organization’s strategic planning process and customer/market focus. Customer and market focus positively influences the organization’s strategic plans. These plans are operationalized, via the information and analysis construct, into action plans (deployment) related to the organization’s human resource and process management. While the organization’s strategic planning process directly influences human resource activities, it only indirectly impacts process management activities via the information and analysis conduit. While process management directly impacts business results, human resource activities only indirectly impact business results through their direct influence on process management.

While not discounting the possibility that a direct relationship exists between leadership and business results as suggested by [18] and supported by [21], the results do provide support for those who believe leadership is an enabler but cannot alone yield positive performance. The results are in fact consistent with the contention of [34]

that the relationship between leadership and quality performance is moderated by the human resource function, and that training (presumably driven by organizational goals) is crucial to performance. This is a key result of this study, namely the identification of the *leadership system* as the primary driver of organizational performance, consistent with a key tenet of the Baldrige framework for performance excellence.

5. Conclusions and Managerial Implications

The effective deployment of quality systems requires a clear understanding of the relationships inherent in strategic and operational quality planning. Until now, managers have had little objective guidance in developing action plans in an increasingly competitive environment. While the Baldrige award has offered an intuitively appealing and credible surrogate, it has not, until now, been proven to accurately reflect the theory underlying its origin. This study provides such validation. It requires strong senior leadership to create a vision for an organization, to set out an agenda for which markets an organization will operate in, how it will serve those markets, and how it will respond to competitive forces. This vision, which must be closely aligned with the expectations and desires of the market place, must be articulated in a way that is consistent with broader organizational objectives, and which can be understood by all those charged with achieving it. Constant feedback and communication is in turn essential to ensure consistency between the what, and the how, of the strategic plan. Deming, upon whose teachings the Baldrige award is based, stated that success is based on visionary leadership that drives an organizational system characterized by communication, cooperation, and learning, which is in turn an enabler for the management of processes with a focus on continuous improvement. The results of this study are entirely consistent with Deming's widely accepted philosophy of quality management. Moreover they offer the guidance managers have been seeking in developing and managing their quality initiatives.

This study leaves certain questions regarding the Baldrige framework and quality management in general, unanswered. While an indirect relationship between leadership and results was identified, it remains to be seen whether a direct link, proposed by some, exists. While such a link is not implied by the Baldrige framework, and was thus not examined in the current study, there is a basis in the literature for suggesting its existence. The precise mechanisms by which leadership affects the strategic planning process, and the impact of alternative paradigms for strategic planning, are also future avenues for research. These have important implications for the organizational and cultural context in which quality planning takes place, and how this affects the validity and relevance of the Baldrige framework. A third issue is the relationship between specific operational processes and performance in the Baldrige context. Is it the case that certain quality practices have a particularly strong impact on performance when executed within the Baldrige framework.

Finally, this study has several shortcomings. The MBNQA framework is very comprehensive – it addresses virtually every aspect of an organization's operation - and it is almost impossible to adequately measure all the categories using a survey instrument of reasonable length. Consequently, we picked a handful of what we think are the key items in measuring the Baldrige categories. Other shortcomings include the fact that some of our measures of Business Results involved measuring performance improvements over the past three years, as opposed to absolute values. This naturally introduces the weakness of not being able to account for the fact that high performing

organizations may have lower rates of improvement (since incremental improvement is more difficult in this case) compared to poor performers. In addition, all of our performance measures are self-reported, and therefore perceptual rather than objective.

These drawbacks notwithstanding, this study does present some highly significant results related to the Baldrige framework and organizational quality improvement. This study also provides a platform for researchers and managers to gain improved insight into organizational quality and performance improvement by validating the relationships depicted in the Baldrige framework. Future research on Total Quality should focus on the implementation problems inherent in global organizations, the drivers for change in strategic management processes, and the critical factors that enable Total Quality implementation to lead to organizational performance improvement.

References

- [1] Malhotra, M.D., D.C. Steele, and V. Grover (1994), "Important Strategic and Tactical Manufacturing Issues in the 1990's," *Decision Sciences*, 25, 2, 189-214.
- [2] Hiam, A. (1993), *Does quality work? A review of relevant studies*, The Conference Board: New York, NY.
- [3] Easton, G.S. & Jarrell, S.L. The Effects Of Total Quality Management On Corporate Performance: An Empirical Investigation. *Journal Of Business*, 1998, 71, 15-35.
- [4] Grant, R, R. Shani, and R. Krishnan (1994), "TQM's Challenge To Management Theory And Practice," *Sloan Management Review*, 35, 25-35.
- [5] Greene, R. (1993), *Global Quality: A Synthesis of the World's Best Management Models*, American Society for Quality Control Press, Milwaukee, WI.
- [6] Flynn, B.B., R.G. Schroeder, and S. Sakakibara (1994), "A Framework for Quality Management Research and an Associated Measurement Instrument," *Journal of Operations Management*, 11, 4, 339-366.
- [7] Flynn, B.B., R.G. Schroeder, and S. Sakakibara (1995), "The Impact of Quality Management Practices on Performance and Competitive Advantage," *Decision Sciences*, 26,5,659-692.
- [8] Ahire, S.L., D.Y. Golhar, and M.A. Waller (1996), "Development and Validation of TQM Implementation Constructs," *Decision Sciences*, 27, 1, 23-56.
- [9] Black, S.A., L.J. Porter (1996), "Identification of the Critical Factors of TQM," *Decision Sciences*, 27, 1, 1-22.
- [10] Anderson, J.C., M. Rungtusanatham, R.G. Schroeder, and S. Devaraj (1995), "A Path Analytic Model of a Theory of Quality Management Underlying the Deming Management Method: Preliminary Empirical Findings," *Decision Sciences*, 26, 5, 637-658.
- [11] Dow, D., D. Samson, and S. Ford (1999), "Exploding the Myth: Do All Quality Management Practices Contribute to Superior Quality Performance?" *Production and Operations Management*, 8, 1, 1-27.
- [12] National Institute of Standards and Technology (NIST), *Malcolm Baldrige National Quality Award 2000 Criteria for Performance Excellence*. Gaithersburg, MD, 1999.
- [13] Ettore, B. (1996), "Is the Baldrige Still Meaningful?" *Management Review*, 85, 28.

- [14] Wisner, J.D. and S.G. Eakins, (1994) "A Performance Assessment of the U.S. Baldrige Quality Award Winners," *International Journal of Quality and Reliability Management*, 11, 2, 8-25.
- [15] Bemowski, K. and B. Stratton (1995), "How Do People Use the Baldrige Award Criteria?" *Quality Progress*, 28, 5, 43-47.
- [16] Helton, R.B., (1995), "The Baldie Play," *Quality Progress*, 28, 2, 43-45.
- [17] Pannirselvam, G.P., S.P. Siferd, and W.A. Ruch (1998), "Validation of the Arizona Governor's Quality Award Criteria: A Test of the Baldrige Criteria," *Journal of Operations Management*, 16, 529-550.
- [18] Deming, W.E. (1986), *Out of the Crisis*, Massachusetts Institute of Technology, Center for Advanced Engineering Study, Cambridge, MA.
- [19] Anderson, J.C., M. Rungtusanatham, and R.G. Schroeder (1994), "A Theory of Quality Management Underlying the Deming Management Method," *Academy of Management Review*, 19, 3, 472-509.
- [20] Dean, J.W. and D.E. Bowen (1994), "Management Theory And Total Quality: Improving Research And Practice Through Theory Development," *Academy Of Management Review*, 19, 392-418.
- [21] Ahire, S.L., R. Landeros, and D.Y. Golhar (1995), "Total Quality Management: A Literature Review and an Agenda for Future Research," *Production and Operations Management*, 4, 3, 277-306.
- [22] Evans, J.R. (1997), "Critical Linkages in the Baldrige Framework: Research Models and Educational Challenges," *Quality Management Journal*, 1997.
- [23] Ghoshal, S. and C. Bartlett (1994), "Linking Organizational Context And Managerial Action: The Dimensions Of Quality Management," *Sloan Management Journal*, 15, 91-113.
- [24] Zeitz, G., R. Johannesson, and J.E. Ritchie (1997), "An Employee Survey Measuring Total Quality Management Practices and Culture," *Group and Organization Management*, 22, 414-444.
- [25] Benson, P.G., J.V. Saraph, and R.G. Schroeder (1991) "The Effects of Organizational Context on Quality Management: An Empirical Investigation," *Management Science*, 37, 9, 1107-1124.
- [26] Dean, J.W., Jr. & J.R. Evans (1994), *Total Quality: Mgt, Organization & Strategy*, West, St Paul, MN.
- [27] Ebrahimpour, M. and B.E. Withers (1992), "Employee Involvement in Quality Improvement: A Comparison of American and Japanese Manufacturing Firms Operating in the U.S.," *IEEE Transactions on Engineering Management*, 39, 2, 142-148.
- [28] Harber, D., K. Burgess, and D. Barclay (1993), "Total Quality Management as a Cultural Intervention: An Integrative Review," *International Journal of Quality and Reliability Management*, 10, 6, 28-46.
- [29] Juran, J.M. (1981), "Product Quality; a prescription for the West: Part I, II," *Management Review*, 70, 6, 8-61.
- [30] Hartley, J.R. (1992), *Concurrent Engineering*, Productivity Press, Cambridge, MA.
- [31] Snell, S.A. and J.W. Dean (1992), "Integrated Manufacturing And Human Resource Management: A Human Capital Perspective," *Academy Of Management Journal*, 35, 467-504.

- [32] Babbar, S. (1992), "A Dynamic Model for Continuous Improvement in the Management of Service Quality," *International Journal of Operations and Production Management*, 12, 2, 38-48.
- [33] Miller, O.M. (1992), "A Customer's Definition of Quality," *Journal of Business Strategy*, 13, 1, 4-7.
- [34] Roth, A.V. and W.E. Jackson III (1995), "Strategic Determinants Of Service Quality And Performance: Evidence From The Banking Industry," *Management Science*, 41, 1720-1734.
- [35] Snell, S.A. and J.W. Dean, Jr. (1994), "Strategic Compensation For Integrated Manufacturing: The Moderating Effects Of Jobs And Organizational Inertia," *Academy of Management Journal*, 37, 1109-1132.
- [36] Waldman, D.A. (1994), "The Contributions Of Total Quality Management To A Theory Of Work Performance," *Academy Of Management Review*, 19, 510-536.
- [37] Powell, T. (1995), "Total Quality Management As Competitive Advantage: A Review And Empirical Study," *Strategic Management Journal*, 16, 15-37.
- [38] Adam, E.E. (1994), "Alternative Quality Improvement Practices and Organization Performance," *Journal of Operations Management*, 12, 1, 27-44.
- [39] Armstrong, J. S. and T.S. Overton (1977), "Estimating Non-Response Bias In Mail Surveys," *Journal Of Marketing Research*, 14, 396-402.
- [40] Lambert, D.M. and T.C. Harrington (1990), "Measuring Non-Response Bias In Mail Surveys," *Journal Of Business Logistics*, 11, 2, 5-25.
- [41] James, L.R., S.A. Mulaik, and J.M. Brett (1982), *Causal Analysis: Assumptions, Models, and Data*. Sage, Beverly Hills, CA.
- [42] Anderson, J.C. and D.W. Gerbing (1988), "Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach," *Psychological Bulletin*, 103, 3, 411-423.
- [43] Jöreskog, K.G. and D. Sörbom (1993), *LISREL8: Structural Equation Modeling with the SIMPLIS Command Language*, Lawrence Erlbaum Associates, Hillsdale, NJ.
- [44] Mulaik, S.A., L.R. James, J.V. Alstine, N. Bennett, S. Lind, and C.D. Stilwell (1989), "Evaluation of Goodness-of-Fit Indices for Structural Equation Models," *Psychological Bulletin*, 105, 430-445.
- [45] Bentler, P.M., and D.G. Bonett (1980), "Significance Tests and Goodness of Fit in the Analysis of Covariance Structure," *Psychological Bulletin*, 88, 588-606.
- [46] Bentler, P.M. (1990), "Comparative Fit Indexes in Structural Models," *Psychological Bulletin*, 107, 238-246.
- [47] Bentler, P.M. (1992), "On the Fit of Models to Covariances and Methodology," *Psychological Bulletin*, 112, 400-404.
- [48] Hartwick, J., and H. Barki (1994), "Explaining the Role of User Participation in Information System Use," *Management Science*, 40, 4, 440-465.
- [49] Hair, J.F. Jr., R.E. Anderson, R.L. Tatham, and W.C. Black (1995), *Multivariate Data Analysis With Readings (4th edition)*, Prentice-Hall, Englewood Cliffs, NJ.

[50] Mintzberg, H. and J.A. Waters (1985), "Of Strategies, Deliberate and Emergent," *Strategic Management Journal*, 6, 257-272.

[51] Porter, M. (1980), *Competitive strategy*, Free Press, New York, NY.

Appendix 1

(1) Leadership

On a Likert scale of 1 (low) to 7 (high), indicate the most appropriate response regarding your firm's practice:

- (A) Extent to which top management clearly communicates quality goals.
- (B) Extent to which top management emphasizes quality through a well-defined quality policy.
- (C) Extent to which top management provides resources to carry out quality improvement.
- (D) Management's efforts to recognize and reward quality improvements.

(2) Strategic Planning

On a Likert scale of 1 (low) to 7 (high), indicate the most appropriate response regarding your firm's practice:

- (A) Degree to which divisional top management is evaluated based on quality performance.
- (B) Degree to which employees throughout the firm are evaluated based on quality results.
- (C) Development of procedures for monitoring key indicators of customer satisfaction.
- (D) Extent to which top management emphasizes environmental protection in quality policy.
- (E) Extent to which manufacturing focuses on customer quality requirements in establishing strategy.

(3) Customer and Market Focus

On a Likert scale of 1 (low) to 7 (high), rate your firm's ability to monitor and manage the following:

- (A) Determining future customer expectations.
- (B) Determining key factors for building & maintaining customer relationships.
- (C) Enhancing customers' ability to seek assistance.
- (D) Following up with customers for quality/service feedback.
- (E) Interacting with customers to set reliability, responsiveness & other standards.
- (F) Measurement and evaluation of customer satisfaction factors.

(4) Human Resource Focus

On a Likert scale of 1 (low) to 7 (high), indicate the most appropriate response regarding your firm's practice:

- (A) Degree to which company environment is conducive to employee well-being and growth.
- (B) Extent to which health and safety are emphasized by top management in quality policy.
- (C) Extent to which human resources management is affected by quality plans.

(5) Process Management

On a Likert scale of 1 (low) to 7 (high), indicate the most appropriate response regarding your firm's practice:

- (A) Amount of coordination between quality department and other departments.
- (B) Amount of training in quality awareness provided to hourly employees.
- (C) Degree to which quality is emphasized in design process vis-à-vis cost or schedule objectives.
- (D) Emphasis on quality instead of price in the supplier selection process.
- (E) Extent to which manufacturability is considered in the product design process.

(6) Information and Analysis

On a Likert scale of 1 (low) to 7 (high), indicate the most appropriate response regarding your firm's practice:

- (A) Actual use of benchmark data to improve quality practices.
- (B) Availability of quality data (internal to organization).
- (C) Collection of after sales quality data.
- (D) Extent to which quality data is made visible (displayed at workstations).
- (E) Timeliness of quality data (internal to organization).

(7) Business Results

On a Likert scale of 1 (below average) to 7 (above average), indicate the level of your firm's performance compared to that of major industry competitors:

- (A) Average annual market share growth over the past three years.
- (B) Average annual sales growth over the past three years.
- (C) Average annual growth in return on total assets over the past three years
- (D) Overall customer service levels.
- (E) Overall product quality.
- (F) Overall competitive position.