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Relative effectiveness of the Malcolm Baldrige National Quality Award categories

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This study fills a critical research gap by assessing the effectiveness of the Malcolm Baldrige National Quality Award (MBNQA) model within a government organisation and by comparing the effectiveness of the categories within the MBNQA model in government to the effectiveness of the categories of the MBNQA model in different industries. This study examines the relative effectiveness of each Baldrige category in the MBNQA 2013–2014 framework to results using data from a municipal government. We tested the hypothesised research model employing partial least squares (structural equation modelling). The results validate the effectiveness of the Baldrige categories and quantitatively support the theoretical foundations of the Baldrige model. Drawing on contingency theory, we explore the commonalities and differences of the effectiveness of Baldrige categories across different industries. The comparisons provide evidence that the Baldrige model has experienced the appropriate adaptations over years. This work discusses theoretical and managerial implications, and suggests future research directions.

Keywords: quality management; contingency theory; information systems; structural equation modelling; government organisation

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1. Introduction

Since 2005 when the National Institute of Standards and Technology (NIST) expanded the scope of the Malcolm Baldrige National Quality Award (MBNQA) to government/nonprofit organisations, 78 government/nonprofit organisations have submitted their applications for the Baldrige award (http://patapsco.nist.gov/Award_Recipients/index.cfm). The winners, including the City of Coral Springs, Florida (awarded in 2007), and the City of Irving, Texas (awarded in 2012) are highly performing municipal governments. While the Baldrige award in this new category has attracted the attention of decision-makers, we found no study that empirically tests the linkages in the MBNQA model in terms of the government/nonprofit area except for Prybutok, Zhang, and Peak (2011). However, Prybutok, Zhang, and Peak (2011) assessed the effectiveness of the MBNQA model by grouping Baldrige categories into the leadership triad and the business results triad. There is a strong need for scholars to investigate the effectiveness of each of the Baldrige categories under an integrated system.

After reviewing the winners' application summary documents, we found that the government/nonprofit organisations had the same strong customer focus found in the manufacturing, health care and education industries. However, their focus on strategic planning is greater, and they concentrate less on measurement, analysis and knowledge management (MAKM). We suspect that these communities and differences in organisational concentration could result in relatively different effectiveness of the MBNQA model. Organisations would benefit from better understanding how to implement quality management (QM) practices outlined in the MBNQA model to maximise their results.

We build on contingency theory as a theoretical perspective to explore the commonalities and differences of the effectiveness of the Baldrige categories across different industries. Academics have recognised the importance of contingency theory since the 1960s (Lawrence, Lorsch, and Garrison 1967). Sitkin, Sutcliffe, and Schroeder (1994) stated that scholars did not consider the effect of contextual factors, which require customised QM practices. Researchers theorised that the role of QM practices is different in different contextual settings. Scholars advanced the application of contingency theory in the area of operations management (Sousa and Voss 2001) and refined the understanding of QM practices (Sousa and Voss 2008). As research in QM matures, scholars need to continue to investigate the effects of context on QM practices, and move beyond justifying their universal applicability (Zhang, Linderman, and Schroeder 2012). This study draws on contingency theory, and empirically demonstrates that the effectiveness of different QM practices

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presented in the MBNQA model are industry dependent, which provides many theoretical and practical insights. The objective of this study is to fill the following gaps. This work:

- Addresses whether the seven Baldrige categories represent a good model for a government organisation.
- Provides insights into the relative effectiveness of the Baldrige categories on results.
- Compares the contingent effect of different industries on the interrelationships between the Baldrige categories, highlighting the commonalities and differences.

This research is the first empirical study that provides a new, in-depth and holistic examination of the causal relationships underlying the MBNQA model within a municipal government. Based on contingency theory, we compare our results with prior research across industries such as manufacturing and health care. It contributes to the validation of the MBNQA model in a government environment, and to the contingency perspective in the QM field. The insights gained from this study also contribute to the development of best practices in QM. Considering the significant and practical implications of the application of the MBNQA model in different industries, this study is essential for several reasons. First, the results have the potential to provide a view to the direct results drivers within a government organisation. Second, while all categories are important at some level, knowing the differences between their contributions can foster better allocation of resources and efforts. Third, the findings allow government organisations that are starting quality initiatives to target initial efforts towards those areas with the most significant return. Fourth, knowing the commonalities and differences in the effectiveness of the Baldrige categories across different industries can help organisations achieve their full quality potentials by avoiding unnecessary losses resulting from not contextualising QM practices to specific industries.

The rest of this paper is organised as follows. Section 2 briefly explains the MBNQA theoretical model and reviews its evolution by comparing its 2002 and 2013–2014 models. Section 3 reviews the literature for the proposed research framework and hypotheses. Subsequently, we describe the empirical part of this research and report the data collection and analysis in Sections 4 and 5. We discuss the results and the insights for both academics and practitioners in Section 6. Section 7 presents limitations and future research directions. Finally, we conclude the paper in Section 8 with a summary of the theoretical and practical contributions of this work.

2. MBNQA theoretical model and its evolution

Since the US Congress established the MBNQA in 1987, the award has encouraged a national effort towards improvement in quality and has resulted in the recognition of superlative performance and quality (Prybutok, Zhang, and Peak 2011). At the beginning of the MBNQA's implementation for manufacturers, service businesses and small businesses, the NIST designed the MBNQA model and based it on best understanding of quality theory and QM practices, with the intention of raising awareness of QM. The NIST has expanded its scope to include educational and health care organisations (in 1999) and government/nonprofit organisations in 2005 (http://www.nist.gov/baldrige/about/history.cfm). The MBNQA model is composed of seven separate, weighted categories: (1) leadership, (2) strategic planning, (3) customer focus, (4) MAKM, (5) workforce focus, (6) operations focus and (7) results.

Both the MBNQA 2002 and 2013–2014 frameworks maintain that the leadership triad – leadership, strategic planning and customer focus – drives the system that creates business results. However, compared with the 2002 Baldrige model, the new version dramatically updated the role of information systems (IS) by expanding the fourth category from information and analysis to MAKM. Figures 1 and 2 outline the systems perspective of the 2002 and 2013–2014 Baldrige criteria for performance excellence.

A key foundation for organisational success is the ability to take advantage of IS to support decision-making. 'Information and Analysis are critical to the effective management of your organisation and to a fact-based system for improving performance and competitiveness' (Criteria for Performance Excellence, Business Category 2002). In the 1997 version of the MBNQA, a key category, information and analysis, was added to the model criteria as an independent variable. The MBNQA 2002 framework updated the information and analysis category as a variable connecting and bridging the leadership and business results triads, shown in Figure 1. However, unlike the 1990s and earlier when proprietary IS prevailed, in the 2000s, we gradually characterised IS as more standardised and homogeneous because of the rapid adoption of ERP and web technologies (Wang 2010). In addition, easy access to outsourcing enabled organisations to decrease the time and cost of IS development significantly, making advanced IT capabilities more affordable to less IT-savvy organisations (Chae, Koh, and Prybutok 2013). The 2013–2014 version of the MBNQA captures this change. 'The system foundation (MAKM) is critical to effective management and to a fact-based, knowledge-driven system for improving performance and competitiveness' (Criteria for Performance Excellence, Business/Nonprofit Category 2013–2014). This update reflects the direct response from the IS-oriented MAKM category to the leadership and results constructs, as shown in Figure 2.

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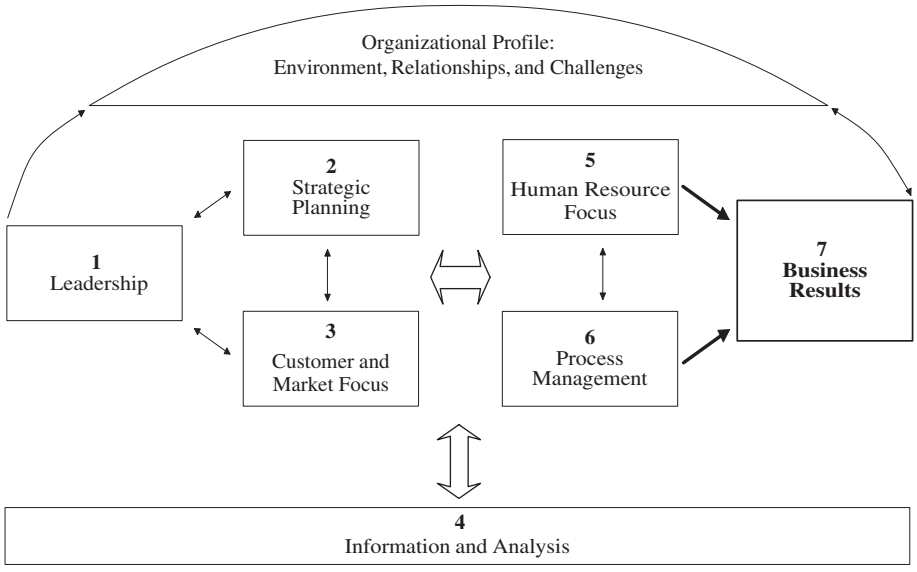

Figure 1. A systems perspective of the 2002 MBNQA criteria for performance excellence framework.
Source: This figure of the Baldrige Performance Excellence Program at the National Institute of Standards and Technology in Gaithersburg, Maryland. Obtain a copy of the Baldrige Criteria for Performance Excellence at www.nist.gov/baldrige/publications/criteria.cfm.

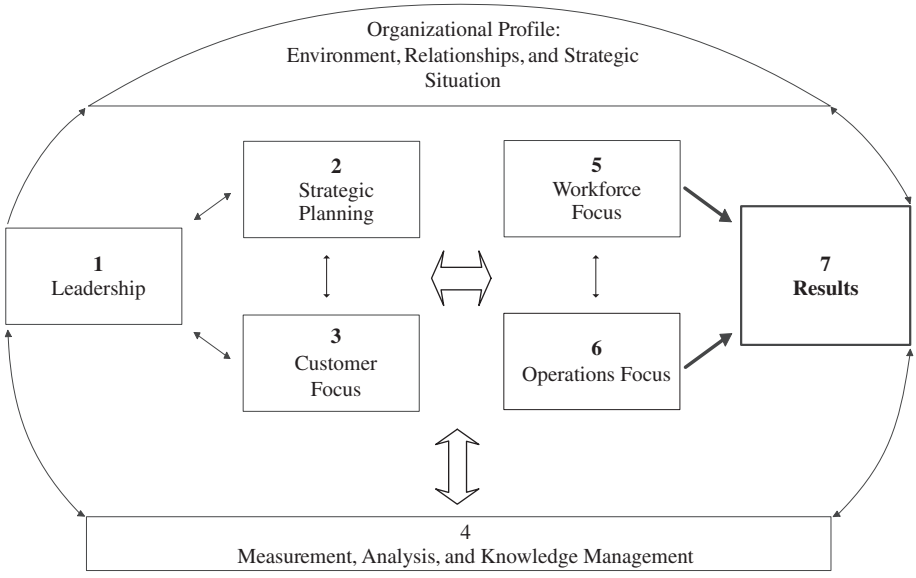

Figure 2. A systems perspective of the 2013–2014 MBNQA criteria for performance excellence framework.
Source: This figure of the Baldrige Performance Excellence Program at the National Institute of Standards and Technology in Gaithersburg, Maryland. Obtain a copy of the Baldrige Criteria for Performance Excellence at www.nist.gov/baldrige/publications/criteria.cfm.

3. Literature review

This study comprehensively examines the interrelationships between Baldrige categories, and investigates their relative effectiveness on results. We found no published studies that fully assess the effectiveness of the MBNQA model in the area of government organisations. To investigate the effectiveness of the MBNQA model in different industries, we narrow down the literature review to the most relevant studies that empirically validate the MBNQA model through direct measurement of the Baldrige criteria. To build the theoretical foundation from an academic standpoint, we also review the studies that empirically investigate the interrelationship between QM practices and performance.

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Wilson and Collier (2000) and Flynn and Saladin (2001) provided empirical evidence of numerous causal relationships among the Baldrige categories in the manufacturing industry. Both studies used structural equation modelling to conduct the data analysis. Wilson and Collier (2000) and Flynn and Saladin (2001) showed that as the driver of the system, leadership has a significant positive influence on each of the system categories, although it does not have a direct effect on results. In addition, Wilson and Collier (2000) reported that information and analysis (IA) is the second most important category and that process management significantly influences results. Wilson and Collier also reported that the Baldrige 1995 model explains 39% of variance in performance results. Flynn and Saladin (2001) found that strategic planning significantly influenced customer satisfaction, and that both process management and human resource management influenced business results. Flynn and Saladin reported that the Baldrige 1997 model explains 45% of variance in business results and provides empirical evidence that the Baldrige framework has appropriately evolved over the years.

Meyer and Collier (2001) examined the MBNQA categories in the health care industry using structural equation modelling. Meyer and Collier identified leadership as a driver of all system components in the MBNQA model, and they empirically supported most causal relationships in the Baldrige health care pilot criteria using empirical data from US hospitals. In addition to the dominant role of leadership in the Baldrige system categories, they found the direct influence of leadership on performance results and identified IA as the critical link in the Baldrige system. Using the reported path coefficients in their study, we calculated that the pilot model explains 62% of variance in performance results.

Researchers have worked to develop measurement constructs for QM and have been examining the relationships between QM practices and business performance (Kim, Kumar, and Kumar 2012). Although there is little agreement on the list of QM practices (Samson and Terziovski 1999), management leadership, strategic planning, customer focus, information and analysis, human resource management, process management, etc. are consistently identified as critical factors of QM (Saraph, Benson, and Schroeder 1989; Flynn, Schroeder, and Sakakibara 1995; Ahire et al. 1996; Nair 2006). Examinations of the interdependent nature of QM practices dominate empirical research on the relationship between QM practices and performance (Ho, Duffy, and Shih 2001; Kim, Kumar, and Kumar 2012). Most empirical studies on QM consider that management leadership drives other QM practices (Kaynak 2003; Zu, Fredendall, and Douglas 2008) and business results (Sila and Ebrahimpour 2005). Process management directly and positively influences business results and mediates the influence of other QM practices on business performance (Kaynak 2003; Sila and Ebrahimpour 2005; Zu, Fredendall, and Douglas 2008).

Based on the discussion above, we present our testable research model and hypotheses in the next section. To compare our results with prior research findings, we summarise the interrelationships between the Baldrige categories hypothesised in the above studies across industries. To compare the results clearly, we unify the seven categories according to the MBNQA 2013–2014 model.

4. Methodology

4.1 *Research model and hypotheses*

Derived from the MBNQA 2013–2014 framework shown in Figure 2, our research model emphasises the direct and indirect influences of each of the Baldrige categories on results. Although the MBNQA model shows the bidirectional links between each category, several prior studies utilised unidirectional arrows to test the model (Meyer and Collier 2001; Prybutok, Zhang, and Peak 2011). NIST uses bidirectional arrows to reflect the significance of decision flows and feedback to organisations' success in an effective performance management system. In this study, we establish results as the dependent variable and follow the unidirectional arrows to research the relationships between Baldrige categories. There are three theoretical foundations for our research model. First, the leadership triad is the driver of the MBNQA system. Second, the MAKM category is the system foundation for MBNQA. Third, all actions on leadership, strategic planning, customer focus, MAKM, workforce focus and operations focus point towards results. Thus, we hypothesise a testable research model shown in Figure 3, built upon the MBNQA 2013–2014 framework and the theoretical foundations.

The research hypotheses, summarised in Table 1, provide a comprehensive assessment of the theory and performance relationships between Baldrige categories within a municipal government.

4.2 *The study site: the municipal government of the City of Denton, Texas*

The City of Denton (COD) is a university town where there are two major state universities: the University of North Texas with over 36,000 students, and Texas Woman's University with over 17,000 students. This city is a small-to-medium size municipality with a population of over 115,000 (2012). The COD, which has been trying to improve organisational performance, appointed a research team at the University of North Texas to evaluate interaction between divisions of the government.

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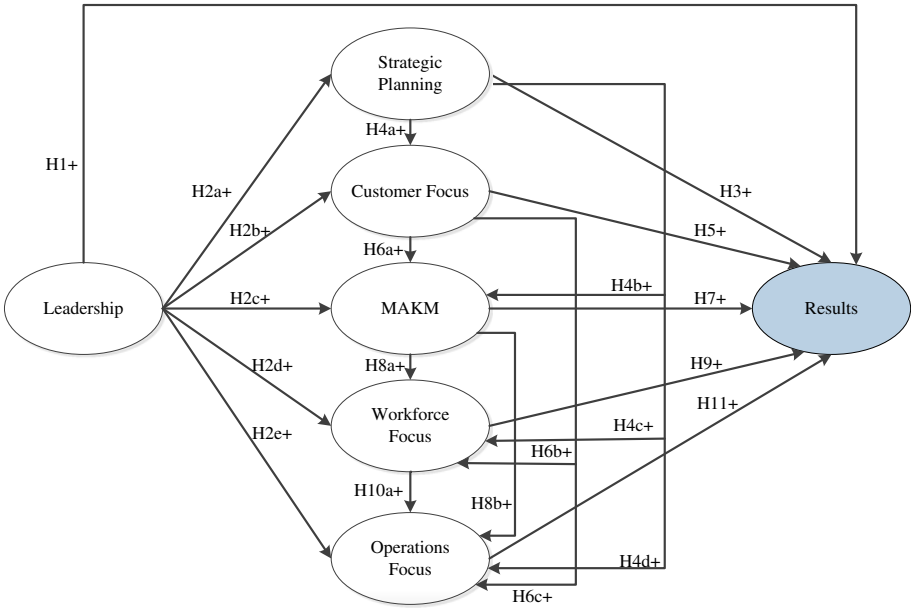

Figure 3. Hypothesised research model to test causal relationships between the Baldrige categories.

Table 1. Summary of hypotheses.

H1: Within the MBNQA model, leadership has a direct positive influence on results
H2: Within the MBNQA model, leadership has an indirect positive influence through other constructs on results
H2a: Within the MBNQA model, leadership has a positive influence on strategic planning
H2b: Within the MBNQA model, leadership has a positive influence on customer focus
H2c: Within the MBNQA model, leadership has a positive influence on MAKM
H2d: Within the MBNQA model, leadership has a positive influence on workforce focus
H2e: Within the MBNQA model, leadership has a positive influence on operations focus
H3: Within the MBNQA model, strategic planning has a direct positive influence on results
H4: Within the MBNQA model, strategic planning has an indirect positive influence through other constructs on results
H4a: Within the MBNQA model, strategic planning has a positive influence on customer focus
H4b: Within the MBNQA model, strategic planning has a positive influence on MAKM
H4c: Within the MBNQA model, strategic planning has a positive influence on workforce focus
H4d: Within the MBNQA model, strategic planning has a positive influence on operations focus
H5: Within the MBNQA model, customer focus has a direct positive influence on results
H6: Within the MBNQA model, customer focus has an indirect positive influence through other constructs on results
H6a: Within the MBNQA model, customer focus has a positive influence on MAKM
H6b: Within the MBNQA model, customer focus has a positive influence on workforce focus
H6c: Within the MBNQA model, customer focus has a positive influence on operations focus
H7: Within the MBNQA model, MAKM has a direct positive influence on results
H8: Within the MBNQA model, MAKM has an indirect positive influence through other constructs on results
H8a: Within the MBNQA model, MAKM has a positive influence on workforce
H8b: Within the MBNQA model, MAKM has a positive influence on operations focus
H9: Within the MBNQA model, workforce has a positive direct influence on results
H10: Within the MBNQA model, workforce has an indirect positive influence through other constructs on results
H10a: Within the MBNQA model, workforce has a positive influence on operations focus
H11: Within the MBNQA model, operation focus has a direct positive influence on results

4.3 *The survey instrument*

We conducted this research based on the survey developed by our research team (see Prybutok, Zhang, and Peak 2011) to assess the effectiveness of the MBNQA model with a municipal government. Appendix 2 presents the items contextualised for a municipal government and used in this study, along with the factor loadings and *t* values. The survey items matched the MBNQA 2002 criteria. A team of experts, including five faculty members and five Ph.D. students from MIS, Management Science, and Psychology assessed the survey. The five faculty members included three senior

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members of American Society for Quality (ASQ) and two others who were ASQ Certified Quality Engineers. All team members possess considerable experience in survey research and QM. Further, they communicated with contacts in the COD as they modified the survey specifically for the city. They also invited quality professionals from the ASQ to test a generic version of this survey. Edits suggested by the reviewers were incorporated into the survey to improve its clarity and readability.

The Baldrige 2013–2014 model enriches the definition of each corresponding category from the Baldrige 2002 model. It also renames some categories in order to fit the modification. However, all versions of the model maintain essentially the same content for each category. Comparison of the award over the decade supports the stability of the MBNQA scoring system. This validates the applicability of the survey in our study of the relationships between the Baldrige 2013–2014 categories.

4.4 *Measures*

The research team collected the data based on a single-site case study methodology, which enabled us to minimise several potential biases. First, utilising a single site minimises the potential bias introduced across organisations, industries or countries (Eisenhardt 1989). Secondly, multiple respondents employed by the COD provide richer and more organisation-specific information than is obtainable from a single respondent across several organisations. Thirdly, the selection of an appropriate study site allows for better control of extraneous variables, eliminates the heterogeneity of data and defines the limits for our study's generalisation.

5. Results

5.1 *Data analysis*

The data was obtained from 1100 COD employees who were invited to participate in an on-line survey. Each participant was issued a unique, easy to remember code such as 'rosetiger' so that they could start and stop the survey but retain anonymity. In addition, the city had a pop-up reminder to complete the survey that appeared upon login each day until the survey was completed. The data were collected via the Web server using WebSurveyor (Copyright @ 1997–2006, WebSurveyor Corporation) and converted to Microsoft Access. As a result of using these methods, which constituted a web modification of the Dillman (2011) approach, the invitation resulted in 339 responses over a period of five weeks with a response rate of 30.82%. Eighty percent of the respondents completed all the survey sections. We deleted the observations when the amount of missing and 'not applicable' data on a questionnaire exceeded 5% of the questions to ensure that the amount of missing data per indicator did not exceed 5%. As a result, 161 usable responses remained for data analysis. The demographics include gender, age, education level and number years of work experience. Table 2 presents the respondents' profile.

The measurement invariance across demographic groups was tested and satisfied via analysis of variance. Assessing for nonresponse bias was achieved by comparing the first 90% of responses received to the last 10% received during the data collection period (Karahanna, Straub, and Chervany 1999). After comparing the early and late respondents by an independent sample *t*-test, we found no significant difference. We checked common method bias through Harman's one-factor test, as suggested by Podsakoff et al. (2003). Ten factors were extracted from all of the measurement items with eigenvalues greater than 1. The results showed that 10 factors explained 76.24% of the variance, with the first factor accounting for 16.10% of the variance, not a majority of the variance. Therefore, we conclude that common method bias is not present.

We elected to use partial least squares (PLS) as the appropriate tool to analyse the data. Minimum sample size is one of the most often suggested reasons for applying PLS-structural equation modelling (SEM) (Henseler, Ringle, and Sinkovics 2009; Hair et al. 2012). Compared with its covariance-based counterpart, PLS-SEM can achieve higher levels of statistical power with a complex model structure with smaller sample sizes. However, as with any statistical technique, PLS-SEM also requires researchers to evaluate the sample size against the background of the model and data characteristics (Hair, Ringle, and Sarstedt 2011). Sample size recommendations in PLS-SEM essentially build on the properties of ordinary least-squares regression, which allow researchers to follow the rule provided by Cohen (1992) for statistical power analysis for multiple regression models. Given the factor loadings of 0.7 and above, and a specific level of complexity of our research model (the maximum number of arrows pointing at a construct is 6), to detect *R*-square value of at least 0.25 with a 5% probability error, we need only 75 observations to achieve a statistical power of 80%.

Using SmartPLS 2.0, the measurement model and structural equation model were estimated simultaneously according to the PLS algorithm. We first evaluated the measurement and then tested the structural equation model shown in

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Table 2. Profile of respondents.

	Percent (%)
Gender	
Male	56.4
Female	43.6
Age	
Less than 20	0.6
20 to less than 30	12.3
30 to less than 40	31.6
40 to less than 50	33.5
50 to less than 60	20.0
60 or over	1.9
Highest education	
High school	15.6
Some college	23.1
Two-year college	10.2
Four-year college	29.9
Graduate school	21.1
Years of experience at COD	
Less than one year	8.8
1 to less than 2 years	11.4
2 to less than 5 years	16.5
5 to less than 10 years	19.6
10 to less than 15 years	15.2
15 to less than 20 years	16.5
20 years or over	12.0
Years of experience at current job	
Less than one year	16.9
1 to less than 2 years	18.2
2 to less than 5 years	29.6
5 to less than 10 years	14.5
10 to less than 15 years	11.3
15 to less than 20 years	5.0
20 years or over	1.3

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Figure 3 with the remaining 'not applicable' data replaced by the mean value (Hair et al. 2014, 51). To calculate the student's *t* test, we used the recommended 5000 bootstrap samples (Hair et al. 2014, 132) to estimate bootstrap standard error.

5.2 *Evaluating the MBNQA model for reliability and validity*

We utilised three measures: Cronbach's alpha, composite reliability and average variance extracted (AVE) to examine internal consistency, following the approach used by Braunscheidel and Suresh (2009). Table 3 provides a summary of reliability analysis for each construct. All of the values of Cronabach's alpha are above the minimum acceptable value of 0.7 (Nunnally 1978). The values of composite reliability are higher than the recommended lower bound of 0.7 (Chin 1998; Gefen, Straub, and Boudreau 2000). The AVEs are greater than the threshold value of 0.5 (Fornell and Larcker 1981; Chin 1998). Therefore, we conclude that the measurements show sufficient reliability. (Note: 'AVE is defined as the grand mean value of the squared loadings of the indicators associated with the construct (i.e. the sum of the squared loadings divided by the number of indicators)' (Hair et al. 2014, 103). In addition, 'The composite reliability is calculated using the following formula: $\rho_c = \frac{(\sum_i l_i)^2}{(\sum_i l_i)^2 + \sum_i var(e_i)}$, whereby l_i symbolises the standardised outer loading of the indicator variable I of a specific construct, e_i is the measurement error of indicator variable i and $var(e_i)$ denotes the variance of the measurement error, which is defined as $1 - l_i^2$' (Hair et al. 2014, 101).

Construct validity includes three dimensions: content validity, convergent validity and discriminant validity. Content validity in this study is supported by a thorough review of MBNQA criteria and review of the initial survey instrument by a panel of experts comprised of academics and practitioners (O'Leary-Kelly and Vokurka 1998).

Table 3. Variable summary.

Scale	Mean	Standard deviation	Cronbach's alpha	Composite reliability	AVE	Average interscale correlation	Average item to total correlation	
							Nonscale items	Scale items
Leadership	4.90	1.60	0.93	0.91	0.63	0.74	0.46	0.63
Strategic planning	4.58	1.44	0.94	0.93	0.71	0.79	0.49	0.66
Customer focus	4.63	1.45	0.96	0.95	0.71	0.77	0.48	0.67
MAKM	4.36	1.50	0.96	0.97	0.79	0.72	0.47	0.72
Workforce focus	4.72	1.64	0.95	0.94	0.67	0.76	0.49	0.65
Operations focus	4.52	1.42	0.96	0.96	0.77	0.76	0.51	0.71
Results	4.89	1.43	0.96	0.94	0.64	0.75	0.46	0.57

Note: The range of responses on the Likert scale was from 1 (strongly disagree) to 7 (strongly agree).

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We examine the individual loadings for each scale item onto its latent variable (Braunscheidel and Suresh 2009) and AVE of scales to assess convergent validity (Shook et al. 2004). Appendix 2 shows all the item loadings for each category in the MBNQA model. All of the loadings in Appendix 2 produced by PLS are greater than 0.7, except two items measuring results with a value of 0.69 and 0.62. Although the two factor loadings are below the recommended value of 0.7 (Chin 1998), we retained these two items in the instrument because both loadings are only slightly below the recommended value. We believe that retaining both items is appropriate to preserve both the construct validity and our research model's applicability in public service systems. Table 3 shows that the AVEs are greater than the threshold value of 0.5 (Fornell and Larcker 1981; Chin 1998) for all categories. The AVEs and statistically significant high factor loadings provide evidence for convergent validity.

Table 3 provides evidence of the discriminant validity of the measurement. Consistent with Flynn and Saladin (2001, 2006), two techniques were used to assess discriminant validity (Ghiselli, Campbell, and Zedeck 1981). First, after analysing the item-to-total correlations in the last two columns of Table 3, we find that the average correlation between the scale and scale items is substantially higher than between the scale and nonscale items. Second, comparing scale reliabilities (Cronbach's α values and composite reliability values) with average interscale correlations shows that the average interscale correlation for each scale is lower than its reliability. We also used the pairwise comparison method to assess discriminant validity (Li et al. 2005, 2012). The results supported the presence of discriminant validity.

5.3 *The PLS-SEM*

In the PLS model fit, the R-square and significant structural paths were used to evaluate the research model (Gefen, Straub, and Boudreau 2000). According to the results provided by PLS in Table 4, not all of the path coefficients are statistically significant. Figure 4 shows the fitted model with all of the statistically significant paths. *R*-square is 80% when the six categories are used to predict the results. Only leadership, workforce focus and operations focus have statistically significant and directly positive influences on results with correlation coefficient values of 0.15, 0.53 and 0.29, respectively, which support our 1st, 9th and 11th hypotheses. The results do not support our 3rd, 5th and 7th hypotheses, suggesting that strategic planning, customer focus, and MAKM do not have statistically significant and direct positive influences on results. According to the significant path model shown in Figure 4, we calculated the total effect and indirect effect for each linkage. Table 5 summarises the direct, indirect, and total effects among seven Baldrige categories. We can see that strategic planning, customer focus, and MAKM have statistical significance, and indirect positive influences on results with coefficient values of 0.11, 0.10, and 0.09, indicating that our 4th, 6th and 8th hypotheses are supported.

Table 5 shows that leadership has a positive influence on strategic planning, customer focus and workforce focus with coefficient values of 0.85, 0.21 and 0.40, respectively, supporting our hypothesis 2a, hypothesis 2b and hypothesis 2d. The coefficient values of 0.69 and 0.51 support hypothesis 4a and hypothesis 4b, indicating a strong positive

Table 4. Path coefficients, *T*-statistics and *R*-squares.

	Leadership	Strategic planning	Customer focus	MAKM	Workforce focus	Operations focus	Results
Leadership	–						
Strategic planning	0.85[a]/28.64[b]**	–					
Customer focus	0.21/2.86**	0.69/10.42**	–				
MAKM	−0.05/0.38	0.51/4.44**	0.37/3.89**	–			
Workforce focus	0.40/3.31**	0.15/1.03	0.15/1.02	0.16/1.72	–		
Operations focus	−0.19/1.86	0.11/0.98	0.22/2.63**	0.30/3.94**	0.50/4.91**	–	
Results	0.15/1.97*	−0.18/1.87	0.16/1.90	0/0.03	0.53/7.58**	0.29/3.71**	–
R-square	**0**	**0.72**	**0.76**	**0.65**	**0.63**	**0.76**	**0.80**

Notes: *R*-squares are shown in bold.
[a]Represents path coefficients.
[b]Represents *T*-statistics.
*Significant at the 0.05 level.
**Significant at the 0.01 level.

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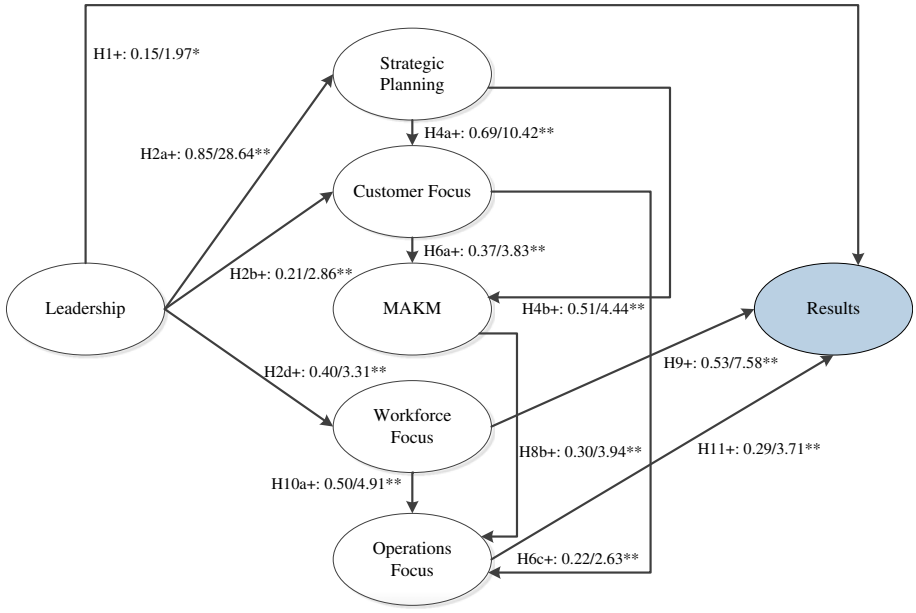

Figure 4. PLS structural equation path results according to the application of the MBNQA 2013–2014 model to a municipal government.
Note: *Path significant at $p < 0.05$; **Path significant at $p < 0.01$.

influence of strategic planning on customer focus and MAKM. The results also support both hypothesis 8b and hypothesis 10a, because of the high correlation coefficient values of 0.30 and 0.50 between MAKM and operation focus, and workforce focus and operation focus. Table 6 summarises whether the hypotheses are supported.

6. Discussion

The 69 items were specifically designed to measure and assess the effectiveness of the MBNQA model within a municipal government. As previously mentioned, the summary of prior studies in Appendix 1 were used as comparisons to analyse the contingent effects of different industries on the Baldrige model.

Although the findings regarding leadership as the driver of the system are consistent, the direct effect of leadership on results is arguable. Our result shows that leadership has a direct effect on results, as indicated by Flynn and Saladin (2001) in the manufacturing industry, and Meyer and Collier (2001) in the health care industry. The strong indirect influence of leadership on system categories facilitates its positive influence on results, which solidifies its primary

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Table 5. Summary of the direct, indirect and total effects among the constructs within MBNQA model.

	Leadership			Strategic planning			Customer focus			MAKM			Workforce focus			Operations focus			Results		
Construct & effect	DE	IDE	TE	DE	IDE	TE	DE	IDE	TE	DE	IDE	TE	DE	IDE	TE	DE	IDE	TE	DE	IDE	TE
Leadership	–	–	–																		
Strategic planning	0.85	0.00	0.85	–	–	–															
Customer focus	0.21	0.59	0.80	0.69	0.00	0.69	–	–	–												
MAKM	0.00	0.73	0.73	0.51	0.26	0.77	0.37	0.00	0.37	–	–	–									
Workforce focus	0.40	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	–	–	–						
Operations focus	0.00	0.59	0.59	0.00	0.38	0.38	0.22	0.11	0.33	0.30	0.00	0.30	0.50	0.00	0.50	–	–	–			
Results	0.15	0.38	0.53	0.00	0.11	0.11	0.00	0.10	0.10	0.00	0.09	0.09	0.53	0.15	0.68	0.29	0.00	0.29	–	–	–

Note: DE represents the direct effect, IDE represents the indirect effect and TE represents the total effect.

Table 6. Summary of hypotheses tests.

Hypotheses	Results
H1: Within the MBNQA model, leadership has a direct positive influence on results	Supported
H2: Within the MBNQA model, leadership has an indirect positive influence through other constructs on results	Supported
H2a: Within the MBNQA model, leadership has a positive influence on strategic planning	Supported
H2b: Within the MBNQA model, leadership has a positive influence on customer focus	Supported
H2c: Within the MBNQA model, leadership has a positive influence on MAKM	Not supported
H2d: Within the MBNQA model, leadership has a positive influence on workforce focus	Supported
H2e: Within the MBNQA model, leadership has a positive influence on operations focus	Not supported
H3: Within the MBNQA model, strategic planning has a direct positive influence on results	Not supported
H4: Within the MBNQA model, strategic planning has an indirect positive influence through other constructs on results	Supported
H4a: Within the MBNQA model, strategic planning has a positive influence on customer focus	Supported
H4b: Within the MBNQA model, strategic planning has a positive influence on MAKM	Supported
H4c: Within the MBNQA model, strategic planning has a positive influence on workforce focus	Not supported
H4d: Within the MBNQA model, strategic planning has a positive influence on operations focus	Not supported
H5: Within the MBNQA model, customer focus has a direct positive influence on results	Not supported
H6: Within the MBNQA model, customer focus has an indirect positive influence through other constructs on results	Supported
H6a: Within the MBNQA model, customer focus has a positive influence on MAKM	Supported
H6b: Within the MBNQA model, customer focus has a positive influence on workforce focus	Not supported
H6c: Within the MBNQA model, customer focus has a positive influence on operations focus	Supported
H7: Within the MBNQA model, MAKM has a direct positive influence on results	Not supported
H8: Within the MBNQA model, MAKM has an indirect positive influence through other constructs on results	Supported
H8a: Within the MBNQA model, MAKM has a positive influence on workforce	Not supported
H8b: Within the MBNQA model, MAKM has a positive influence on operations focus	Supported
H9: Within the MBNQA model, workforce has a positive direct influence on results	Supported
H10: Within the MBNQA model, workforce has an indirect positive influence through other constructs on results	Supported
H10a: Within the MBNQA model, workforce has a positive influence on operations focus	Supported
H11: Within the MBNQA model, operation focus has a direct positive influence on results	Supported

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importance among QM practices. However, inconsistent with prior studies in the manufacturing and health care industries, we do not find a direct influence of leadership on MAKM and operations focus in government organisations. Examining the nature of leadership in different industries could be the future research direction.

The Baldrige 2013–2014 model implies that both strategic planning and customer focus should have indirect impact on organisational results. The results support these premises and do not indicate direct influence of strategic planning and customer focus on results. The role of strategic planning is enhanced in government organisations compared with its identified role in previous MBNQA research in the manufacturing and health care industries. The possible reasons for the change in strategic planning's importance are the following. First, strategic planning has become more important due to the increasingly dynamic business environment (Lee, Zuckweiler, and Trimi 2006). Strategic planning capabilities can strengthen an organisations' ability to respond to change. Secondly, because of its continued application, organisations have improved their ability to utilise strategic planning to address development and deployment action plans, along with clear priorities and required resources. Customer focus does have an indirect influence on the results through the overall system. The results support the contention that customer focus significantly influences MAKM and operations focus, consistent with the findings in the manufacturing and health care industries. Organisations research the customer requirements and expectations, ever-changing market conditions and new practices of customer relationship management to improve performance.

In the context of a government organisation, MAKM does not have a significant positive direct influence on results and workforce focus, which is different from the findings in the manufacturing and health care industries. In addition,

the influence of MAKM on operations focus in government organisation is less strong than in the manufacturing and health care industries. The results indicate that MAKM plays the least important role on results through the overall system, which supports our contention that MAKM serves as a necessary set of tools to establish an environment vs. being a direct driver of results (Wilson and Collier 2000; Meyer and Collier 2001). The disconnection between MAKM and workforce focus and the relatively weak influence on operations focus seriously weakens the role of leadership, strategic planning and customer focus in the Baldrige framework. The possible explanations are that government organisations have limited ability to measure their performance in terms of the scope, validity and management of relevant data and information. In addition, government organisation must improve the effectiveness of the processes for information and knowledge management.

The result supports the contention that workforce focus directly influences results in government organisations, which is not the case in the manufacturing and health care industries. In addition, workforce focus is positively associated with operations focus, which is consistent with findings in the manufacturing industry. Throughout the Baldrige government model, workforce focus has the greatest impact on results. Workforce practices, such as quality training, IS training and employee involvement, more effectively improve production efficiency, product quality and customer satisfaction than activities in other categories. Such a finding is supportive of the philosophy popularised by quality leaders like W. Edwards Deming (Evans and Lindsay 2011).

The impact of operations focus on results in government organisations is significant and direct, as is true in the manufacturing industry. Operations focus is a stronger predictor of results than other categories excluding workforce focus and leadership in a government organisation. A physical operations process, such as product design, quality control and production flow, more effectively reduce product variance, lead-time and customer complaints, thereby improving overall competitiveness, than activities in other categories.

Appendix 3 shows the trend across industries in terms of the numbers of the Baldrige winners vs. applicants. There is often an immediate increase in the number of applicants in new industries. After a short time, the numbers of winners in new industries increases. In the context of the data presented, the Baldrige award serves as a motivator for improving quality within an industry. We believe that competition for the MBNQA award results in an increased awareness of quality within organisations in each industry. In recent years, the winners and applicants in the health care industry have almost dominated the competition for the Baldrige award. However, we can reasonably expect more nonprofit/government organisations to enter the playing field. The results of the PLS analysis and the comparisons across industries provide many insights for both academics and practitioners.

6.1 *Insights for academics*

In our application we found that the Baldrige 2013–2014 model is strong, having very few linkages not supported, particularly for such a complex model. Additionally, the overall fit is better than older Baldrige models. In this study, the results show that the Baldrige 2013–2014 model explains 80% of the variance in results. Comparing this result with 39% (the Baldrige 1995 model, Wilson and Collier 2000), 45% (the Baldrige 1997 model, Flynn and Saladin 2001) and 62% (the Baldrige health care pilot model, Meyer and Collier 2001), we conclude that, as the worldwide leading quality award, the QM practices presented by the MBNQA model are consistently good predictors of organisational results across industries. In addition, the comparisons provide evidence that the Baldrige model has experienced the appropriate adaptations over time.

Since the 2002 version was introduced, MBNQA models have consistently emphasised that the leadership triad, composed of leadership, strategic planning and customer focus, rather than leadership alone, is the driver of the system. The testing of research hypotheses supports this view of the Baldrige framework. As discussed in Section 2, the evolution of IT has changed the role of the MAKM construct in the Baldrige framework. Our results support that MAKM serves as the system foundation of the Baldrige system.

Through the comparisons across industries, we can see that the concept of the leadership triad as the driver of the system was always embedded in the Baldrige model, even though the Baldrige model during the 1990s did not clearly state this. Strategic planning and customer focus partially mediate the driving role of leadership in the Baldrige system. This is strengthened in government organisations. Customer focus is equally important in both government organisations and the manufacturing industry. However, customer focus can directly benefit results and improve workforce focus and operations focus. MAKM is more influential in manufacturing and in the health care industry than it is in government organisations. Nevertheless, workforce is the most important result in government organisations. The direct influence of the operations construct on results holds consistent in both government organisations and manufacturing.

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6.2 *Insights for practitioners*

Results suggest that leaders in government organisations should focus on three critical components of QM: leadership, workforce focus and operations focus. These three QM practices contribute the most to the success of organisations. For start-up organisations, motivating the workforce and designing operational processes can offer direct benefits even when resources are limited. However, for mature organisations, in addition to developing workforce potential and optimising operational processes, effectively utilising advanced IS and managing customer relationships will further enhance performance and increase sustainability. Additionally, organisational leaders should analyse the contingent effects of related industries on the effectiveness of QM practices. They must customise their QM practices by allocating effort proportionately, to maximise the outcome of each Baldrige category based upon the categories that have the most significant impact in their industries.

7. Limitations and future research

Some of the limitations in this study provide insight for possible future research. The use of data from a single organisation could limit the generalisability of study results. Although we justify the applicability of single organisation data, it would be valuable to evaluate the hypotheses using different samples from multiple government organisations.

Second, alternative models should be proposed and tested. We precisely followed the MBNQA model defined by NIST in this study. However, there is no guarantee that the quality model defined by NIST is the best model. Considering the rapid advancements in operations and supply chain management during the last several decades (Ho, Au, and Newton 2002; Singhal and Singhal 2012), it is arguable that the MBNQA model does not define the role of supply chain clearly. We suggest that researchers embed the supply chain triad, composed of customer focus, supplier focus and operations focus, into the quality model. The relevance of a supply chain focus within the MBNQA goes beyond the objective of this study, but has the potential to contribute to the body of knowledge about the relevance of the supply chain to the Baldrige model.

Another topic for future research direction is to identify ways to improve the assessment of Baldrige winners using the MBNQA model. This study provides suggestion on how to best utilise the most up-to-date MBNQA model. Baldrige winners should conduct self-assessments periodically based on the updates to the MBNQA model. Self-monitoring has value for many organisations, including winners of the Baldrige award, because winning does not guarantee continued success. The use of a self-assessment survey provides an inexpensive approach to ongoing, periodic monitoring that will allow leaders to track changes within the organisation. This is particularly valuable to MBNQA winners because they can quickly evaluate the impact of a change on their organisation at a much lower cost than they could by conducting an internal self-assessment MBNQA audit. Further analysis of how the QM practices of winners relate to MBNQA constructs and their degree of influence on the results can provide additional insights into the complex and contingent nature of the various relationships within the model.

8. Conclusion

This research was the first to study the causal relationships between categories in the MBNQA for a government organisation using empirical data. As implied in the MBNQA framework, our results revealed many insights based on the survey responses. With quantitative results, we summarised the findings for each QM practice in the Baldrige model and conducted comparisons across different industries.

This study contributes to academia and best practices in the following ways. First, we comprehensively validate the effectiveness of the Baldrige model and quantitatively support its theoretical foundations. The leadership triad is consistently the driver of the system. The role of MAKM has become the system foundation rather than the direct driver. Second, we reveal the similarities and differences across industries of the effectiveness of the Baldrige categories. Third, along with the prior studies, we provide evidence that the Baldrige model has experienced appropriate adaptations over the years. Fourth, we suggest how practitioners can maximise benefits by customising QM practices to their own industries.

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Appendix 1. Summary of the interrelationships between Baldrige categories in prior studies and this study

	Manufacturing		Health care	Government
	Wilson and Collier (2000)	Flynn and Saladin (2001)	Meyer and Collier (2001)	This study
Leadership & Strategic Planning	0.30[a]**	0.38**	0.47**	0.85**
Leadership & Customer Focus	NS	0.24**	NS	0.21**
Leadership & MAKM	0.73**	0.62**	0.78**	NS
Leadership & Workforce Focus	0.38**	NT	0.38**	0.40**
Leadership & Operations Focus	0.23*	NT	0.36**	NS
Leadership & Results	NS	0.30**	0.43**	0.15*
Strategic Planning & Customer Focus	NS	NS	NS	0.69**
Strategic Planning & MAKM	0.56**	0.33**	0.46**	0.51**
Strategic Planning & Workforce Focus	0.33**	0.21**	NT	NS
Strategic Planning & Operations Focus	NT	NT	NT	NS
Strategic Planning & Results	NS	NT	NS	NS
Customer Focus & MAKM	0.27**	0.36**	NS	0.37**
Customer Focus & Workforce Focus	NS	NT	0.26*	NS
Customer Focus & Operations Focus	0.46**	0.25**	0.77**	0.22*
Customer Focus & Results	NS	NT	0.30**	NS
MAKM & Workforce Focus	0.19**	0.53**	0.55**	NS
MAKM & Operations Focus	0.16*	0.48**	0.61**	0.30**
MAKM & Results	0.25*	NS	0.52*	NS
Workforce Focus & Operations Focus	0.42**	0.22**	NT	0.50**
Workforce Focus & Results	NS	NS	NS	0.53**
Operations Focus & Results	0.19*	0.24*	NS	0.29**

[a]Standardised path coefficient.
*Significant at the 0.05 level
**Significant at the 0.01 level.

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Appendix 2. Measurement scales with factor loadings and *t* statistics for government organisations which in this study was a municipal government

Construct name	Construct items	Loadings	*T*-statistics
Leadership	1. My government organisation achieves high quality performance that applies through all facets of the organisation	0.79	19.91
	2. My government organisation maintains effective communication channels in order to deliver values and expectations of senior leaders to employees	0.81	25.16
	3. Management in my government organisation sets strategy, goals, and objectives for future directions	0.84	25.09
	4. Management in my government organisation establishes and reinforces an environment that fosters empowerment and innovation	0.83	25.83
	5. Management in my government organisation encourages and supports organisational and employee learning	0.79	21.36
	6. My government organisation regularly evaluates all functions' performance and capabilities	0.76	18.37
	7. My government organisation utilises performance review findings to identify opportunities for improvement and innovation	0.78	19.60
	8. Management in my government organisation cares about the impact of its products, services or operations on society	0.82	23.72
	9. My government organisation actively supports and strengthens the relationships with key communities, such as religious organisations, education organisations or professional associations	0.72	14.13
Strategic Planning	1. My government organisation establishes a short-term (1–2 years) plan to help achieve goals and objectives	0.86	35.67
	2. My government organisation establishes a long-term (2–5 years) plan to help achieve goals and objectives	0.87	35.04
	3. My government organisation establishes a strategy/plan to improve customer satisfaction	0.86	35.25
	4. My government organisation establishes human resource requirements and plans considering employees' capabilities and needs	0.75	17.48
	5. My government organisation establishes a strategy/plan to strengthen supplier/partner relationships	0.86	26.98
	6. My government organisation establishes a strategy/plan to address key goals and objectives	0.91	56.96
	7. My government organisation utilises performance measures to track progress of its action plans	0.80	18.89
	8. My government organisation allocates resources advisably to achieve overall action plans	0.81	22.16
Customer Focus	1. My government organisation has an official method to determine current product/service requirements and customer expectations	0.88	39.44
	2. My government organisation has an official method to determine future product/service requirements and customer expectations	0.87	42.59
	3. My government organisation has an official method to identify customer groups and market segments	0.80	23.79
	4. My government organisation implements effective customer relationship management practices to ensure customers seek assistance	0.88	42.22
	5. My government organisation continuously improves its customer relationship management practices	0.86	35.13
	6. My government organisation determines key customer requirements and delivers them to all employees involved in the response chain	0.77	20.74
	7. My government organisation resolves customer complaints promptly and effectively	0.88	39.88
	8. My government organisation officially examines customer complaints in order to improve its processes	0.89	43.03
	9. My government organisation measures and analyses current levels of customer satisfaction and dissatisfaction	0.79	22.89
	10. My government organisation compares its customer satisfaction results with similar government organisations	0.82	23.66

(*Continued*)

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Appendix 2. (*Continued*).

Construct name	Construct items	Loadings	*T*-statistics
Measurement, Analysis, and Knowledge Management	My government organisation offers effective measurement techniques to ensure the following items of data and information (1–5):		
	1. Reliability	0.93	66.58
	2. Consistency	0.91	44.45
	3. Accessibility	0.90	48.91
	4. Review	0.93	69.79
	5. Timely update	0.90	47.53
	6. My government organisation regularly compares its performance to similar leading organisation benchmarks to support its performance, evaluation and improvement	0.84	34.59
	7. My government organisation systematically analyses performance data and information collected internally to support its overall quality goals	0.83	25.75
	8. My government organisation systematically analyses performance data and information collected externally to support its overall quality goals	0.86	39.48
Workforce Focus	1. My government organisation establishes human resource plans derived from its strategic plans, aiming at achieving the full potential of its workforce	0.70	14.55
	My government organisation puts efforts to build a work environment and an employee support climate beneficial to the followings items (2–5):		
	2. Performance excellence	0.87	37.25
	3. Full involvement	0.89	39.13
	4. Personal growth	0.88	26.66
	5. Organisational growth	0.85	25.86
	6. My government organisation promotes cooperation, individual initiatives, innovation, and flexibility to achieve its objectives	0.82	21.83
	7. My government organisation's compensation, recognition, and related reward practices enhance high performance	0.84	33.13
	8. My government organisation establishes formal education and training programmes keeping up with business and individual needs	0.73	16.05
	9. All employees in my government organisation receive necessary training to accomplish their objectives of job responsibilities	0.70	14.73
	10. My government organisation supports a work environment beneficial to the well-being and growth of all employees	0.85	35.01
	11. My government organisation regularly examines employee satisfaction and utilises the results to support its quality and innovation	0.83	27.84
Operations Focus	My government organisation establishes a systematic method to introduce new products/services, including the following items (1–3):		
	1. Designing in customer requirements	0.86	30.82
	2. Addressing quality issues early in the design cycle	0.89	45.88
	3. Analysing relevant process capabilities	0.89	45.88
	4. My government organisation monitors the processes producing products/services to identify necessary actions to make corrections	0.89	42.01
	5. My government organisation continuously improves the processes used to provide its products and services	0.92	65.29
	My government organisation formally assesses the quality of its (6–8):		
	6. Products/services	0.91	50.36
	7. Production/delivery systems	0.87	21.86
	8. Goods/services supplied by external suppliers/partners	0.85	25.04
	9. My government organisation delivers its quality requirements to all external suppliers of goods/services	0.83	26.63

(*Continued*)

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Appendix 2. (*Continued*).

Construct name	Construct items	Loadings	*T*-statistics
Results	My government organisation's current level is superior to similar cities it terms of the following items (1–14)		
	1. Customer satisfaction	0.84	29.09
	2. Customer loyalty and positive referral	0.82	26.73
	3. Customer-perceived value	0.80	25.86
	4. Financial performance	0.81	25.57
	5. Employee well-being and growth	0.85	32.57
	6. Employee satisfaction	0.84	32.66
	7. Supplier/partner performance	0.82	24.74
	8. Regulatory/legal compliance	0.74	16.68
	9. Quality	0.89	46.25
	10. Productivity	0.85	34.47
	11. Environmental citizenship	0.81	25.61
	12. Fostering economic development	0.69	13.30
	13. Crime control	0.62	11.09
	14. Education	0.74	18.09

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Appendix 3. Number of recipients and applicants of the Baldrige award by category

Years	Manufacturing	Service	Small business	Education	Health care	Nonprofit/government
1988	2[a] (45[b])	0 (9)	1 (12)	n/a	n/a	n/a
1989	2 (23)	0 (6)	0 (11)	n/a	n/a	n/a
1990	2 (45)	1 (18)	1 (34)	n/a	n/a	n/a
1991	2 (38)	0 (21)	1 (47)	n/a	n/a	n/a
1992	2 (31)	2 (15)	1 (44)	n/a	n/a	n/a
1993	1 (32)	0 (13)	1 (31)	n/a	n/a	n/a
1994	0 (23)	2 (18)	1 (30)	n/a	n/a	n/a
1995	2 (18)	0 (10)	0 (19)	n/a	n/a	n/a
1996	1 (13)	1 (6)	2 (10)	n/a	n/a	n/a
1997	2 (9)	2 (7)	0 (10)	n/a	n/a	n/a
1998	2 (15)	0 (5)	1 (16)	n/a	n/a	n/a
1999	1 (4)	2 (11)	1 (12)	0 (16)	0 (9)	n/a
2000	2 (14)	1 (5)	1 (11)	0 (11)	0 (8)	n/a
2001	1 (7)	0 (4)	1 (8)	3 (10)	0 (8)	n/a
2002	1 (8)	0 (3)	1 (11)	0 (10)	1 (17)	n/a
2003	1 (10)	2 (8)	1 (12)	1 (19)	2 (19)	n/a
2004	1 (8)	0 (5)	1 (8)	1 (17)	1 (22)	n/a
2005	1 (1)	1 (6)	1 (8)	2 (16)	1 (33)	n/a
2006	0 (3)	1 (4)	1 (8)	0 (16)	1 (45)	0 (10)
2007	0 (2)	0 (4)	1 (7)	0 (16)	2 (42)	2 (13)
2008	1 (3)	0 (5)	0 (7)	1 (11)	1 (43)	0 (16)
2009	1 (2)	0 (4)	1 (5)	0 (9)	2 (42)	1 (8)
2010	2 (3)	0 (2)	3 (7)	1 (10)	1 (54)	0 (7)
2011	0 (2)	0 (3)	0 (2)	0 (8)	3 (40)	1 (14)
2012	1 (1)	0 (3)	1 (2)	0 (3)	1 (25)	1 (5)
2013	0 (0)	0 (0)	0 (0)	1 (2)	1 (15)	0 (5)

[a]Winner number.
[b]Applicant number.
Sources: Summarized from data on the website (www.nist.gov/baldrige) of the Baldrige Performance Excellence Program at the National Institute of Standards and Technology in Gaithersburg, Maryland.

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