Enhancing the quality and competitiveness of small businesses: A pooled cross-sectional analysis

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ABSTRACT

Compared with large organizations, small businesses have been slower to adopt quality management practices. This study combined the context-free perspective with the contingency theory of quality management to investigate the association between quality management and the quality and operational outcomes of a sample of 231 small businesses that applied for the Baldrige quality excellence award program. Using a pooled cross-sectional design and structural equation modeling, we examined the validity and reliability of the Baldrige model for measuring the quality management practices of small businesses, to determine the relationship between the Baldrige criteria and their impact on quality outcomes. Our analysis confirms the validity and reliability of the Baldrige quality excellence model when used as an assessment tool for improving the performance outcomes and competitiveness of small businesses. Based on the results, leadership was found to be the key determinant of quality outcomes during the application year, with leadership practice scores increasing by 40% over 16 years. This study found that *Information analysis and knowledge management* only influences *Customer focus and satisfaction,* but *Strategic planning for quality* and *Management of process quality* significantly and positively influence both *Customer focus and satisfaction* and *Quality and operational results*. However, the score for *Quality and operational results* diminishes over time for small businesses. This study provides some effective insights and recommendations for small businesses as well as policymakers looking to support small businesses' quality and competitiveness, because quality improvements will enhance the stability, profitability, and survivability of small businesses when facing crises like the ongoing COVID-19 pandemic.

1. Introduction

Similarly to large organizations, small or medium-sized enterprises (SMEs) can apply quality management practices to gain a competitive advantage by improving business efficiency and effectiveness (e.g., Martínez-Costa and Jiménez-Jiménez, 2009; Romero and Martínez-Román, 2012; Dunne et al., 2016; Yang, 2020). While quality management practices are popular among large enterprises (Demirbag et al., 2006; Assarlind and Gremyr, 2014), SMEs have been slow to follow suit due to barriers such as culture, management awareness, limited physical and financial resources, and training (Kumar and Antony, 2008; Hansson, 2001; Martínez-Costa and Jiménez-Jiménez, 2009; Valmohammadi, 2011; Assarlind and Ida Gremyr., 2016).

Applying quality management solutions can enhance an SME's core competencies and competitive advantages even more than in a large enterprise, mostly due to an SME's relative immaturity, greater

flexibility and agility, organic structure, and scarcity of management knowledge and skills when compared to larger firms (Thakkar et al., 2013). Quality improvement efforts significantly reduce product or service variations and also improve customer retention and satisfaction (Sriram et al., 2015; Basu and Bhola, 2016; Wilfred et al., 2018). Quality management, specifically the Baldrige model, helps SMEs to understand an effective managerial and leadership framework from a quality-based perspective. Thus, SMEs look for management practices and initiatives that will improve their business efficiency and effectiveness while still focusing on customer service and product quality. Improving the quality of an SME's systems, products, and services is also important because many SMEs provide services or products to larger organizations (Assarlind and Gremyr, 2014; Murphy, 2016). From the perspective of public policy, improving small businesses' quality management systems is emphasized by state and federal agencies such as the Small Business Administration (SBA), which highlights the critical role of quality in

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small businesses for enhancing economic growth (Mills, 2017). Based on data from the Small Business Administration (SBA), small businesses are 99.7% of total employer businesses and provide 64 percent of net new jobs in the private sector, 49.2% of private sector employment, 42.9% of private sector payroll, 46% of private sector output, 43% of high-tech employment, 98 percent of goods exported from the US, and 33 percent of export value of the US (Small Business Administration, 2012). Since small businesses are a major contributor to the US economy, it is important to understand the effectiveness of quality management programs and to identify critical success factors for quality management in small businesses.

In addition to enhancing an SME's core competencies and competitive advantages, quality management practices can reduce an SME's risk of failure and improve its chances of survival, long-term stability, and future growth (ZhaoCiwei Dong and Cheng, 2018). The literature highlights two main causes of SME failure: internal factors, and external factors (Leonidou, 1995; 2004; Yamakawa, 2015; Walsh & Cunningham, 2016; Nikolić et al., 2019). Internal factors relate to a firm's internal problems, such as a lack of systematic record keeping, inadequate financial control, a scarcity of effective management knowledge and skill, poor quality products or services, inefficient operations and systems, and underqualified staff (Lussier, 1995). External factors are issues such as a scarcity of startup capital and a challenging environment in the markets and the wider economy (Lussier, 1995; Frazer and Winzar, 2005). Quality management philosophies and principles, such as those of the Baldrige model, are concerned with improvements in areas such as leadership and management practices, supply chains, organizational culture and employment empowerment, cybersecurity, and product/service quality (NIST, 2020), aiming beyond simply controlling and improving product/service quality. Quality management can significantly enhance an SME's stability and potential for success, even during challenging times like the ongoing COVID-19 pandemic (Akpan et al., 2020). Thus, understanding the critical success factors of quality management and identifying the most important quality management practices may have a significant effect in terms of enhancing the quality and competitiveness of small businesses, thereby improving their chances of survival and providing a path toward organizational growth.

The quality management concept aims at continuously improving an organization and its products or services (Salimian et al., 2020). Research in quality management has been promoted by the development of national and international standards for quality, such as the traditional TQM, business excellence frameworks, the Deming Prize, the Baldrige model, the European Foundation for Quality Management (EFQM), ISO-9001, Lean, and Six Sigma (Martín-Gaitero & Escrig-Tena, 2018; Castka, 2018). A common theme among these prominent quality platforms and models is improving business efficiency and effectiveness by providing organizations with a framework for recognizing quality practices, developing a quality plan, assessing their quality performance, and identifying areas for quality improvement (Bou-Llusar et al., 2009; Bourke and Roper, 2017). The Malcom Baldrige National Quality Award (MBNQA) is an annual award given by the U.S. National Institute of Standards and Technology (NIST), a part of the U.S. Department of Commerce, for six industry sectors, namely service, healthcare, manufacturing, education, small business, and non-profit (Parast et al., 2007). The Baldrige model acts as an effective means for improving quality management systems, which is arguably applicable to all organizations regardless of type, size, and industrial sector (Bandyopadhyay and Leonard, 2016). There is, however, limited evidence concerning the impact of the Baldrige model on improving quality in small businesses, despite claims that it is a helpful tool for them (Stephens et al., 2005). Alternatively, some argue that the limited participation of such businesses in the program could undermine its credibility (Lawrence and Hammoud, 2017). For some time, it has been impossible to examine the

effect of the Baldrige framework on improving organizational quality outcomes because the Baldrige model data was not publicly available due to the confidentiality of firms' internal quality assessment data.[1]

In this study, we focus on small businesses by assessing how quality management practices affect quality outcomes and the pursuit of business excellence. This study therefore examines the relationship between a well-known quality management practice (the Baldrige model) and the organizational quality and operational results of small businesses, by analyzing original high-quality data for 231 small U.S. firms that applied for the Baldrige award over 16 years. This empirical data was collected by independent reviewers as part of the evaluation process for the MBNQA. Our study is unique in the sense that it provides the first comprehensive analysis of the applicability of the Baldrige model for small businesses. Previous studies have shown that the Baldrige criteria can be used as a robust model for evaluating quality management practices, but the relationships among the Baldrige criteria depend upon the industry sector (Parast, 2015; Mai et al., 2018; Parast and Golmohammadi, 2019). Furthermore, because of the longitudinal aspect of this study, which spans 16 years of data, we should be able to establish a stronger examination of the association between quality management practices and quality and operational results. By using scores from independent reviewers, we will be able to enhance the robustness of our results and minimize biases in data collection and perceptions through the use of objective measures of service quality, thus allowing our conclusions to be more generalizable (Parast, 2015; Mai et al., 2018; Parast and Golmohammadi, 2019). By applying a more holistic, objective, and detailed-oriented instrument like the Baldrige quality assessment model (Sofaer and Firminger, 2005), we can show how different practices and mechanisms enhance the quality and operational results of small firms, thus helping to identify the best quality practices for them.

In summary, this study seeks to make two main contributions. First, from a theoretical perspective, this research examines the validity and reliability of the Baldrige model for SMEs. Considering the significant differences that exist between SMEs and large organizations in adopting and implementing quality management systems like the Baldrige model, it is important to examine the effectiveness of quality and business excellence models for SMEs. Second, from a management and practice perspective, it is important for SMEs to know the key quality management practices that will have the greatest impact on quality and business results. Due to SMEs' limited resources, our empirical findings will provide insights into the long-term effects of quality management practices in terms of improvements in customer satisfaction and business results. These questions remain thus far unexplored in the research into SME quality management, so we address them here.

2. Quality management in small businesses

SMEs usually adopt quality management to reduce costs, improve profits, optimize the use of resources and facilities, and maintain their competitive edge in the market (Zhou, 2016). Early studies acknowledged the fundamental differences between SMEs and large organizations in implementing quality management practices (North et al., 1998). This argument is made with reference to the difference in size, which in turn reflects smaller market shares, scarcer resources (in terms of finance, knowledge, and personnel), and a lack of managerial expertise (Ahire, 1996; Gibson and Cassar, 2002; Assarlind and Ida Gremyr., 2016). This suggests that some dynamics among quality management practices are unique to small businesses.

Despite small firms' limitations in resources, knowledge, and competencies, quality management principles and premises are still applicable, since they provide an opportunity for employee engagement and empowerment, and this supports innovation (Sonfield, 1984; Ahire, 1996). However, the implementation of quality management in a small

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[1] The data for the Baldrige assessment became available in 2011.

business needs to be contextualized according to organizational needs and existing goals (Salaheldin, 2009; Assarlind and Ida Gremyr., 2016; Toke and Kalpande, 2020). It also needs to be incremental, since small businesses have limited resources and capacities. To overcome these constraints, small businesses have found value in developing cooperative programs with larger organizations (Okamuro, 2007), so this is a potential way for small businesses to improve their quality programs.

The literature provides some insights into quality management that are unique to SMEs. For example, SMEs tend to attribute a higher level of importance to supplier and customer relationships (Davig et al., 2003). Small organizations are also more flexible and enjoy a closer employee-management relationship due to a smaller, flatter hierarchy. All these factors facilitate the implementation of quality management (Haksever, 1996; Pun and Jaggernath-Furlonge, 2012). This suggests that small businesses can more effectively incorporate customers' and suppliers' input into their product development process. Due to SMEs' flatter organizational hierarchy and organic organizational structure, management–employee relationships are generally good, which in turn enhances employee participation and management commitment (Hansson, 2001). However, hiring and retaining capable employees is considered a major challenge for SMEs (McElwee and Warren, 2000). SMEs also have some reservations about the effectiveness of quality management systems, arguing that they are too bureaucratic, complex, and expensive, with a negative impact on creativity (Price and Chen, 1993; Sahoo & Yadav, 2017, 2018). To make quality management relevant to SMEs, such programs need to emphasize issues that are important for SMEs and identify appropriate quality solutions for them (Vandenbrande, 2021). Another suggestion for SMEs is to apply hard quality management practices (i.e., "system oriented" practices such as quality measurement and control, benchmarking, and efficiency improvement) in parallel with softer practices or behavioral aspects (e. g., leadership engagement, training, and employee and customer interaction) to improve business performance, increase customer satisfaction, and yield a greater return on assets (Gadenne and Sharma, 2009; Bourke and Roper, 2017).

Table 1 presents a review of studies on quality management in SMEs. A common theme among these studies is the difference between SMEs and large firms with regard to quality management implementation. This suggests that quality management needs to be tailored to fit the needs of SMEs (Murphy, 2016; Vandenbrande, 2021), yet prior studies have not addressed the impact of quality management practices on quality and operational results, indicating a major limitation of the research into quality management in SMEs. Although quality management principles can clearly be implemented in SMEs, it is important to know the magnitude of the impact that quality management practices will have on organizational quality performance. This is crucial for SMEs, because they have limited resources for improvement projects and experience high rates of failure due to issues such as inefficiency and low performance, personal and team-related issues, flaws in products/services and operations, and a lack of funds (e.g., Headd, 2003; Cope, 2011; Jenkins and McKelvie, 2016). Understanding this relationship will provide SMEs with practical insights into their decision-making processes and help them to become more efficient and effective, which in turn supports their long-term survival.

Our review of previous studies provides additional insights. First, none of these studies used the Baldrige framework or a comparable quality excellence framework (e.g., the Deming prize, or the EFQM excellence model) to assess the association between quality management solutions and organizational quality outcomes. Second, we found that while quality management solutions do lead to better performance for small businesses, it is unclear how different quality management practices affect quality results. More importantly, the relative significance of different quality management practices for improving organizational quality results is overlooked in the literature. This study aims to address these gaps in the literature.

3. Theory development and research hypotheses

We used two theoretical lenses when examining the relationship between the Baldrige criteria in small businesses. One theoretical perspective is referred to as the context-free approach to quality, where quality management applies an "off-the-shelf" set of universal practices for implementation within an organization, regardless of the context (Sousa and Voss, 2008; Sousa and Aspinwall, 2010). A competing perspective, building upon the contingency theory of management, is that contextual factors—such as strategy, culture, lifecycle, and customer focus—affect the effectiveness of quality management practices (McAdam et al., 2019). While quality management practices can be implemented in small businesses from this perspective, their impact on quality outcomes will be unique to each small business because of contingent factors such as firm size, type of customer, and structural and organizational practices that are unique to each small business.

Our conceptualization and theorization of the relationships among the Baldrige criteria build upon an integrative approach that applies both the context-free perspective and the contingency perspective of quality management. From the context-free perspective, we argue that quality management practices are universally suitable for implementation in all organizations, regardless of the context. Indeed, the literature provides numerous examples where quality management practices have been effectively implemented in different regions, industries, and organizations with different sizes. We also argue that the relationships among the Baldrige constructs and their influence on quality outcomes are contingent upon the specific context. This view suggests that the relationships among the Baldrige constructs are different for small businesses when compared to large corporations. Having said that, the Baldrige model does not suggest any specific framework for small businesses. In the absence of any meaningful Baldrige model for small businesses, we use the general framework model proposed in previous studies of the Baldrige model. With this approach, we can examine the validity of the Baldrige model for small business and make further improvement to the model to incorporate the relationships that are unique to small businesses. Thus, the first step is to assess the validity of the general models proposed for the Baldrige model for small businesses.

Several studies have developed the link between leadership and other components of the Baldrige model (Pannirselvam et al., 1998; Wilson and Collier, 2000; Pannirselvam & Ferguson, 2001). Empirical analysis using the Baldrige data shows that leadership is the key determinant of a quality system, because it influences strategic quality management and the management of information and knowledge, process quality, and human resources (HR). These practices collectively determine two quality outcomes: customer focus and satisfaction; and quality and operational results. We examine the relationships among these elements in the structural model for the Baldrige framework (as shown in Fig. 1) and test all hypotheses using empirical data collected from small businesses.

The structural model examines the following hypotheses for small businesses. These hypotheses were developed based on prior studies of the Baldrige model. To further strengthen the theoretical foundation of the Baldrige model, the justification for each hypothesis was also sourced from the quality management literature based on the Baldrige model (e.g., Wilson and Collier, 2000; Parast, 2015; Parast and Golmohammadi, 2019). These justifications are shown in Table 2.

4. Methodology

To conduct this study for small businesses, we apply the same Baldrige criteria for quality management that were used when collecting the data. These criteria are (NIST, 2020): 1) *Leadership*; 2) *Strategic Quality Planning*; 3) *Measurement, Analysis, and Knowledge Management*; 4) *Customer Focus and Satisfaction*; 5) *HR Development and Management*; 6) *Management of Process Quality*; and 7) *Quality and Operational Results*. The details and scopes of these variables for the Baldrige excellence

Table 1
Previous Studies about Quality Management in SMEs (in chronological order).

Study	Research	Country	Baldrige	Major findings
Moreno-Luzon (1993)	Survey	Spain	No	Quality management program improved sales and improved management skills.
Ghobadian and Gallear (1996)	Case study	UK	No	SMEs are slower to adopt TQM, but TQM improves the likelihood of survival and growth for SMEs. TQM supports SMEs to sharpen their market focus, optimize human resources, and become more efficient.
Ahire and Golhar (1996)	Survey	USA	No	Firm size does not impact implementation of quality management practices. Small firms can use their own strengths in flexibility and innovation. However, compared to large firms, small firms have limited resources.
Ahire (1996)	Survey	USA	No	Small firms that implement quality management produce higher quality products and services compared to non-QM small firms.
Lee (1998)	survey	South Korea	No	Small businesses that implement quality management are more involved in international business.
Lin et al. (1999)	Survey	Taiwan	No	De-emphasizing organizational structure and increasing flexibility in SMEs leads to a tendency to have an orientation toward high quality.
McAdam (1999)	Survey	Northern Ireland	No	SMEs should learn how to focus better. They need to assess the effects of quality management solutions on financial and non-financial performance as well as customer satisfaction.
Holt and Henson (2000)	Case study	UK	No	Problems with technical implementation of quality systems are related to a lack of training. Effective communication was observed in small organizations.
Rahman (2001)	Survey	Australia	No	Quality practices including leadership and human resource management are more critical to SMEs. More emphasis on strategic direction and customer focus is needed.
Davig et al. (2003)	Survey	USA	No	The importance of supplier management and customer relationship management was highlighted in quality management practices. Continuous improvement is not well supported.
Temtime and Solomon (2002)	Survey	Ethiopia	No	TQM perception is different by firm size and planned behavior. The main issues in SMEs are emphasis on short-term benefits, business planning, lack of vision, lack of resources, and misperception about TQM.
Lee (2004)	Survey	China	No	Organizational structures are still traditional in China's small manufacturing companies, and little authority is delegated to the first-line managers or workforce. This creates some problems in the effective implementation of quality management programs.
Nguyen and Bryant (2004)	Survey	Vietnam	No	The results show that firm size is positively associated with HR management formality, and that human resource formality is positively associated with owners' perceptions of firm performance.
Stephens et al. (2005)	Survey	USA	No	There are significant differences in importance among different quality management criteria. Strategic planning and leadership are the most important factors.
Lewis et al. (2006)	Literature review	Global	No	Results show that previous studies have placed more emphasis on the "soft" quality management practices, than on "hard" factors.
Fening et al. (2008)	Survey	Ghana	No	Most of the quality management variables positively affect firm performance.
Gadenne and Sharma (2009)	Survey	Australia	No	Firm performance is affected by both hard and soft TQM factors. Soft factors include effective leadership and top management support, supplier support, and employees' training and effective engagement with customers. Hard factors include quality measurement, continuous improvement, benchmarking, and improvements in efficiency.
Okay and Semiz (2010)	Survey	Turkey	No	Quality certification has a positive effect on SMEs' performance.
Rowland-Jones (2013)	Survey	UAE	No	There is considerable variability of management approaches in SMEs. The findings highlight lack of business planning within the UAE SMEs.
Kober et al. (2015)	Archival data	Australia	No	Management accounting practices applied to large firms may not be transferrable to SMEs.
Zhou (2016)	Survey	USA	No	SMEs implement quality management to reduce costs, improve profits, optimize resources and facility utilization, and maintain a competitive position.
Assarlind and Gremyr (2014)	Case study	Sweden	No	The study identifies important areas for applying quality management in small firms: the importance of initiation and contextualization; quality management is an iterative process; and quality management requires external support.
Assarlind and Gremyr (2014)	Literature review	N/A	No	Quality improvement program in large companies can be useful for SMEs. For successful implementation, such programs should have more focus, and implementation should be gradual and incremental.
Juanzon and Muhi (2017)	Survey	Philippines	No	The study found that SMEs in construction sectors are motivated to implement ISO 9001 Quality Management Standards due to three main factors: client requests; qualification to bid; and increased customer satisfaction.
Sahoo and Yadav (2017)	Survey	India	No	The results indicate that entrepreneurship orientation (EO) is a significant factor when adopting TQM strategies and improving firm performance. This improvement diminishes when the indirect impact of an entrepreneurship orientation through TQM is considered and added to the total effect model. Higher levels of entrepreneurship orientation are very helpful in adopting a TQM strategy, which is effective for developing new capabilities and achieving better firm performance.
Basu et al. (2018)	Survey	India	No	This study found the unique nature of the interrelationships among the main QM practices in India's industries. These relationships are unique to the Indian context.
Sahoo and Yadav (2018)	Survey	India	No	Quality management solutions positively influence firm performance.
Eniola et al. (2019)	Survey	Nigeria	No	This study confirmed that implementing TQM improves SMEs' performance in the manufacturing sector. This also helps SMEs by providing direction for organizational culture.
Sternad et al. (2019)	Qualitative	Austria	No	The main barriers to SMEs' adoption of business excellence approaches include the attitudes of their managers and employees, resource constraints, and conceptual concerns. The study supports a gradual move by SMEs toward adopting business excellence.
Chakraborty et al. (2019)	Survey	India & Namibia	No	This study found there were limited implementations of QM practices in both studied countries due to their lack of knowledge, lack of skills, and the associated costs. The commitment and support from senior management did not seem to have a significant impact on SMEs' success.
McAdam et al. (2019)	Qualitative (case study)	UK	No	This study found that the contingency factors of strategy, lifecycle, culture, and customer focus, as well as their respective typologies, interact with quality management solutions to help shape the "strategic alignment between the SMEs and their environments." This alignment, which is based on contingency approaches, happens in a way that is unique for each firm and its environment rather than through any overarching best-practice approach.

Table 1 (*continued*)

| Study	Research	Country	Baldrige	Major findings
Sahoo (2019)	Survey	India		According to this study, quality management indirectly influences firms' performance through their capability for innovation. This confirms the opinion that quality management solutions improve the relevance of innovation strategies for processes and products in manufacturing sectors, which in turn impacts other aspects of a firm's performance. In addition, the author confirmed previous studies' findings about the positive role of quality management in increasing firms' innovation capability.
Ali et al. (2020)	Survey	Saudi Arabia		This study's results indicate that entrepreneurship orientation, market orientation, and TQM positively influence an SME's performance. The results also confirm that TQM makes the greatest contribution to enhancing organizational development, followed by entrepreneurship orientation and market orientation.
Toke and Kalpande (2020)	Literature Review	India	No	This study discusses the key success factors of QM implementation in SMEs. TQM is mainly aimed at large organizations, and it is necessary to adapt and develop TQM models for SMEs.
Zhou and Li (2020)	Survey	China		No significant differences were found in quality management practices, supply chain information sharing, and business performance for businesses with different supplier-related investment levels (i. e., high or low). However, both quality management and supplier-specific investment improved firms' innovation outcomes.
Vandenbrande (2021)	Conceptual	General	No	This study found that using QM methods and tools is an effective driving force for SMEs to engage in sustainability (in terms of the awareness, adoption, and achievement phases). It developed a sustainability–quality matrix from financial, environmental, and social aspects of sustainability and proposed effective quality methods to apply for each element of the matrix.
Yang (2020)	Survey	Taiwan	No	SMEs fail to perform the full range of QM practices and maximize their benefits. They should start by implementing the product quality stage, followed by the process, system, total, and business quality stages, if they are successful at each stage. SMEs should also focus on critical practices such as lean production, customer relationship management, process capability control, and business performance.
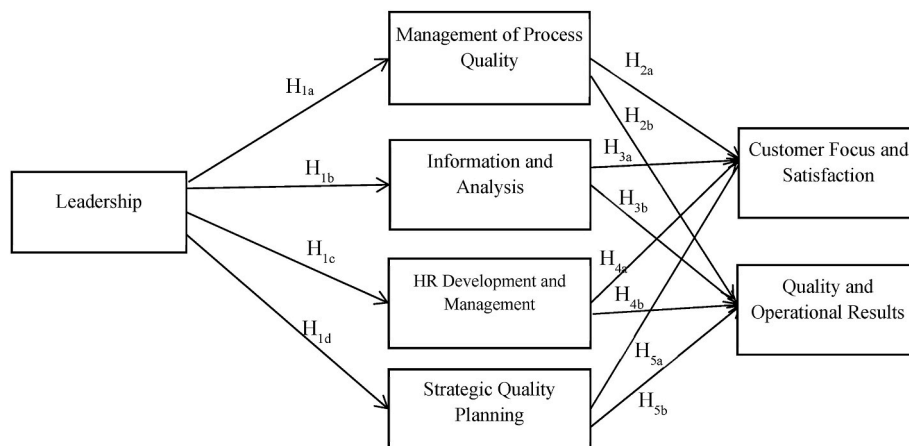
Fig. 1. Structural model for quality management in small businesses (adapted from Parast, 2015).

program can be found on the NIST website.

4.1. Data

Quality data for small businesses were collected from the Baldrige performance excellence program organized by the NIST (2020). According to the NIST (2020), organizations with fewer than 40 employees were considered small businesses. The data are the scores of independent evaluators for small businesses in a period from 1990 to 2006, thus providing a unique opportunity to empirically examine the theoretical and causal associations within the Baldrige framework (Fig. 1). The objectivity, soundness, and robustness of the assessment process will ensure a high degree of reliability and a good-quality dataset (Evans, 2010; Parast, 2015). The data are publicly available on the NIST website. More detailed descriptive statistics for the MBNQA data can be found at http://www.nist.gov/baldrige or by contacting a Baldrige program coordinator at Baldrige@nist.gov.

4.2. Sample

Our sample includes all the small businesses that applied for the MBNQA in the 1991–2006 period. Data from 1990 were excluded

because they were collected at the beginning of the program. The original dataset has 314 observations. We eliminated observations that had missing data. The final sample had 231 observations.

Table 3 presents the descriptive statistics for each year. The first column shows the year and the corresponding sample size (in brackets). To test the normality of the data, both the skewness (asymmetry) and kurtosis (peakedness) were calculated. The skewness and kurtosis ranged between −0.851 and 0.302, which are within the acceptable ranges (smaller than 3) for a normality test (West et al., 1995; Kline, 1998; Cao and Dowlatshahi, 2005).

As Table 3 shows, the mean value of some constructs improved over time. The main reason for these improvements may well be the widespread application of the MBNQA among small businesses. For instance, the *Leadership* score increased from 0.354 in 1990 to 0.49 in 2006. We also see similar patterns of improvement for other key constructs of the Baldrige model: *Management of quality process* (from 0.32 to 0.49); *Information and analysis* (from 0.27 to 0.48); *HR development and management* (from 0.36 to 0.51); *Strategic planning* (from 0.28 to 0.45); and *Customer focus and satisfaction* (from 0.26 to 0.54).

The overall average scores for quality management range from 0.35 to 0.48 (out of 1) for each Baldrige construct for all 231 small businesses considered. (The original data contained 314 observations; we removed

Table 2

Hypotheses.

Hypothesis	Justification
H₁ₐ: In small businesses, leadership positively influences the management of process quality.	According to the Baldrige model, leadership directly influences process quality. In addition, the studies of Wilson and Collier (2000), Meyer and Collier (2001), and Pannirselvam and Ferguson (2001) showed the positive effect that quality leadership has on process quality. The significant and positive effect of organizational leadership on enhancing quality in service organizations is addressed in the literature (Benavides-Velasco et al., 2014; Adjei & Mensah, 2016).
H₁ᵦ: In small businesses, leadership positively influences information and analysis.	According to the Baldrige model, leadership directly affects information and analysis. This is consistent with the studies of Wilson and Collier (2000) and Meyer and Collier (2001); both studies showed that quality leadership significantly affects information and analysis.
H₁ᵧ: In small businesses, leadership positively influences HR management and development.	According to the Baldrige model, leadership directly improves HR management and development. The studies of Wilson and Collier (2000), Pannirselvam and Ferguson (2001), and Meyer and Collier (2001) confirm that quality leadership significantly affects HR management and development.
H₁d: In small businesses, leadership positively influences strategic quality planning.	According to the Baldrige model, there is a direct relationship between leadership and strategic planning for quality, as shown by the study of Wilson and Collier (2000).
H₂ₐ: In small businesses, management of process quality positively influences customer focus and satisfaction.	According to the Baldrige model, effective management of process quality influences customer focus and satisfaction. Wilson and Collier (2000), Meyer and Collier (2001), and Pannirselvam and Ferguson (2001) all showed the significant impact that process quality has on customer focus and satisfaction.
H₂ᵦ: In small businesses, management of process quality positively influences quality and operational results.	Based on the Baldrige model, management of process quality directly affects quality and operational results. The studies of Wilson and Collier (2000), Pannirselvam and Ferguson (2001), Ouzrout et al. (2008), Sekhari and Savino (2009), and Savino and Mazza (2014) have all illustrated the positive impact that effective process quality has on continuous improvement and quality and operational results. Chan and Ho (1997) also showed that considering the continuous improvement of processes as a low priority negatively affects quality results.
H₃ₐ: In small businesses, information and analysis positively influences customer focus and satisfaction.	According to the Baldrige model, information and analysis directly affects customer focus and satisfaction. The studies of Wilson and Collier (2000) and Pannirselvam and Ferguson (2001) also confirmed the significant impact of information and analysis on customer focus and satisfaction.
H₃ᵦ: In small businesses, information and analysis positively influences quality and operational results.	Based on the Baldrige model, information and analysis directly affect quality and operational results. The study of Meyer and Collier (2001) confirmed this positive impact of information and analysis on quality and operational outcomes. In addition, the studies of Bardhan and Thouin (2013) and Parast and Golmohammadi (2019) confirmed the positive impact of information technology

Table 2 (*continued*)

Hypothesis	Justification
	on quality and on the reduction of operational costs in a health system.
H₄ₐ: In small businesses, HR management and development positively influences customer focus and satisfaction.	Based on the Baldrige model, HR management and development positively affects customer focus and satisfaction. The studies of Wilson and Collier (2000) and Pannirselvam and Ferguson (2001) confirmed the positive impact that HR management and development has on customer focus and satisfaction. Using MBNQA data, Parast and Golmohammadi (2019) also showed the positive impact of HR management and development on customer focus and satisfaction.
H₄ᵦ: In small businesses, HR management and development positively influences quality and operational results.	The studies of Wilson and Collier (2000) and Pannirselvam and Ferguson (2001) showed the positive impact that HR management and development has on quality and operational outcomes. Furthermore, Gowen et al. (2006) and Savinoa and Batbaatarb (2015) found strategic HR planning and management strongly associated with quality results.
H₅ₐ: In small businesses, strategic quality planning positively influences customer focus and satisfaction.	Based on the Baldrige model, strategic quality planning positively affects customer focus/satisfaction. The studies of Wilson and Collier (2000) and Meyer and Collier (2001) also found a significant positive impact that strategic quality planning has on customer focus/satisfaction.
H₅ᵦ: In small businesses, strategic quality planning positively influences quality and operational results.	Based on the Baldrige model, strategic quality planning positively affects quality and operational results. Wilson and Collier (2000) confirmed the positive impact that strategic quality planning has on quality and operational results. Parast and Golmohammadi (2019) also showed that strategic planning for quality positively affects quality and operational results.

observations with missing data.) Table 4 shows the mean, standard deviation, and pairwise correlation for all the constructs of our sample. This simple analysis clarifies the existence of significant opportunities for effectively implementing quality management practices in small businesses. We can also see high degrees of correlation among the constructs, further supporting the existing argument about the interrelationships among the Baldrige constructs.

The correlation table provides some useful insights into the relationships among the variables. All the correlations are statistically significant, so the underlying assumption that "everything is related to everything else" in the Baldrige model appears to be valid for small businesses. With reference to the effect of leadership on quality practices, we notice that the correlation between leadership and quality results and the correlation between leadership and customer focus and satisfaction are stronger than the correlation between leadership and process management. This suggests that leadership plays a much stronger role in small businesses, and its effects on business results and customer satisfaction are more pronounced; we discuss this further in the discussion section. The pairwise correlations between the indicators are provided in Appendix 1.

Table 5 provides the Cronbach alphas, standardized loadings, and average variance extracted values. An initial review of standardized factor loadings finds that they are all significant, thus providing initial evidence for convergent validity (Parast and Golmohammadi, 2019). All the reliability values are greater than the recommended value of 0.7 (Nunally and Bernstein, 1994; Hair et al., 2010). To address convergent validity, we calculated the average variance extracted (AVE); all the AVE values were found to be greater than the recommended value of 0.5

Table 3
Descriptive statistics for the entire sample (N = 314).

Year	Leadership	Strategic Quality Planning	Customer Focus and Satisfaction	Information and Analysis	HR Development and Management	Management of Quality Process	Quality and Operational Results
1990 (33)	(.35, .19)	(.28, .16)	(.26, .16)	(.27, .17)	(.36, .15)	(.32, .14)	(.19, .22)
1991 (48)	(.44, .17)	(.31, .15)	(.31, .15)	(.32, .14)	(.38, .15)	(.22, .15)	(.39,.14)
1992 (44)	(.47, .17)	(.39, 19)	(.39, .18)	(.37, .16)	(.38, .16)	(.28, .18)	(.40, .19)
1993 (30)	(.50, .20)	(.38, .16)	(.43, .17)	(.38, .15)	(.42, .17)	(.31. .21)	(.43, .19)
1994 (28)	(.44, .19)	(.31, .15)	(.33, .12)	(.30, .15)	(.32, .17)	(.27, .18)	(.40, .15)
1995 (18)	(.47, .20)	(.32, .15)	(.33, .12)	(.40, .17)	(.37, .15)	(.34, .17)	(.38, .17)
1996 (10)	(.53, .17)	(.44, .16)	(.39, .16)	(.42, .16)	(.47, .14)	(.41, .17)	(.45, .16)
1997 (10)	(.49, .17)	(.33, .19)	(.46, .18)	(.39, .18)	(.44, .16)	(.41, .18)	(.32, .18)
1998 (16)	(.50, .12)	(.40, .14)	(.45, .12)	(.38, .13)	(.47, .12)	(.42, .13)	(.35, .13)
1999 (11)	(.45, .15)	(.41, .16)	(.49, .10)	(.40, .13)	(.46, .11)	(.43, .16)	(.31, .11)
2000 (11)	(.49, .17)	(.42, .16)	(.46, .16)	(.42, .14)	(.46, .11)	(.41, .13)	(.33, .16)
2001 (8)	(.44, .14)	(.39, .13)	(.45, .17)	(.40, .13)	(.43, .10)	(.41, .14)	(.37, .15)
2002 (11)	(.40, .15)	(.37, .13)	(.42, .17)	(.39, .14)	(.38, .16)	(.41, .15)	(.32, .16)
2003 (12)	(.40, .14)	(.33, .14)	(.37, .12)	(.35, .12)	(.37, .13)	(.36, .13)	(.22, .15)
2004 (8)	(.45, .10)	(.44, .11)	(.50, .11)	(.50, .13)	(.49, .06)	(.43, .12)	(.37, .18)
2005 (8)	(.54, .14)	(.46, .15)	(.56, .12)	(.53, .15)	(.52, .10)	(.52, .16)	(.41, .15)
2006 (8)	(.49, .17)	(.45, .11)	(.54, .10)	(.48, .11)	(.51, .09)	(.49, .12)	(.36, .15)

Table 4
Correlations.

Construct (Criterion)	Mean	S.D.	1	2	3	4	5	6	7
1. Leadership	.48	.16	1.00						
2. Strategic planning	.38	.16	.790***	1.00					
3. Customer focus and satisfaction	.41	.16	.734***	.796***	1.00				
4. Information and analysis	.40	.15	.792***	.817***	.802***	1.00			
5. Human resource development and management	.42	.15	.728***	.799***	.765***	.771***	1.00		
6. Management of process quality	.35	.18	.675***	.744***	.763***	.770***	.727***	1.00	
7. Quality and operational results	.40	.16	.794***	.763***	.659***	.710***	.675***	.607***	1.00

***p < 0.01.

(Hair et al., 2010).

5. Data analysis and estimation procedure

We applied confirmatory factor analysis (CFA) as well as structural equation modeling (SEM) to our model and the data validation and analysis. The CFA method helps to test if the measured (observed) variables are good fits for our Baldrige constructs. SEM helps to examine the entire Baldrige model's constructs and their complex structural relationships in the model. A combination of CFA and multiple regression analysis was then applied to test the structural relationships between latent and measured (observed) variables (e.g., Bryne, 2009; Bagozzi and Yi, 2012).

5.1. Measurement model: validation and assessment

As Hair et al. (2010) indicate, CFA is an effective analytical method for measuring the full model. We therefore applied CFA here to examine the fitness of our Baldrige model. This provided the following fit statistics: $\chi^2 = 225.85$; RMSEA = 0.09 (0.07, 010); RMR = 0.002; TLI = 0.93, CFI = 0.97. In addition, we used the Kaiser-Meyer-Olkin measure of sampling adequacy to assess the validity of the factor model (Kärnä et al., 2003). The statistics were found to be KMO = 0.96 and $\chi^2 = 4568.82$ with p < 0.01, suggesting that there are no concerns with the factor model. Another reliability parameter, Cronbach's alpha, was estimated for the constructs, and they were found to range between 0.83 and 0.92, well above the acceptable minimum of 0.70 (Nunally and Bernstein, 1994; Hair et al., 2010).

5.2. Structural model and hypotheses testing

Control variables: Two control variables for industry (small business) and application year were used in this study. We used a vector of 15 dummy variables (Y_{1992} to Y_{2006}) to control the year as the year of evaluation for the small businesses, with 1991 being the reference year. This allows us to handle the pooled cross-sectional data using year as the control variable (Parast, 2015).

Statistical procedure: To examine our entire MBNQA model (as

Table 5
Properties of the model.

Construct	Items (Construct Elements)	Measurements		
		Reliability	Loadings	Average Variance Extracted (AVE)
Leadership (LEA)	Leadership approach and deployment	.85	.69	.72
	Societal Responsibility		.98	
Strategic Planning (STR)	Strategy development	.91	.69	.65
	Strategy deployment		.91	
Customer Focus and Satisfaction (CFS)	Customer and market knowledge	.87	.71	.71
	Customer relationship building and satisfaction determination		.96	
Information and Analysis (INF)	Measurement and analysis	.83	.88	.77
	Information management		.87	
Human Resource Development and Management (HRD)	Work systems	.88	.65	.56
	Education, training, and development		.63	
	Employee well-being and satisfaction		.93	
Management of Process Quality (PRO)	Value creation processes	.84	.86	.76
	Support processes (including business and supplier)		.88	
Quality and Operational Results (RES)	Customer and product results	.89	.67	.72
	Financial and market results		.91	
	Human resource results		.90	
	Process/operational results		.88	

shown in Fig. 1) and investigate the association between quality practices and the subsequent quality and operational results for the 16 years of annual data, we applied SEM. We use a pooled cross-sectional estimation process to examine the research questions (Dielman, 1983; Disegna et al., 2018). Because we are dealing with cross-sectional data that are collected over 16 years, the estimation process needs to capture the dynamic of change in the model over time. Pooled cross-sectional studies are quite rare in operations management due to the challenges associated with data collection over multiple years (Narasimhan and Schoenherr, 2013). The type of datasets we used for this study are suitable for policy analysis, since we would be able to capture the dynamics of change in the sample over time. To examine the relationships between the constructs and quality outcomes shown in Fig. 1, we used structural equation modeling in AMOS 25.0. To address the concern related to multivariate normality of the data, we used the maximum likelihood (ML) procedure, which is less sensitive to the assumption of normality of the data.

Table 6 shows all the paths, with the estimation of the regression coefficient and p-value for each path. Consistent with hypotheses H_{1a} to H_{1d}, the results support the existence of significant relationships between *Leadership* and *Strategic planning for quality* (ß = 0.896, p < 0.01), *Leadership* and *Information and analysis* (ß = 0.864, p < 0.01), *Leadership* and *HR development* (ß = 0.750, p < 0.01), and *Leadership* and

Management of process quality (ß = 0.645, p < 0.01). In addition, *Strategic planning for quality* is a strong predictor for both *Customer focus and satisfaction* (ß = 0.257, p < 0.1) and *Quality and operational results* (ß = 0.464, p < 0.01).

Furthermore, the SEM results show significant relationships between *Information and analysis* and *Customer focus and satisfaction* (H_{3b}: ß = 0.446, p < 0.05) and also between *Management of process quality* and *Quality and operational results* (H_{5b}: ß = 0.252, p < 0.01). The model explains 87% of the variability in *Customer focus and satisfaction* and 74% of the variability in *Quality and operational results*; this is discussed further in the following sections. The structural model yielded the following fit statistics: χ^2 = 566.957; RMSEA = 0.06 (0.05, 0.07); RMR = 0.004; CFI = 0.80.

5.3. Follow-up case study

We further investigated whether our findings and statistical results could be applicable to the small businesses that applied for the MBNQA beyond the timeline of the study. To investigate this, we compiled a list of organizations that applied for the Baldrige award between 2007 and 2020; our goal was to assess the applicability and generalizability of our statistical results and ensure that our findings are still valid.

The independent reviewers' scores were not available for years after 2006, however, so we used a case study approach where we evaluated the company's information and further examined the critical success factors that enabled the service organizations to achieve a high level of quality results. The NIST provides a list of Baldrige awardees in each category along with a profile and award application summary for each award recipient. We found this information very useful because it provided important information about quality practices at these top-performing service organizations. The list can be found through the following link:

award-recipients" title="https://www.nist.gov/baldrige/award-recipients">https://www.nist.gov/baldrige/award-recipients.

From this list, we found two award recipients of the MBNQA program in the small business category: MESA 2020 (2020) and Integrated Project Management Company, Inc. (2018). We reviewed the documents for these small firms to better examine their approach toward quality management, their best practices, and how they were able to achieve superior quality outcomes.

Our review of these documents found that in both organizations, an emphasis on information systems and knowledge management was key to their success. In the case of MESA 2020, the company leadership was fully engaged in the development of strategic plans for the organization. Leadership encouraged honest and open communication, which in turn helped build a culture of learning and improvement across an organization by emphasizing individual and team performance, and this in turn further supported the critical role of leadership in improving organizational quality. The company was also heavily involved in strategic planning, which incorporated both short-term and long-term planning timelines. They frequently reviewed their strategic planning and updated it as needed, thus providing more flexibility in their overall strategic plan and ensuring that their strategic planning addressed several areas: the need for transformational change; the prioritization of changing initiatives; and organizational agility. This aligned with the results of our statistical model, which identified strategic quality planning as one of the key factors determining the success of quality management programs in small businesses. With respect to management of the quality process, the total recordable incident rate of MESA 2020 was much better when compared to the construction industry. In addition, MESA outperformed the U.S. Bureau of Labor Statistics' published rate during the 2013–2017 period, and the company's performance in 2019 was equal to the top performer in a survey conducted among the North American trade industry. This observation concurs with the results of our statistical model, which identified management of process quality as one of the key practices in quality management within the Baldrige

Table 6
Standardized regression coefficients.

Controls	Dependent Variables		Independent Variables			
	CFS	RES	STR	INF	HRD	PRO
Y_{1992}	.152	.157	-.219*	-.151	-.427***	-.318***
Y_{1993}	.205***	.072	-.266***	-.222***	-.335***	.160*
Y_{1994}	.176***	.180***	-.345***	-.294***	-.484***	-.245***
Y_{1995}	.030	.062	-.212***	-.046	-.244***	-.086
Y_{1996}	.082	.009	-.117	-.155***	-.138*	-.100
Y_{1997}	.088	-.122*	-.170***	.029	-.102	.109
Y_{1998}	.046	-.154***	-.125	-.026	.059	.085
Y_{1999}	.082	-.241***	.084	.109*	.104	.213***
Y_{2000}	.083	-.229***	.060	.124*	.082	.160***
Y_{2001}	.051	-.142***	.101	.149***	.168***	.208***
Y_{2002}	.019	-.199***	.197***	.235***	.100	.317***
Y_{2003}	.035	-.263***	.211***	.202***	.175***	.257***
Y_{2004}	.044	-.240***	.205***	.295***	.236***	.200***
Y_{2005}	.124***	-.239***	.117	.204***	.133*	.228***
Y_{2006}	.117***	-.294***	.195***	.226***	.187***	.284***
Predictors	CFS	RES	STR	INF	HRD	PRO
Leadership (LEA)	n.s.	n.s.	.896***	.864***	.750***	.645***
Strategic quality planning (STR)	.257*	.464***				
Information and analysis (INF)	.446**	.142				
HR Dev. (HRD)	.149	.176				
Process Mgmt. (PRO)	.156*	.252***				

*p < 0.10 **p < 0.05 ***p < 0.01 n.s. hypothesis is not stated.

model.

Turning to the Integrated Project Management (IPM) company, a review of the documents found three important practices that are key to success: leadership and corporate social responsibility, strategic quality planning, and process efficiency and effectiveness. The senior management team promoted employee engagement, and it solicited employees' input to identify areas for improvement and to prioritize strategic objectives and action plans. The leadership was also involved in developing process improvement plans. They developed an Executive Dashboard on The Hub as an effective tool for linking key requirements and measures to the main and supporting processes. The leadership team frequently reviewed, analyzed, and applied defined metrics to monitor and improve the system and ensure that all requirements were met. Its emphasis on the Baldrige criteria led to significant improvement in financial performance, with IPM's company-wide annual revenue significantly increasing by 62% from 2013 to 2017, suggesting the Baldrige model was effective at improving organizational business results.

Overall, our review of the documents for the top-performing small businesses in recent years suggests that along with a high level of commitment and responsibility among the leadership of these organizations, an emphasis on strategic quality planning and management of process quality yielded superior business results. These observations from these recent recipients of the Baldrige award for small businesses are consistent with our empirical findings based on the data using independent reviewers' scores. This provides supportive evidence that our empirical findings can be extended beyond the timeline of the dataset and are relevant to the current business environment.

5.4. Robustness tests

Normality: We used measures of skewness and kurtosis to assess the symmetry and peakedness of the data; these measures were found to range from 0.851 to 0.302. According to Westfall and Henning (2013), a kurtosis value above 3.00 is an indication of departure from normality.

We further examined whether the data followed a multivariate normal distribution. Using Bartlett's test of sphericity, $\chi^2 = 3350.89$ with 136 degrees of freedom, which is statistically significant at the one percent level of significance. This further suggests that the requirement of multivariate normality was met. As an additional step, we used the procedure in AMOS that determines multivariate normality (the Marida

test); this provided the critical ratio of 7.92. It should be noted that the significant tests do not provide much insight about the potential deviation from multivariate normality and suggest using alternative measures, such as kurtosis values for individual variables. Since statistics tests for kurtosis are influenced by sample size, a large sample can indicate a nonnormal distribution (Gallagher et al., 2008). Alternatively, we checked for multivariate outliers by calculating the Mahalanobis distance. According to Bryne (2009), observations with d-squared that are significantly different from their adjacent observations provide an indication of multivariate outliers. We did not identify any observation that has a significantly larger d-squared compared to the rest of the (adjacent) observations. Overall, we can conclude that there are no serious concerns related to departure from the assumption of multivariate normality in the data.

Heteroscedasticity: Where we face inconsistency in our observations in terms of the variance of regression disturbances (i.e., different variances for the error terms), we experience heteroscedasticity, which in turn leads to biased estimations (Greene, 2012). To test the data for this potential issue, a scatter plot of the standardized residuals versus standardized predicted values is an effective and simple method to test for heteroscedasticity. The scatter plot for our data did not reveal any evidence of heteroscedasticity.

Multicollinearity: To ensure the results are robust and not sensitive to correlations among the variables, a multicollinearity test is useful. According to our initial tests, all the VIF values for our regression analysis are far below 4.5, meaning that there are no concerns about multicollinearity issues in the study (Hair et al., 2010).

Power analysis: To assess whether we had enough power to minimize the type II error, we conducted a post-hoc power analysis. Using the process recommended by Cohen (1988) and Cohen et al. (2003), the power of the test was calculated to be one. This suggested that our sample size was adequate for detecting type II errors.

Common method bias: Our data consisted of the scores provided by quality experts (independent reviewers) who followed specific protocols and assessment guidelines to evaluate quality practices in line with MBNQA guidelines. Such assessments provide objective measures of quality practices that are not subject to the biases inherent in survey studies. Having said that, we investigated for common method biases by examining the number of factors that contributed to the total variance (Podsakoff et al., 2003; Krishnan et al., 2006). Using Harman's one-factor test, the unrotated principal component factor analysis

confirmed that about 78% of the model variance was derived from seven factors, with the largest factor accounting for 33% of the total variance. We could therefore conclude that the model outcomes were not affected by common method bias.

Endogeneity: From a methodological standpoint, we added several robustness tests and checks to minimize the impact of endogeneity in the model and its estimates. First, by focusing on a single industry (small businesses), we were able to address the industry effect. Second, the scatter plot of the predicted values for the independent variables versus their error terms in the structural model showed a random pattern; this supports the homogeneity of variance for *Quality and operational results* (Fig. 2) and *Customer focus and satisfaction* (Fig. 3), which is known as homoscedasticity. These findings provide empirical support for consistency of the standard errors (e.g., consistency of inference), suggesting that the residuals are identically and independently distributed. Third, we also recognized that measurement error could lead to an endogeneity problem and the production of biased estimates. While we are unable to fully eliminate measurement error in any study, the independent reviewer scores and the objectivity of the evaluation and scoring process ensured that measurement error was minimized.

Alternative structural models. We explored the validity of alternative models for quality management in the Baldrige model. One alternative model that is suggested in the literature asserts the mediating effect of *Information and analysis* on other Baldrige criteria, i.e., *Information and analysis* mediated the effect of *Leadership* on *Management of process quality*, *HR development*, and *Strategic planning of quality* (Wilson and Collier, 2000). This suggests that *Leadership* has both a direct and an indirect effect on *Strategic quality planning, Management of process quality*, and *HR development and management*, which added three new regression lines to the model and increases the degrees of freedom of the original model by three units. This alternative model provides the following model fit statistics: $\chi^2/df = 1.724$; RMSEA = 0.056; RMR = 0.004, with $\chi^2 = 551.78$ and $df = 320$ (reduced model). The structural model proposed in this study has the following fit indices: $\chi^2/df = 1.755$, RMSEA = 0.057; RMR = 0.005 with $\chi^2 = 566.957$ and $df = 323$ (full model). To test whether the alternative model is a significant improvement over the full model, we perform a chi-square test of ratio as follows (Bryant and Satorra, 2012):

$$\Delta\chi^2 = \chi^2_{\text{Full}} - \chi^2_{\text{Nested}} = 566.957 - 551.78 = 15.177$$

$$\Delta df = df_{\text{Full}} - df_{\text{Nested}} = 291 - 288 = 3.00$$

We then calculate whether the difference in the chi-square in the two models ($\Delta\chi^2$) with the corresponding degrees of freedom (Δdf) is statistically significant, with the understanding that $\Delta\chi^2$ follows a chi-square (χ^2) distribution (Steiger et al., 1985). The corresponding p-value for $\Delta\chi^2 = 15.177$ and $\Delta df = 3$ is 0.002, suggesting that the alternative model provides a stronger relationship among the variables and is statistically significant (an improvement). We also assess whether such a difference is relevant from a practical standpoint. To assess this, we calculate the Cohen's effect size ($w = \sqrt{\Delta\chi2/N. \ \Delta df}$), where N is the sample size (Dziak et al., 2014; Newsom, 2015). This gives us a value of $w = .15$ for the effect size, which is considered small (Cohen, 1988), suggesting that the practical implications of the alternative model would not be significant. In this alternative model, all the coefficients from *Leadership* to other quality practices are negative, which is in contrast with the literature (*Leadership* to *Strategic quality planning* β = −.092; *Leadership* to *HR development* β = −0.168; *Leadership* to *Management of process quality;* β = −0.039). Thus, we conclude that the alternative model is not valid.

5.5. Alternative estimation procedure

To examine whether our results are sensitive to the methodological approaches, we apply two methodologies for this examination: multivariate regression analysis and directly observed variables (path analysis). Since these methodologies apply different estimation procedures, we are able to validate our results and to ensure that these results are not sensitive to the estimation procedure.

Multivariate regression analysis. We realize that our sample sizes for some years are relatively small, which may raise some concerns regarding the validity of the results obtained from the SEM model. To mitigate the concern related to sample size, we use alternative estimation procedures that are less sensitive to the sample size. A very small sample size cannot detect significant relationships between the variables, while in a large sample size, every relationship becomes significant (Hair et al., 2010). A decision regarding the appropriate sample size in SEM should consider the following items: 1) multivariate normality, 2) estimation procedure, 3) model complexity, 4) missing data, and 5) communalities (Parast, 2020). While none of the above items appear to be a major concern in this study, we still have a relatively small sample in some years. Thus, we examine the structural model presented in Fig. 1 using alternative estimation procedures. We present the results in Table 7.

Step 1. Regressing *Leadership* on *Strategic Quality Planning, Information and Analysis, HR Development,* and *Management of Process Quality*
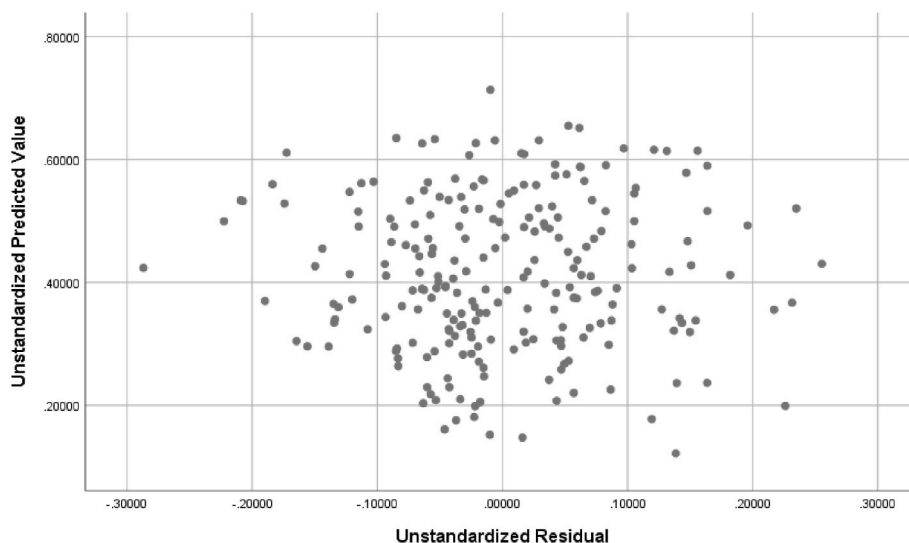

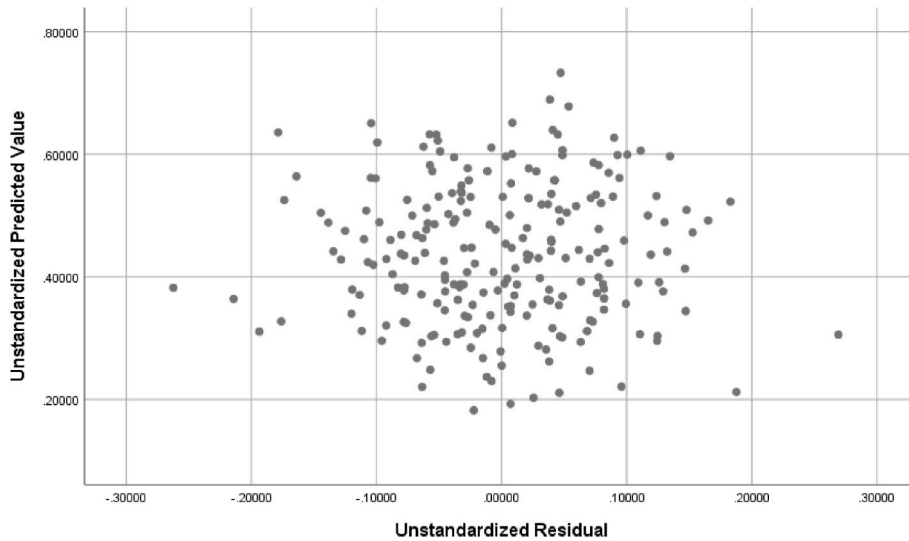**Fig. 2.** Error variance of Quality and operational results.

Fig. 3. Error variance of customer focus and satisfaction.

Table 7
Multivariate regression analysis.

Step	Independent Variables	Dependent Variables	Estimate
1	Leadership	Strategic quality planning	.790***
		Information and analysis	.792***
		HR Development	.728***
		Management of process quality	.675***
2	Strategic quality planning	Customer focus and satisfaction	.273***
	Information and analysis		.276***
	HR Development		.166***
	Management of process quality		.164***
3	Strategic quality planning	Operational and business results	.336***
	Information and analysis		.220***
	HR Development		.111***
	Management of process quality		.254***

***$p < 0.01$.

Step 2. Regressing *Strategic Quality Planning, Information and Analysis, HR Development,* and *Management of Process Quality* on *Customer Focus and Satisfaction*

Step 3. Regressing Strategic Quality Planning, Information and Analysis, HR Development, and Management of Process Quality on Operational and Business Results

Path analysis. We are aware of the small sample size in some years of the study. While this may not be an issue for the entire sample, for some years (especially years 1996–2006) it could be a concern. An important advantage of path analysis is that it collapses all latent variables into an observed variable (Williams and Hazer, 1986; Parast, 2020). In this case, we create a score for each given variable in the model

based on the scores for the indicators of constructs. By eliminating the indicators, we would be able to reduce the number of factors that should be estimated, thereby reducing the model's complexity and relaxing the need for a larger sample size. The result is provided in Table 8.

We find that *Leadership* is a significant predictor of *Strategic Quality Planning, Information and Analysis, Human Resource Development,* and *Management of Quality Process,* which is consistent with the results of the SEM model. We notice that *Leadership* has the largest impact on *Strategic Quality Planning,* which is also consistent with the results of the SEM model. We also find that *Strategic Quality Planning* is a significant predictor of *Customer Focus and Satisfaction* and *Quality and Operational Results;* this is also consistent with our SEM results. *Information and Analysis* is also a significant predictor of *Customer Focus and Satisfaction* and *Quality and Operational Results.* Furthermore, *Human Resource Management Development* is a significant predictor of both *Customer Focus and Satisfaction* and *Quality and Operational Results.* While we were not able to find a significant relationship in this case using the SEM model, our regression coefficients were relatively close to the results obtained from the path analysis. Consistent with our SEM results, we find that *Management of Process Quality* is a significant predictor of *Customer Focus and Satisfaction* and *Quality and Operational Results.* While the overall dynamics of the relationships in the path analysis are similar to the SEM results, we notice some differences, especially in the magnitude of the relationships of *Human Resource Development* and *Management of Process Quality* with *Customer Focus and Satisfaction* and *Operational and Business Results.* This is primarily due to the sensitivity of the SEM model to sample size and the number of freely estimated factors that we should estimate with a limited number of observations. By using path analysis, we are significantly reducing the number of observations needed for parameter estimations, so our results are more robust due to the smaller standard error of estimations.

In summary, our alternative estimation procedures provide further

Table 8
Parameters' estimates using path analysis.

Predictors	Dependent Variables		Independent Variables			
	CFS	RES	STR	INF	HRD	PRO
Leadership (LEA)	n.s.	n.s.	.556***	.536***	.481***	.511***
Strategic quality planning (STR)	.221***	.395***				
Information and analysis (INF)	.275***	.249***				
HR Dev. (HRD)	.154***	.130***				
Process Mgmt. (PRO)	.202***	.160***				

***$p < 0.01$ n.s. hypothesis is not stated.

evidence of the validity of the relationship between the Baldrige criteria. We also realize that due to the small sample size, the SEM results have led to a larger standard error of estimate, which generates a larger confidence interval for some parameters. This had led to the insignificant relationships between the variables. Our alternative estimation procedures provide more clarity on the validity of the Baldrige model, since they are less sensitive as SEM to sample size requirements.

6. Results and discussion

Quality management practices play a crucial role in improving an SME's quality and operational results, efficiency, and effectiveness, which in turn enhance the SME's chances of survival. This study presents the first objective evaluation of the Baldrige model for small businesses using empirical data from small U.S. firms following this framework. This research addresses two major gaps in the quality management literature. First, unlike earlier studies based on self-reported data, this study uses the evaluations and scores of independent reviewers for each firm according to the Baldrige criteria. This empirical data and its analysis therefore provide greater reliability and give more confidence in the validation and robustness of the datasets, the assessment process, the perceptions, and the outcomes. Second, this study examines the impacts of quality management practices on the quality results and performances of SMEs on a more detailed level by measuring the magnitude of these impacts for each construct. No previous study has sought to assess the effectiveness of the Baldrige model for small businesses using long-term empirical data.

This study also examines the effect of *Leadership* from two aspects: First, *Leadership* directly affects other aspects of a firm in the model, including, but not limited to, *Strategic planning for quality*, *Information and analysis*, *HR development and management*, and *Process management*. Improvements in *Leadership* significantly and positively influence all the Baldrige criteria. This finding aligns with those of Parast (2015) and Parast and Golmohammadi (2019). Second, the point estimate for the effect of *Leadership* on *Strategic planning for quality* is positive and significant, which was the largest coefficient for *Leadership* among the Baldrige criteria. This leads us to conclude that *Leadership* most strongly influences *Strategic planning for quality* when compared to other criteria. This suggests that even in small businesses, leaders should recognize the critical role that long-term strategic planning plays in improving quality. Our results also support the findings of Rowland-Jones (2013), who claimed that business planning in small businesses is an important determinant of a successful quality management implementation.

Our study also confirms the significant effect of *Information and analysis* on *Customer focus and satisfaction* in SMEs. This may seem obvious because processing customer information will clearly help to determine any expectations, dissatisfactions, and shortfalls that need addressing. This agrees with the findings of Meyer and Collier (2001) and the Baldrige theory, which emphasize the importance of information and data analysis. Next, because *Information and analysis* directly influences *Customer focus and satisfaction*, the effective use of data, measurement, and information enhances a small business's performance by supporting its decision-making processes. These empirical results support the argument put forward by some operations management scholars that coordination (information exchange) among providers (e. g., healthcare organizations) and customers (e.g., patients) is crucial to achieving a higher level of client/patient satisfaction (Boyer and Pronovost, 2010; Queenan et al., 2011). Therefore, if quality improvement is considered a strategic concern (Fundin et al., 2018), small businesses should invest in their information systems and knowledge-management infrastructure.

In addition, this study examines and illustrates the significant associations of *Strategic planning for quality* with *Customer focus and satisfaction* and *Quality and operational results* in small businesses. According to our results, *Strategic planning for quality* significantly and positively influences *Customer focus and satisfaction*, again indicating the critical

role that strategy plays in the quality management process for improving customer satisfaction and loyalty. In addition, *Strategic planning for quality* is a significant predictor of *Quality and operational results*, suggesting that *Strategic planning for quality* is central to improving organizational quality outcomes. However, the impact on quality and operational results is twice the impact on customer focus and satisfaction (in terms of the coefficients). In this regard, our findings support those of Stephens et al. (2005), who suggested that leadership and strategic planning play a critical role in improving the quality outcomes of small businesses.

Finally, our study reveals the crucial role that *Management of process quality* plays in *Quality and operational results* for small businesses. While previous studies have suggested that a lack of resources can inhibit a small business from investing in a process-management program (Ahire and Golhar, 1996), our findings show that *Management of process quality* is a significant driver of *Quality results*. Indeed, studies have shown that implementing a process approach to quality improvement, such as Lean or Six Sigma, leads to significant improvements in organizational processes and business outcomes (Assarlind and Ida Gremyr., 2016). We also recognize that SMEs are structured into four clusters: structure, contact, processes, and people. By emphasizing flexible processes, a low degree of standardization, and a result-oriented approach, small businesses can improve their organizational processes (Assarlind and Gremyr, 2014). Our findings support those of Zhao et al. (2008) and Harris et al. (2011), who demonstrated the importance of process management in successfully implementing a quality management program. It is also important to realize that as a small firm grows, implementing an integrated model to enhance the efficiency and effectiveness of the business becomes more important (Gélinas and Bigras, 2004; Morrissey and Pittaway, 2006).

Surprisingly, our data did not reveal any significant links for small businesses between *HR development and management* and either *Customer focus and satisfaction* or *Quality and operational results*. However, *HR development and management* did have positive effects on *Customer focus and satisfaction* and *Quality and operational results*. These coefficients were not statistically significant despite HR management serving an important function in any type of firm. One possible explanation for this lack of significance may lie in the relationship between firm size and the adoption of HR management practices (Vguyen & Bryant, 2004). This suggests that as a small business grows, it adopts more formalized HR management practices, and the effect then becomes more evident in promoting quality outcomes. Unfortunately, we lacked any measure of firm size to examine in this study. Another point concerns how small-business managers usually lack some of the necessary knowledge and skills for HR development and employee relations, making them less likely to apply effective HR management practices (Bartram, 2005).

6.1. Theoretical contributions

This study makes several theoretical contributions to the areas of small business management, operations management, and quality management, as well as informing policy and management practices. First, this study shows that the Baldrige model is an effective and comprehensive framework for diagnosing and improving all the quality-related aspects of a small business. In fact, this model goes beyond quality and operations management: It starts with evaluating a firm's leadership followed by its processes, information management, HR management, and strategy for quality. These are the main components for any organization; improving these hard and soft management elements can significantly enhance a small business's performance and outcomes, thus enhancing its resilience and reducing the risk of failure. As McKenzie and Woodruff (2016) confirm, better business management practices improve survival rates and sales growth in SMEs. Furthermore, according to NIST (2020), the application of the Baldrige model to small firms significantly improves several areas: customers' and employees' levels of satisfaction and engagement, product/service

outcomes, revenue and market share, and social responsibility. One of the main implications of this study is that it confirms that small businesses can apply the Baldrige model as a powerful and holistic self-assessment and diagnosis tool to improve their quality, operations, competitiveness, overall performance, and customer satisfaction, thereby improving business sustainability and performance.

The second theoretical contribution of this study concerns our knowledge of how SMEs can improve the different dimensions of their performances with the Baldrige model at a more detailed level. For instance, we found *Leadership* to be the key determinant of quality management practices in a small business, and this consequently affects all other quality (and even non-quality) performance aspects of the firm. This concurs with former studies on the implementation of quality management in small businesses (e.g., Rahman, 2001). The assessment of the correlation analysis also confirmed that *Leadership* had a strong association with *Quality and operational results* and *Customer focus and satisfaction*, one that is stronger than the correlation between *Leadership* and *Management of process quality*. This suggests the possible existence of an alternative relationship among the Baldrige criteria for small businesses.

Third, our study has made a significant theoretical contribution by examining all the Baldrige model criteria and measuring the magnitude of the impacts for the significant ones. As discussed earlier in the results section, *Leadership* had the largest coefficient among the Baldrige criteria, leading to the conclusion that *Leadership* impacts most strongly on *Strategic planning for quality* when compared to other criteria. In addition, improvements in *Leadership* significantly and positively influence all the other Baldrige criteria. This simple finding confirms the Baldrige theory that *Leadership* is the main driver of a system, and it agrees with the findings of Parast (2015) and Parast and Golmohammadi (2019) in that strong commitment and support from the senior leadership team for quality management programs is a key element in improving quality in small firms. We also determine the magnitude of the impacts of *Information and analysis* on *Customer focus and satisfaction*; *Strategic planning for quality* on *Customer focus/satisfaction* and *Quality and operational results*; and *Management of process quality* on *Quality and operational results*. Our study did not find any significant effects of *HR development and management* on either *Customer focus/satisfaction* or *Quality and operational results*.

Finally, our results provide other important knowledge about SMEs regarding the long-term impact of quality management practices on improving their quality results. While the literature contains mixed opinions about the effectiveness of quality management programs (Sterman et al., 1997; Nair, 2006; Bourke and Roper, 2017), we here shed some light on the long-term effect of a quality management program on the studied firms. By reviewing the effect over time and comparing it with our reference year (1991), we managed to provide some valuable insights for small businesses. A review of the coefficients for this effect in Table 4 shows how the coefficients change their signs from positive to negative. Since we use the first year's data (1991) as the reference point, we are comparing our outcome results with this reference point. This suggests that in comparison with 1991, we see gradual improvements from 1992 to 1996 (i.e., all coefficients are positive), but after 1996, all the coefficients turn negative again. This implies that while small businesses can improve their business results by implementing the Baldrige model, their quality outcomes start to degrade after 1996. This observation makes the theoretical contribution that quality management practices within SMEs are subject to diminishing returns over time. This interesting finding may explain previous mixed results about the effectiveness of quality management programs, because this phenomenon cannot be captured using cross-sectional surveys. It may also explain the emergence of alternative quality management programs such as Six Sigma and Lean practices as different approaches for further enhancing organizational quality outcomes.

6.2. Practical and managerial implications

This applied research provides effective insights for startup and SME owners and managers, who usually also control quality management practices in their firms. First and foremost, they can apply the Baldrige model to diagnose issues and reorganize, restructure, and streamline their processes, quality programs, and business operations. If small businesses are committed to improving their business efficiency and effectiveness, thereby gaining a competitive advantage, the Baldrige model is a robust and comprehensive choice of an assessment framework. Second, small businesses should recognize the critical importance of *Information and analysis*, the timely availability of accurate data, and effective customer relationship management to understand and address their expectations and needs and therefore use them in the product/service design and development phase. Satisfying and engaging customers, employees and other stakeholders is critical for an SME's business success and growth. Third, SMEs should recognize the importance of business process management as a major element of any business operation. Most quality improvement programs (e.g., TQM, ISO 9000, Kaizen, Lean, and Six Sigma) focus on business process improvement to improve business outcomes and *Quality and operational results*. Fourth, SME managers should pay more attention to developing strategic, long-term planning for quality, to address customer needs and overcome any shortfalls. Since *Strategic planning of quality* significantly influences both *Quality and operational results* and *Customer focus and satisfaction*, attention to it should be a top priority for the management team. Finally, SME managers should understand that the quality improvements associated with implementing the Baldrige criteria will diminish over time because there are simply more opportunities for improvement at the beginning of an implementation. They should therefore be prepared to initiate other quality management and process improvement programs like Six Sigma and Lean solutions to further improve their business processes, quality outcomes, customer satisfaction, and business performance.

6.3. Policy implications

Our study also has important policy implications for policymakers and regulators concerned with promoting better quality outcomes and competitiveness in small businesses. Our findings may be immediately applicable for managers and policymakers in organizations like the Small Business Administration (SBA), which is directly engaged in promoting quality and business excellence in small firms. This study's first implication for policy is that SMEs need support in three core areas: leadership, strategic planning, and process management. Although variations are expected across SMEs in their capabilities for quality management practices, it is important for regional and national agencies to establish policies to invest in organizational capabilities that will enhance quality outcomes.

Another policy implication relates to support for small businesses (e. g., grants and loans) in implementing policies promoted at the national level. For example, if a small business applies for a grant or loan, a national agency, such as the SBA, can consider the firm's level of quality management implementation as a decision criterion. Such a robust mechanism would not only ensure a fair decision-making process, but it would also send a signal to SMEs that improvements in quality practices will be reflected in the level of support they receive from national agencies. Such a system may be instrumental during global crises and disruptions, such as the ongoing COVID-19 pandemic, where governments are supporting small businesses through forgivable loans and grants (Hare, 2020). If such a mechanism were in place, the SBA would be able to include the quality performance of SMEs in the decision-making process and prioritize funding for those small businesses that have endeavored to improve their overall quality performance, although there would certainly be other criteria. We would then expect that SMEs with more robust quality management programs

would benefit more from such loans and grants, as government agencies would want to ensure that their investments in SMEs would not only preserve jobs but also create more value for the economy.

7. Limitations and future research

This study has limitations that can be addressed in future studies. The first limitation concerns the lack of access to the most recent Baldrige program data. Public data for the model's application to SMEs is available only for the 1990–2006 period; more recent data is still confidential. This study's findings would be more useful for researchers and practitioners if they were based on more recent MBNQA data. Despite this limitation, this study's empirical analysis of 16 years of MBNQA assessment data provides a robust assessment of the dynamics of quality systems in small businesses. To address this limitation, we used a case study approach and examined the critical success factors and best practices of small businesses that received the Baldrige award for small business in more recent years, which further supported our empirical findings for the 1991–2006 period. In addition, we recommend exploring other types of relationships among the Baldrige criteria that could be unique to small businesses. Because the majority of studies of the Baldrige criteria are conducted on large organizations, there are opportunities for further research to examine alternative models that would work for small businesses.

We are also mindful of the low number of observations for the most recent years. While this low number of observations can be a concern, we were able to use alternative estimation procedures that have less stringent restrictions on sample size. We understand that a large sample size provides more efficient parameter estimates; however, this appears to be a limitation of such studies on the Baldrige model because of the lack of access to more recent data and the confidentiality concerns associated with the Baldrige process.

Furthermore, including other parameters for firms—such as size, age, and annual revenue—in the analysis could provide further insight into the effects of organizational and contextual variables on the quality outcomes of SMEs. Research shows that small businesses that are more internationally oriented usually implement more advanced management practices (Lal, 2002). Thus, a potential avenue for study would be to assess the quality management practices of small businesses that received the MBNQA as successful case studies. Such a study could provide a deeper understanding of how small businesses improve quality and performance outcomes by following the Baldrige model. While we were able to examine the validity of the Baldrige model as reported in the literature, future studies could examine the validity of alternative models that relate quality management practices to organizational quality outcomes. This could provide new theoretical and practical insights for the quality management literature.

Care should be taken with regards to generalizing and extending the research findings. We studied data for small businesses in the U.S., but we expect that our results can be extended to other economies with similar management, social, and legal conventions. Since there are similar quality excellence models (e.g., the Deming Prize, the EFQM, and other national quality excellence awards based on the popular models), it would also be interesting to investigate their validity for improving quality and performance results, including in various economic and geographical settings, to compare, analyze, and generalize the effect of different quality award programs on SMEs.

Leadership (category 1)

This category asks how senior leaders' personal actions and the governance system guide and sustain the organization.

1.1 Senior leadership: how do your senior leaders lead the organization?

(1) How do SENIOR LEADERS set your organization's VISION and VALUES?
(2) HOW do SENIOR LEADERS' personal actions demonstrate their commitment to legal and ETHICAL BEHAVIOR?
(3) HOW do SENIOR LEADERS communicate with and engage the entire WORKFORCE, KEY PARTNERS, and KEY CUSTOMERS?
(4) HOW do SENIOR LEADERS create an environment for success now and in the future?
(5) HOW do SENIOR LEADERS create a focus on action that will achieve the organization's MISSION?

1.2 Governance and societal contributions: how do you govern your organization and make societal contributions?

(1) HOW does your organization ensure responsible GOVERNANCE?
(2) HOW do you evaluate the PERFORMANCE of your SENIOR LEADERS and your GOVERNANCE board?
(3) HOW do you address current and anticipate future legal, regulatory, and community concerns with your products and operations?
(4) HOW do you promote and ensure ETHICAL BEHAVIOR in all interactions?
(5) HOW do you consider societal well-being and benefit as part of your strategy and daily operations?
(6) HOW do you actively support and strengthen your KEY communities?

Strategic quality planning (category 2)

This category asks how the organization develops strategic objectives and action plans, implements them, adapts them if the circumstances require, and measures progress.

2.1 Strategy development: how do you develop your strategy?

1) HOW do you conduct your strategic planning?
(2) HOW does your strategy development PROCESS stimulate and incorporate INNOVATION?
(3) HOW do you collect and analyze relevant data and develop information for use in your strategic planning PROCESS?
(4) HOW do you decide which KEY PROCESSES will be accomplished by your WORKFORCE and which by external suppliers, PARTNERS, and COLLABORATORS?
(5) What are your organization's KEY STRATEGIC OBJECTIVES and timetable for achieving them?
(6) HOW do your STRATEGIC OBJECTIVES achieve appropriate balance among varying and potentially competing organizational needs?

2.2 Strategy implementation: how do you implement your strategy?

(1) What are your KEY short- and longer-term ACTION PLANS?
(2) HOW do you DEPLOY your ACTION PLANS?
(3) HOW do you ensure that financial and other resources are available to support the achievement of your ACTION PLANS while you meet current obligations?

(4) What are your KEY WORKFORCE plans to support your short- and longer-term STRATEGIC OBJECTIVES and ACTION PLANS?

(5) What KEY PERFORMANCE MEASURES or INDICATORS do you use to track the achievement and EFFECTIVENESS of your AC-TION PLANS?

(6) For these KEY PERFORMANCE MEASURES or INDICATORS, what are your PERFORMANCE PROJECTIONS for your short- and longer-term planning horizons?

(7) HOW do you recognize and respond when circumstances require a shift in ACTION PLANS and rapid execution of new plans?

Customer focus and satisfaction (category 3)

This category asks how the organization engages with its customers for long-term market success, including how it listens to the voices of customers and serves or even exceeds their expectations, as well as how it builds relationships with these customers.

3.1 customer expectations: how do you listen to your customers and determine products and services to meet their needs?

1) HOW do you listen to, interact with, and observe CUSTOMERS* to obtain actionable information?

(2) HOW do you listen to potential CUSTOMERS to obtain actionable information?

(3) HOW do you determine your CUSTOMER groups and market SEGMENTS?

(4) HOW do you determine product offerings?

3.2 Customer engagement: how do you build relationships with customers and determine satisfaction and engagement?

(1) HOW do you build and manage CUSTOMER relationships?

(2) HOW do you enable CUSTOMERS to seek information and support?

(3) HOW do you manage CUSTOMER complaints?

(4) HOW do you determine CUSTOMER satisfaction, dissatisfaction, and ENGAGEMENT?

(5) HOW do you obtain information on CUSTOMERS′ satisfaction with your organization relative to other organizations?

(6) HOW do you use VOICE–OF–THE-CUSTOMER and market data and information?

Information and analysis (category 4)

In simple terms, Category 4 is the "brain center" for aligning the organizations operations with its strategic objectives.

4.1 Measurement, analysis, and improvement of organizational performance: how do you measure, analyze, and then improve organizational performance?

(1) HOW do you track data and information on daily operations and overall organizational PERFORMANCE?

(2) HOW do you select comparative data and information to support fact-based decision making?

(3) HOW do you ensure that your PERFORMANCE measurement system can respond to rapid or unexpected organizational or external changes and provide timely data?

(4) HOW do you review your organization's PERFORMANCE and capabilities?

(5) HOW do you project your organization's future PERFORMANCE?

(6) HOW do you use findings from PERFORMANCE reviews to develop priorities for continuous improvement and opportunities for INNOVATION?

4.2 Information and knowledge management: how do you manage your information and your organizational knowledge assets?

(1) HOW do you verify and ensure the quality of organizational data and information?

(2) HOW do you ensure the availability of organizational data and information?

(3) HOW do you build and manage organizational knowledge?

(4) HOW do you share best practices in your organization?

(5) HOW do you use your knowledge and resources to embed LEARNING in the way your organization operates?

HR development and management (category 5)

This category addresses key workforce practices directed at creating and maintaining a high-performance environment and engaging with the workforce to enable it and the organization to adapt to change and ultimately succeed.

5.1 Workforce environment: how do you build an effective and supportive workforce environment?

(1) HOW do you assess your WORKFORCE CAPABILITY and CA-PACITY needs?

(2) HOW do you recruit, hire, and onboard new WORKFORCE members?

(3) HOW do you prepare your WORKFORCE for changing CAPA-BILITY and CAPACITY needs?

(4) HOW do you organize and manage your WORKFORCE?

(5) HOW do you ensure workplace health, security, and accessibility for the WORKFORCE?

(6) HOW do you support your WORKFORCE via services, benefits, and policies?

5.2 Workforce engagement: how do you engage your workforce for retention and high performance?

(1) HOW do you determine the KEY drivers of WORKFORCE ENGAGEMENT?

(2) HOW do you assess WORKFORCE ENGAGEMENT?

(3) HOW do you foster an organizational culture that is characterized by open communication, HIGH PERFORMANCE, and an engaged WORKFORCE?

(4) HOW does your WORKFORCE PERFORMANCE management system support HIGH PERFORMANCE?

(5) HOW does your LEARNING and development system support the personal development of your WORKFORCE members and your organization's needs?

(6) HOW do you evaluate the EFFECTIVENESS and efficiency of your LEARNING and development system?

(7) HOW do you manage career development for your WORKFORCE and your future leaders?

Management of process quality (category 6)

This category asks how the organization focuses on its work, the

design and delivery of products and services, innovation, and operational effectiveness to achieve organizational success now and in the future.

6.1 Work processes: how do you design, manage, and improve your key products and work processes?

(1) HOW do you determine KEY product* and WORK PROCESS requirements?
(2) What are your organization's KEY WORK PROCESSES?
(3) HOW do you design your products and WORK PROCESSES to meet requirements?
(4) HOW does your day-to-day operation of WORK PROCESSES ensure that they meet KEY PROCESS requirements?
(5) HOW do you determine your KEY support PROCESSES?
(6) HOW do you improve your WORK PROCESSES and support PROCESSES to improve products and PROCESS PERFORMANCE, enhance your CORE COMPETENCIES, and reduce variability?
(7) HOW do you manage your supply network?
(8) HOW do you pursue your opportunities for INNOVATION?

6.2 Operational effectiveness: how do you ensure effective management of your operations?

(1) HOW do you manage the cost, efficiency, and EFFECTIVENESS of your operations?
(2) HOW do you ensure the security and cybersecurity of sensitive or privileged data and information and of KEY assets?
(3) HOW do you provide a safe operating environment?
(4) HOW do you ensure that your organization is prepared for disasters or emergencies?

Quality and operational results (category 7)

This category provides a systematic focus that encompasses all the results necessary to sustain an enterprise: the key process and customer-focused results, workforce results, leadership and governance system results, and the overall financial and market performance.

7.1 Product and process results: what are your product performance and process effectiveness results?

(1) What are your RESULTS for your products and your CUSTOMER service processes?

(2) What are your PROCESS EFFECTIVENESS and efficiency RESULTS?
(3) What are your safety and emergency preparedness RESULTS?
(4) What are your supply-network management RESULTS?

7.2 Customer results: what are your customer-focused performance results?

(1) What are your CUSTOMER satisfaction and dissatisfaction RESULTS?
(2) What are your CUSTOMER ENGAGEMENT RESULTS?

7.3 Workforce results: what are your workforce-focused performance results?

(1) What are your WORKFORCE CAPABILITY and CAPACITY RESULTS?
(2) What are your WORKFORCE climate RESULTS?
(3) What are your WORKFORCE ENGAGEMENT RESULTS?
(4) What are your WORKFORCE and leader development RESULTS?

7.4 Leadership and governance results: what are your senior leadership and governance results?

(1) What are your RESULTS for SENIOR LEADERS' communication and engagement with the WORKFORCE, PARTNERS, and CUSTOMERS?
(2) What are your RESULTS for GOVERNANCE accountability?
(3) What are your legal and regulatory RESULTS?
(4) What are your RESULTS for ETHICAL BEHAVIOR?
(5) What are your RESULTS for societal well-being and support of your KEY communities?

7.5. Financial, market, and strategy results: what are your results for financial viability and strategy implementation?

(1) What are your financial PERFORMANCE RESULTS?
(2) What are your marketplace PERFORMANCE RESULTS?
(3) What are your RESULTS for the achievement of your organizational strategy and ACTION PLANS?

Dimensions of Baldrige Criteria

Construct	Items
1. Leadership (LEA)	1) Senior Leadership: How do your senior leaders lead the org.?
	2) Governance and Societal Contributions: How do you govern your organization and make societal contributions?
2. Strategic Quality Planning (STR)	1) Strategy Development: How do you develop your strategy?
	2) Strategy Implementation: How do you implement your strategy?
3. Customer Focus and Satisfaction (CFS)	1) Customer Expectations: How do you listen to your customers and determine products and services to meet their needs?
	2) Customer Engagement: How do you build relationships with customers and determine satisfaction and engagement?
4. Information and Analysis (INF)	1) Measurement, Analysis, and Improvement of Organizational Performance: How do you measure, analyze, and then improve organizational performance?
	Information and Knowledge Management: How do you manage your information and your organizational knowledge assets?
5. Human Resource Development and Management (HRD)	1) Workforce Environment: How do you build an effective and supportive workforce environment?
	2) Workforce Engagement: How do you engage your workforce for retention and high performance?
6. Management of Process Quality (PRO)	1) Work Processes: How do you design, manage, and improve your key products and work processes?
	2) Operational Effectiveness: How do you ensure effective management of your operations?
7. Quality and Operational Results (RES)	1) Product and Process Results: What are your product performance and process effectiveness results?
	2) Customer Results: What are your customer-focused performance results?
	3) Workforce Results: What are your workforce-focused performance results?
	4) Leadership and Governance Results: What are your senior leadership and governance results?
	5) Financial, Market, and Strategy Results: What are your results for financial viability and strategy implementation?

Pairwise Correlations Among Sub-Items of the Baldrige Criteria (Above Table)

	1.1	1.2	2.1	2.2	3.1	3.2	4.1	4.2	5.1	5.2	5.3	6.1	6.2	7.1	7.2	7.3	7.4
1.1	1	.813**	.676**	.626**	.663**	.540**	.622**	.616**	.568**	.531**	.538**	.487**	.565**	.649**	.669**	.677**	.574**
1.2		.813**	1	.631**	.622**	.636**	.523**	.614**	.633**	.563**	.523**	.555**	.470**	.561**	.643**	.661**	.681**	.645**
2.1	.676**		.631**	1	.713**	.667**	.615**	.624**	.560**	.605**	.586**	.612**	.508**	.581**	.640**	.614**	.657**	.591**
2.2		.626**	.622**	.713**	1	.659**	.624**	.681**	.662**	.646**	.578**	.624**	.565**	.595**	.635**	.562**	.568**	.500**
3.1	.663**	.636**	.667**	.659**	1	.791**	.745**	.582**	.612**	.555**	.616**	.627**	.655**	.568**	.528**	.580**	.473**
3.2	.540**	.523**	.615**	.624**	.791**	1	.765**	.470**	.566**	.541**	.652**	.614**	.563**	.503**	.470**	.490**	.422**
4.1	.622**	.614**	.624**	.681**	.745**	.765**	1	.639**	.585**	.560**	.659**	.627**	.637**	.507**	.499**	.538**	.443**
4.2	.616**	.633**	.560**	.662**	.582**	.470**	.639**	1	.569**	.552**	.517**	.509**	.638**	.528**	.511**	.590**	.540**
5.1	.568**	.563**	.605**	.646**	.612**	.566**	.585**	.569**	1	.748**	.660**	.507**	.508**	.480**	.475**	.477**	.444**
5.2	.531**	.523**	.586**	.578**	.555**	.541**	.560**	.552**	.748**	1	.663**	.513**	.519**	.467**	.433**	.501**	.493**
5.3	.538**	.555**	.612**	.624**	.616**	.652**	.659**	.517**	.660**	.663**	1	.644**	.567**	.442**	.500**	.535**	.501**
6.1	.487**	.470**	.508**	.565**	.627**	.614**	.627**	.509**	.507**	.513**	.644**	1	.718**	.402**	.374**	.431**	.357**
6.2	.565**	.561**	.581**	.595**	.655**	.563**	.637**	.638**	.508**	.519**	.567**	.718**	1	.506**	.449**	.596**	.505**
7.1	.649**	.643**	.640**	.635**	.568**	.503**	.507**	.528**	.480**	.467**	.442**	.402**	.506**	1	.780**	.696**	.666**
7.2	.669**	.661**	.614**	.562**	.528**	.470**	.499**	.511**	.475**	.433**	.500**	.374**	.449**	.780**	1	.730**	.676**
7.3	.677**	.681**	.657**	.568**	.580**	.490**	.538**	.590**	.477**	.501**	.535**	.431**	.596**	.696**	.730**	1	.723**
7.4	.574**	.645**	.591**	.500**	.473**	.422**	.443**	.540**	.444**	.493**	.501**	.357**	.505**	.666**	.676**	.723**	1

Covariances: (Group number 1 - Default model)

	Path		Estimate	Standard Error	Critical Ration	p-value
D2001	<->	D2000	-.004	.002	−1.806	.071
LEAD	<->	D2000	.003	.002	1.876	.061
LEAD	<->	D2001	-.001	.002	-.414	.679
LEAD	<->	D2002	-.002	.002	−1.061	.289
LEAD	<->	D2003	-.004	.002	−2.449	.014
LEAD	<->	D2004	-.001	.002	-.900	.368
LEAD	<->	D2005	-.001	.002	-.679	.497
LEAD	<->	D2006	-.001	.002	-.738	.460
D2001	<->	D2002	-.005	.002	−2.153	.031
D2000	<->	D2002	-.004	.002	−1.518	.129
D2000	<->	D2003	-.001	.002	-.323	.747
D2000	<->	D2004	-.002	.002	-.768	.442
D2000	<->	D2005	-.002	.002	−1.145	.252
D2000	<->	D2006	-.002	.002	−1.086	.277
D2001	<->	D2003	-.004	.002	−1.774	.076
D2001	<->	D2004	-.003	.002	−1.547	.122
D2001	<->	D2005	-.002	.002	−1.055	.291
D2001	<->	D2006	-.002	.002	−1.134	.257
D2002	<->	D2003	-.005	.002	−1.953	.051
D2002	<->	D2004	-.004	.002	−1.646	.100
D2002	<->	D2005	-.003	.002	−1.170	.242
D2002	<->	D2006	-.003	.002	−1.264	.206
D2003	<->	D2004	-.005	.002	−2.600	.009
D2003	<->	D2005	-.004	.002	−1.827	.068
D2003	<->	D2006	-.004	.002	−1.896	.058
D2004	<->	D2005	-.003	.002	−1.607	.108
D2005	<->	D2006	-.004	.002	−2.129	.033
D2004	<->	D2006	-.003	.002	−1.344	.179
D1994	<->	D1992	-.024	.005	−4.447	***
D1992	<->	D1996	-.011	.003	−3.356	***
D1992	<->	D1998	-.019	.005	−3.811	***
D1992	<->	D1993	-.007	.006	−1.176	.239
D1992	<->	D1995	-.017	.005	−3.724	***
D1992	<->	D1997	-.010	.004	−2.850	.004
D2000	<->	D1992	-.010	.004	−2.660	.008
D2001	<->	D1992	-.005	.004	−1.436	.151
D2002	<->	D1992	-.005	.004	−1.119	.263
D2004	<->	D1992	-.001	.004	-.355	.723
D2005	<->	D1992	-.002	.004	-.642	.521
D2006	<->	D1992	-.002	.003	-.606	.544
D1994	<->	D1993	-.019	.005	−3.814	***
D1996	<->	D1993	-.009	.003	−2.905	.004
D1998	<->	D1993	-.011	.004	−2.543	.011
D1993	<->	D1995	-.007	.004	−1.654	.098
D1993	<->	D1997	-.010	.003	−2.881	.004
D1993	<->	D1999	-.004	.003	−1.348	.178
D2000	<->	D1993	-.003	.003	-.969	.332
D1998	<->	D1995	-.004	.003	−1.093	.274
D1995	<->	D1997	.003	.002	1.057	.290
D1995	<->	D1999	.001	.002	.234	.815
D2001	<->	D1995	.003	.002	1.256	.209
D2002	<->	D1995	.000	.003	.085	.933
D2004	<->	D1995	-.001	.002	-.447	.655
D2005	<->	D1995	-.005	.002	−2.034	.042
D2006	<->	D1999	-.003	.002	−1.435	.151
D1992	<->	D1999	-.007	.003	−2.262	.024

Correlations: (Group number 1 - Default model)

	Path		Estimate
D2001	<–>	D2000	-.132
LEAD	<–>	D2000	.150
LEAD	<–>	D2001	-.033
LEAD	<–>	D2002	-.081
LEAD	<–>	D2003	-.200
LEAD	<–>	D2004	-.069
LEAD	<–>	D2005	-.052
LEAD	<–>	D2006	-.056
D2001	<–>	D2002	-.154
D2000	<–>	D2002	-.110
D2000	<–>	D2003	-.023
D2000	<–>	D2004	-.055
D2000	<–>	D2005	-.082
D2000	<–>	D2006	-.078
D2001	<–>	D2003	-.128
D2001	<–>	D2004	-.109
D2001	<–>	D2005	-.075
D2001	<–>	D2006	-.080
D2002	<–>	D2003	-.139
D2002	<–>	D2004	-.115
D2002	<–>	D2005	-.082
D2002	<–>	D2006	-.088
D2003	<–>	D2004	-.185
D2003	<–>	D2005	-.129
D2003	<–>	D2006	-.134
D2004	<–>	D2005	-.112
D2005	<–>	D2006	-.148
D2004	<–>	D2006	-.093
D1994	<–>	D1992	-.321
D1992	<–>	D1996	-.208
D1992	<–>	D1998	-.287
D1992	<–>	D1993	-.078
D1992	<–>	D1995	-.290
D1992	<–>	D1997	-.194
D2000	<–>	D1992	-.174
D2001	<–>	D1992	-.092
D2002	<–>	D1992	-.071
D2004	<–>	D1992	-.022
D2005	<–>	D1992	-.041
D2006	<–>	D1992	-.036
D1994	<–>	D1993	-.295
D1996	<–>	D1993	-.202
D1998	<–>	D1993	-.197
D1993	<–>	D1995	-.132
D1993	<–>	D1997	-.211
D1993	<–>	D1999	-.096
D2000	<–>	D1993	-.069
D1998	<–>	D1995	-.098
D1995	<–>	D1997	.090
D1995	<–>	D1999	.019
D2001	<–>	D1995	.099
D2002	<–>	D1995	.007
D2004	<–>	D1995	-.034
D2005	<–>	D1995	-.159
D2006	<–>	D1999	-.105
D1992	<–>	D1999	-.150

Appendix 1. The Baldrige Criteria

https://www.nist.gov/system/files/documents/2019/02/06/2019-2020-baldrige-excellence-builder.pdf.

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