

Firm characteristics, total quality management, and financial performance

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Abstract

This paper uses a sample of quality award winners to empirically test hypotheses that relate changes in operating income associated with effective implementation of total quality management (TQM) to various firm characteristics. The characteristics examined are firm size, the degree of capital intensity, the degree of diversification, the timing of TQM implementation, and the maturity of the program. We find that smaller firms do significantly better than larger firms. Firms that have won awards from independent award (a proxy for more mature TQM implementation) do significantly better than just supplier award winners. The evidence weakly supports the hypotheses that less capital-intensive firms do better than more capital-intensive firms, and more focused firms do better than more diversified firms. Finally, we do not observe any significant differences between the performance of earlier and later implementers of effective TQM.

The key implications of these results are that many organizational characteristics moderate the benefits of TQM implementation. Although not all of these characteristics are controllable by managers, managers must set realistic expectations for the degree of benefits from TQM. The results for size and capital-intensity validate the importance of TQM practices for smaller firms and environments that are more labor intensive. Investing to achieve a broader, deeper, and more mature TQM implementation (possibly by targeting an independent TQM award) should also result in higher benefits from TQM implementation. Furthermore, the results indicate that it is never too late to invest in TQM. © 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

Recently, many researchers have examined the link between total quality management (TQM) and financial performance. Christiansen and Lee (1994), Ittner and Larcker (1996), Hendricks and Singhal (1997,

1999) and Easton and Jarrell (1998) provide evidence to show that effective TQM implementations improve long-term profitability and stock returns. Flynn et al. (1995a,b) report that higher intensity of TQM practices results in improved quality performance. The conclusion from these studies is that effective implementation of TQM improves financial performance.

This paper extends the existing research on TQM and financial performance by examining how the impact of TQM on financial performance is moderated by various firm characteristics. For example, the time and cost to implement TQM could vary across firms,

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the extent of potential gain from implementing TQM could be impacted by a firm's technology, and the synergies in implementing TQM could be dependent on the number of different markets that a firm operates in. Furthermore, the gains from TQM could be a function of how intensely TQM is implemented, and when it is implemented relative to competitors. Since such differences do exist among firms, we expect the impact of TQM to be different across different firms.

The three primary concepts of TQM — the cost of quality, total customer satisfaction, and organizational learning — also suggest that the benefits of TQM will be moderated by firm characteristics. For example, the cost of quality concept predicts that as conformance quality increases the total cost of quality decreases. Obviously, the higher the initial conformance quality, the smaller the resulting benefit from improvements. Thus, one might expect firms with already tight process controls to see lower benefits from TQM. The concept of total customer satisfaction predicts that higher customer satisfaction should lead to higher retention rates, increased market share, and higher profitability. The concept of organizational learning involves teaching an organization to use the scientific method, to create and utilize specific knowledge, and to change its performance measurement systems. The ability to successfully implement customer responsiveness and organizational learning is likely to vary by firm characteristics.

This paper relates financial performance from effective implementation of TQM to specific firm characteristics. It documents the extent to which the financial impact of TQM varies by firm characteristics, and tests whether the magnitude of observed differences are statistically significant. The characteristics examined are firm size, the degree of capital intensity, the degree of diversification, the maturity of the TQM implementation, and the timing of effective TQM implementation.

There are a number of reasons why it is important to understand how the financial impact of TQM varies by firm characteristics. First, the success and failure of TQM implementations are often judged by comparing the actual benefits against prior expectations. It seems to us that in many cases expectations about the potential benefits of TQM are based on a few well-publicized success stories such as Motorola, Xerox, and Milliken and Co. The experience of these

firms may not apply to all firms. If firms set high and unrealistic expectations about what TQM can deliver, even those TQM implementations that have delivered good results but below expectations may be perceived to be failures. By providing evidence on how TQM affects the financial performance of firms with different characteristics, we provide an empirical basis for forming realistic expectations about the benefits from TQM.

Second, many firms are often able to estimate how much investment is required to implement TQM. Investment could include items such as training costs, cost of implementing new information and performance measurement systems in place, redeployment of resources, and other capital investments to improve quality and increase customer satisfaction. However, the benefits of implementing TQM are much harder to estimate as it could vary by firms. Evidence on how the gains vary by firm characteristics could be used to justify TQM investments as firms can base their return calculations on the actual experiences of firms with similar characteristics.

Third, despite the widespread adoption of TQM, it has come under increasing criticism for delivering lackluster economic returns. *Business Week* (Byrne, 1997), *The Economist* (1995), *Wall Street Journal* (Fuchsberg, 1992a,b), and *USA Today* (1995), among others, have featured articles that question whether TQM has created significant economic value. Much of the criticisms about TQM seem to be motivated by results from studies done by consulting firms who generally report management perceptions about whether TQM is beneficial or not, but make little effort to assess the basis for these perceptions (see, for example, the studies discussed in Kelly (1992) and *The Economist* (1992)). These studies rarely provide objective data backed by statistical evidence to support their claims. By documenting how the financial impact of TQM is influenced by firm characteristics, we provide more detailed evidence on the value of TQM. This hopefully will help move the discussion on the value creation potential of TQM to hard and rigorously tested facts instead of perceptual and anecdotal data.

Finally, the issue of how the gains from TQM vary by firm characteristics has not yet been extensively explored in the literature. Our research makes an initial effort to explore this issue.

Section 2 develops the hypotheses examined in this paper. Section 3 describes sample selection and issues related to methodology. Section 4 describes the main empirical results and various sensitivity analyses. The final section summarizes the paper.

2. Hypotheses

This section discusses our hypotheses regarding firm characteristics and financial performance associated with implementing TQM effectively.

2.1. Firm size

Firm size is probably one of the single most influential variables in organizational studies. Chen and Hambrick (1995), and Mintzberg (1979) provide a summary and overview of the importance of firm size. Firm size has also been shown to be related to industry-sunk costs, concentration, vertical integration, and overall industry profitability (Dean et al., 1998). Larger firms are more likely to have more layers of management, greater number of departments, increased specialization of skills and functions, greater formalization, greater centralization, and greater bureaucracy than smaller firms (Daft, 1995). In addition, recent research has found an association between firm size and 'inertia' where inertia is typically defined as inadequate or slow adaptation to change or resistance to fundamental changes in conducting business (Miller and Chen, 1994). Inertia can be caused by 'constraints on action' such as bureaucratic rigidity, insularity, and institutional networks, all of which tend to be associated with firm age and size (Miller and Chen, 1994; Hannan and Freeman, 1984; Aldrich and Austen, 1986; Meyer and Zucker, 1989). Starbuck (1985) argues that inertia can make change more costly and harder to achieve and maintain.

Based on these arguments, we expect firm size to be an important predictor for financial performance associated with TQM. The widely accepted view is that implementing TQM effectively requires that firms move away from inspection toward approaches that are based on prevention and customer focus (Deming, 1986; Juran and Gryna, 1980; Crosby, 1984). The elements to achieve this include top management commitment, training and education of employees, employee involvement, continuous process improvement,

developing long-term relationships with suppliers, and a real focus on quality throughout the organization. These steps are difficult to implement because they involve drastic changes in management philosophy and management/labor relations, such as breaking down functional barriers, encouraging and rewarding team effort, changing the nature of information provided to workers, empowerment, and changing performance measurement and reward systems.

Since larger firms are more likely to have more layers of management, be organized across functional lines, have long standing barriers between functional departments, and have a bigger and entrenched bureaucracy and more inertia to change when compared to smaller firms, one would expect that larger firms would experience greater resistance to change and would require higher expenditures to implement and maintain TQM (Kelly, 1992). Furthermore, many of the key elements of TQM such as teamwork, empowerment, spirit of co-operation across functional departments are already present to some extent in smaller firms, thereby lowering their costs of implementing and maintaining TQM (Struebing and Klaus, 1997). Larger firms may also find it more difficult to maintain an atmosphere of continuous improvement (which requires continuous change) than smaller firms (Starbuck, 1985). Hence, maintaining an effective TQM implementation is likely to be more difficult for larger firms than smaller firms. Our hypothesis, stated in alternate form (as are all the hypotheses in this paper), is as follows.

Hypothesis 1. Smaller firms with effective TQM implementations will have higher rate of change in profitability than larger firms with effective TQM implementations.

Note that the hypothesis on firm size is about the extent of change (as are all the hypotheses in this paper) from effectively implementing TQM in smaller versus larger firms. It does not imply that smaller firms will have higher or lower financial performance levels than larger firms.

2.2. Capital intensity of the firm

There are at least two main reasons why we expect the gains from effectively implementing TQM to be

related to the capital intensity of the firm. First, the high degree of automation in higher capital-intensive firms may already enable these firms to have a high degree of inherent process control. Hence, the potential for process improvement from TQM practices may be less. On the other hand, in lower capital-intensive (more labor intensive) firms, the lack of automation and the dependence of process control on the skills and motivation of the workforce are likely to offer more opportunities for process improvements. Hence, the potential for cost reductions from adopting TQM practices may be higher for lower capital-intensive environments than higher capital-intensive environments.

Second, an important component of TQM is the implementation of work practices such as employee training, information sharing, involvement, and empowerment. Employees are the driving force for improvements originating from activities such as quality circles, cross-functional teams, process improvement teams, customer orientation, and suggestion plans. Clearly, the opportunities for gains from these activities are likely to be higher in a lower capital-intensive environment than in a higher capital-intensive environment. Thus, our hypothesis is as follows.

Hypothesis 2. Lower capital-intensive firms with effective TQM implementations will have higher rate of change in profitability than higher capital-intensive firms with effective TQM implementations.

2.3. Firm diversification

Many researchers have studied the relationship between firm diversification and performance. Datta et al. (1991), Hoskisson and Hitt (1990), and Ramanujam and Varadarajan (1989) provide excellent surveys, analyses, and critiques of previous findings. An important observation in these papers is that there does not seem to be any consistent or conclusive findings between firm diversification and performance. Interestingly, Stimpert and Duhaime (1997) argue that the inconsistencies are due to the fact the diversification impacts other variables, which in turn determines firm performance. For example, they suggest that diversification may influence performance indirectly by increasing administrative complexity and bureaucratic costs. In fact, their study shows that diversification

has a negative relationship with the amount of R&D spending. Thus, diversification may impact negatively the amount of strategic investments in the development of new product or process technologies.

Given that TQM does represent an investment in improving products and processes, Stimpert and Duhaime's (1997) results may argue for a negative relation between firm diversification and performance associated with TQM. Since firm size and diversification are positively correlated (Daft, 1995), the arguments about inertia and constraints on action related to firm size could also apply to diversification.

In addition because a less diversified firm operates in one or few industries, the different operating units in a less diversified firm are likely to be very similar in terms of organizational culture, technology, operating procedures, and competitive priorities. Therefore, the lessons learned from a successful implementation of TQM in one operating unit can easily and efficiently be implemented in other operating units. More specifically, the approaches, procedures, techniques, and systems developed at one operating unit should be applicable and transferable at low cost to other operating units. Furthermore, as operating units gain experience with TQM, the specific knowledge created in the process can be transferred at low cost to other units. In addition, synergies among product quality improvements are more likely. A higher quality product in one area is more likely to reflect well on similar products in related areas.

On the other hand, since a more diversified firm operates in many industries, the different operating units are likely to differ significantly in terms of organizational culture, technology, operating procedures, and competitive priorities. Therefore, the approaches, procedures, and systems necessary to maintain an effective TQM implementation would differ across different operating units. Each unit would have to invest resources to identify what works best for that unit. The learning and knowledge gained in one unit would be harder to transfer and apply to other units, other products, and other markets. Thus, our hypothesis is as follows.

Hypothesis 3. Less diversified firms with effective TQM implementations will have higher rate of change in profitability than more diversified firms with effective TQM implementations.

Table 1
Names of some quality award givers whose award recipients are included in the sample

Organizations that give awards to their suppliers	Independent award givers
Auto Alliance International Inc.	Alabama Senate Productivity & Quality Award
Chrysler Corp.	Arizona's Governor's Award for Quality
Consolidated Rail	California Governor's Golden State Quality Awards
Eastman Kodak Co.	Connecticut Quality Improvement Award
Ford Motor Co.	Delaware Quality Award
General Motors Corp.	Florida Governor's Sterling Award
General Electric	Maine State Quality Award
Goodyear Tires	Malcolm Baldrige National Quality Award
GTE Corp.	Maryland Senate Productivity Award
Honda of America Manufacturing Inc.	Massachusetts Quality Award
International Business Machines	Michigan Quality Award
J.C. Penny & Co.	Minnesota Quality Award
Lockheed Corp.	Missouri Quality Award
Minnesota Mining and Manufacturing	Nebraska Edgerton Quality Award
National Aeronautical and Space Authority	New Mexico Quality Award
New United Motor Manufacturing Inc.	New York Governor's Excelsior Award
Toyota Motor Manufacturing USA Inc.	North Carolina Quality Leadership Award
Nissan Motor Manufacturing Corp. USA	Oklahoma Quality Award
Pacific Bell	Oregon Quality Award
Sears Roebuck & Co.	Pennsylvania Quality Award
Texas Instrument Co.	Rhode Island Award for Quality Excellence
TRW Inc.	Shingo Prize
Xerox Corp.	Texas Quality Award
Union Carbide	Tennessee Quality Award
Westinghouse	Virginia Senate Productivity & Quality Award
Whirlpool	Washington State Quality Award

2.4. Maturity of the TQM implementation

As described in detail in Section 3, the results of this paper are based on a sample of quality award winners. Different award givers use different criteria for evaluating quality management initiatives, and have different standards to qualify for the awards. Furthermore, the extent of competition differs across awards. Therefore, different awards could be indicative of different levels of maturity in TQM implementations. To examine this issue we classify award givers into two groups: (1) supplier awards which are given by customers to their suppliers, and (2) independent awards given by organizations such as the National Institute of Standards and Technology, which administers the Malcolm Baldrige Award, and the various state quality organizations. Table 1 gives some examples of supplier and independent award givers whose winners are included in our sample.

Three main reasons motivate us to use the winning of supplier awards as a proxy for less mature, and winning of independent awards as a proxy for more mature TQM implementations. First, most firms that give awards to their suppliers require that their suppliers periodically enter the award competition and go through the evaluation process. Awards are then given as long as the winners meet some minimum criteria. In contrast, competing for awards from independent award givers is voluntary. This suggests that firms that have more effective TQM implementations are more likely to enter independent award competitions. Thus, winning an independent award could be a stronger indication about the maturity of a firm's TQM implementation. Second, our review of the documents obtained from a number of award givers seems to indicate that independent award givers cover more aspects of TQM, place a heavier emphasis on the process of implementation, and the evaluation is more comprehensive and stringent when compared to typical supplier awards givers. Third, much of the literature also seems to im-

ply that winning an independent award could indicate a more mature TQM implementation (Garvin, 1991; Easton, 1993; Ghosh et al., 1997). Thus, our hypothesis is as follows.

Hypothesis 4. Independent award winners (more mature TQM implementations) will have higher rate of change in profitability than supplier award winners (less mature TQM implementations).

2.5. *Timing of effective TQM implementation*

One would expect that firms that are among the early ones to effectively implement TQM would experience the benefits typically associated with being 'first-to-the-market'. For example, earlier implementers could improve the quality of their products while lowering costs, and therefore be able to offer higher quality products at the same or lower prices earlier than their competition. Earlier implementers could also be the first to increase customer satisfaction, and capitalize on benefits such as increased customer loyalty and reduced price sensitivity. Lederer and Rhee's (1995) model shows that early adopters can earn positive abnormal returns when competitors are slow to adopt TQM. Our hypothesis is as follows.

Hypothesis 5. Firms that effectively implement TQM earlier will have higher rate of change in profitability than firms that effectively implement TQM later.

3. Selection of sample and methodology

3.1. *Sample selection*

We use the winning of quality awards as the proxy for effective implementation of TQM. There are a number of reasons why this is a reasonable choice. Our review of the criteria of various national, state, and supplier quality awards indicates that the core concepts and values emphasized are typically those that are widely considered to be the building blocks of effective TQM implementations. Furthermore, quality awards are given after the applicant typically goes through a multi-level evaluation process where a group of experts judge the applicants against the criteria,

thereby ensuring award winners are effectively implementing and practicing TQM.

There is a fair amount of academic literature that has used various quality award criteria to describe and research various aspects of TQM (see, for example, Garvin, 1991; Easton, 1993; Adams et al., 1996; Hendricks and Singhal, 1996, 1997, 1999; Ghosh et al., 1997). Furthermore, many organizations use quality award criteria to define and benchmark their TQM practices and to conduct internal self-assessments (Haim, 1993). Finally, most books that cover quality management typically discuss quality awards and their role in TQM. Given this, we make the case that quality awards are proxies for effective TQM implementation.

We note that there are at least two other approaches that have been used to identify firms that could have effectively implemented TQM. One approach uses surveys to collect information on managers' perception on the intensity with which key TQM practices are deployed in their organizations (Flynn et al., 1994; Ghosh et al., 1997). Although these studies do not explicitly categorize the responding firms as effective implementers or not, it is implicit that more intense and extensive deployment of key TQM practices leads to more effective implementations. The other approach uses interviews conducted by TQM experts to assess the state of TQM efforts, and identify firms that have made significant progress in implementation (Easton and Jarrell, 1998). Conceptually, these approaches are similar to the process award givers follow to identify firms that deserve their quality awards.

Our sample of quality award winners is from three sources. First, from announcements of quality awards in the Wall Street Journal, PR Newswires, Business Wires, and Dow Jones News Service. Second, from lists of quality award winners published in monthly publications such as Automotive Engineering, Business Electronics, Distribution, and Ward's Auto World. Third, by contacting a number of award givers for a list of their award winners.

To avoid the biases associated with asking winners to self-judge the financial impact of TQM, we focus on the financial performance of publicly traded award winners in our sample. It also makes the task of gathering financial data manageable, as it is available electronically in databases. Furthermore, it provides the flexibility to use objective and historical financial data

as far back as necessary on uniformly defined performance measures. Compustat Annual Industrial File is our primary source of financial information.

3.2. Setting the time period for measuring performance

For each winner, we identified the year when they won their first quality award. This establishes the year when the winner had a reasonably effective TQM implementation in place. It typically takes award givers about 6–8 months to evaluate and certify the effectiveness of the TQM implementation. Therefore, we assume that award winners had an effective TQM implementation an year prior to the year of winning their first quality award.

The impact of TQM on financial performance is likely to be spread over several years because of the evolutionary rather than revolutionary nature of the changes associated with TQM (Garvin, 1991). Unfortunately, the TQM literature does not provide much theoretical or empirical guidance on what should be the appropriate length of time period in examining performance. Our choice of the length of the time period is based on time periods typically used in studies that examine long-term performance of TQM firms. For example, Hendricks and Singhal (1997, 1999), and Easton and Jarrell (1998) use a 5-year time period. Consistent with previous studies, we choose a 5-year period following the effective implementation of TQM as the time period over which to measure the performance changes. For example, the relevant time period would be from 1989 to 1994 for a winner that won its first award in 1990, and from 1986 to 1990 for a winner that won its first award in 1987.

Some winners in our sample do not have complete data over the 5-year period. Reasons for this include instances where the winner went public 3–4 years after winning the first award, or it went private soon after winning the first award, or it was acquired soon after winning the first award. Including winners with limited financial data could introduce noise and potentially obscure our results. An obvious way to control for this potential problem is include only those winners that have complete data over the 5-year period. However, doing this severely reduces the sample size. To strike a balance, we decided to include those winners where

we could compute the performance change over at least a 4-year period. For example, a winner that won its first award in 1990 would be included if it had data over any one of the following time periods: 1989–1994 (a 5-year period), 1990–1994 (a 4-year period), and 1989–1993 (a 4-year period). Using these criteria, our final sample consists of 435 winners, which represents firms from about 40 distinct two-digit SIC codes.

3.3. Measuring performance and firm characteristics

Our primary measure of performance is operating income before depreciation, which equals net sales less cost of goods sold and selling and administrative expenses before depreciation is deducted. While our main focus is on testing hypotheses that link changes in operating income to firm characteristics, we also examine the sources for changes in operating income. Operating income can change because of changes in growth and efficiency. We measure growth as the change in sales, and efficiency as the change in cost per dollar of sales computed from the sum of cost of goods sold and selling, general, and administrative expenses.

Our analysis focuses on changes in performance over the 4- or 5-year interval rather than annual intervals. There are two reasons for this. First, the pattern of changes in performance could vary in time across firms and therefore, may not be captured by the results of any single year. Second, the philosophy of continuous improvement is a key element of TQM. The thrust of this philosophy is on making small and incremental improvements on a regular basis, which could add up to significant improvements over longer time periods. In this case, the changes measured on an annual basis may be small, but could be significant when accumulated over longer intervals.

The various firm characteristics are measured as follows:

- *Firm size*: Measured as a categorical variable (smaller versus larger) based on the median sales of the sample firms in the year prior to the year of winning the first quality award. The median is based on sales converted to constant 1990 dollars using the consumer price index.
- *Capital intensity*: Measured as a categorical variable (lower versus higher) based on the sample median

of the ratio of net property, plant, and equipment (converted to constant 1990 dollars) to the number of employees in the year prior to the year of winning the first quality award.

- *Firm diversification*: Measured as a categorical variable (less versus more diversified) based on the median Herfindahl index of the sample firms. The Herfindahl index is the sum of the ratio of the squared fraction of sales of each business segment to the firm's total sales. The value of this index ranges between 0 and 1. A low value of the index indicates a more diversified firm, whereas a high value indicates a less diversified firm (see Palepu (1985) for more discussion of the Herfindahl index). The Herfindahl index is computed from data on sales by segment and product line in the year prior to the year of winning the first quality award from data.
- *Maturity of the TQM implementation (independent versus supplier award winners)*: Firms that won an independent award anytime over the period covered are categorized as independent award winners, and the others are categorized as supplier award winners.
- *Timing of effective TQM implementation*: Firms that won their first quality awards in 1987 or earlier are categorized as earlier implementers, and others are categorized as later implementers. The reason for using 1987 as the cut-off year is that the Malcolm Baldrige National Quality Award was introduced in 1987, and many experts believe that this award has played a major role in bringing awareness about TQM in the US.

3.4. Generating matched-pair control samples

Our methodology is based on one to one comparisons of award winners to controls. The controls are chosen to be similar in size and industry characteristics of the award winners. To the best of our knowledge and based on the information we collected, our control firms have not won a quality award. If we knew they had won a quality award, they would obviously be part of the sample of award winners. By using one to one comparisons of award winners and controls, we are estimating and testing the statistical significance of abnormal growth, which is the difference between the growth in performance of winners and the con-

trol. Thus, our results are based on abnormal growth adjusted for size and industry.

The matching process we have chosen, SIC code matches and constraints on size mismatches, is similar to that used in the literature (see Barber and Lyon (1996), Kaplan (1989), Denis and Denis (1993) and Dann et al. (1991) for a discussion of these issues). The appropriateness of the constraints on SIC code matches and size mismatches is typically judged by the overall quality of the matching.

To control for size and industry, we create three control samples where each control sample is designed to address a specific potential bias or weakness in the others. The first control sample is designed to do the best overall job of matching on all dimensions simultaneously without regard to the number of firms matched. Each winner is matched to a control firm that has sufficient financial data available; has at least the same two-digit SIC code; and is closest in size as measured by the book value of assets, with the constraint that the ratio of the book value of total assets of the control and the winner is always less than a factor of 2. We are unable to match nearly 24% of our sample firms, with the preponderance of unmatched firms being larger firms.

The second control sample is designed to overcome our inability to match larger firms in the first control sample. The second control sample augments the first control sample by relaxing the industry matching constraint to at least a one-digit SIC code match. As a result the second control sample does not have quite as good an industry match as the first control sample but does help prevent any size bias from being introduced. We match an additional 40 winners, bringing the total matches to 369 (85%) out of 435.

Even with the relaxed industry constraint in the second control sample, 15% of the award winners are unmatched. Ignoring these unmatched firms from our analysis could possibly introduce an omission bias. To deal with this issue, we generate the third control sample by removing the constraint on size from within a factor of 2 to just choosing the closest firm in size. This allowed us to match all 435 firms in our sample.

It is important to note that no matching process will be perfect and more so when a large number of firms are to be matched. The key issue is the quality of the matches. In the first two control samples the matching on size is good. When the size factor constraint

Table 2
Sample description of the 435 quality award winners

	Mean	Median	S.D.	Maximum	Minimum
Sales (millions 1990)	4289.3	917.0	11529.3	127337.3	0.1
Net PPE/employee ^a (thousands 1990)	57.3	25.2	91.5	598.1	0
Herfindahl index	0.6	0.5	0.3	1.0	0.1

^a PPE refers to property plant and equipment.

is dropped (control sample 3), the award winners become significantly mismatched on size (larger than the controls on average). However, under all three control samples, more than 75% of the award winners are matched at the two-digit SIC level or better, and award winners are well matched to the controls in terms of capital intensity and the debt/equity ratio. Nonetheless, to prevent weaknesses in any one of the three control samples from driving our results, we only report results that are consistent across all three control samples. Due to length constraints and the consistency criterion for the results, we only report the results from our third control sample where we match all 435 firms.

4. Empirical results

Table 2 gives summary statistics for the sample of 435 award winners. The median winner represents a firm with sales of about US\$ 0.9 billion in 1990, net property plant and equipment per employee of US\$ 25,000, and Herfindahl index of 0.5. Table 3 gives the distribution of the year when the firms in our sam-

Table 3
The distribution of the year when the sample firms won their first quality award

Year	Number of firms
1983	15
1984	4
1985	23
1986	50
1987	30
1988	27
1989	107
1990	61
1991	59
1992	55
1993	4
Total	435

ple won their first quality award. The distribution of the year of winning the first quality award shows that nearly 28% of the winners won their first award in 1987 or earlier (these winners are designated as early implementers). Nearly 30% of the winners (129 out of 435) have ever won an independent award.

We use single-factor analysis of variance (ANOVA) techniques to test our hypotheses. We view this approach as appropriate given that at the current stage of TQM research, little is known about the exact functional form of the relations between firm characteristics and performance from effectively implementing TQM. To test for the sensitivity of the univariate results, we repeat our tests using analysis of covariance (ANCOVA) techniques and multiple regression analyses.

We report mean percent changes in various performance variables. To control for outliers, all results are reported after symmetrically trimming the data at the 2.5% level in each tail. The main conclusions are similar using capping (or winsorizing) at the 2.5% level in each tail. We use *t*-statistics to test whether the mean values of various performance variables are significantly different from zero, and whether differences in the performance between two subsamples are statistically significant. The significance of results is measured conservatively by reporting two-tailed tests of significance. Although not reported here, the conclusions are similar to the ones from non-parametric tests.

4.1. Univariate results

Table 4 documents the performance of the award winners by reporting the mean of the paired-differences in the performance between winners and their respective controls. Since percent changes are meaningless if the denominator used in the computation is negative, we exclude from our analyses those firms whose operating income at the

Table 4
Mean percent changes in the various performance measures for the sample of award winners^a

Performance measure	Number of observations	Mean (%)	t-value
Percentage change in operating income	372	39.10	4.46 a
Percentage change in sales	411	25.99	5.30 a
Percentage change in cost per dollar of sales	411	-1.22	-2.45 b

^a The changes are the mean of the paired-differences between the performance of the winners and their respective controls. Letters 'a' and 'b' denote significantly different from zero at the 1 and 2.5% levels, respectively, for two-tailed tests.

beginning of the measurement period is negative. Therefore, we have fewer observations for changes in operating income than for changes in sales and cost per dollar of sales. Our results are not sensitive to excluding such firms as other methods that do not have the negative denominator problem give similar results.

Table 4 shows that award winners do better than controls. The mean change in operating income of the winners is about 39% higher than that of the controls. This change is significantly different from zero at the 1% level in a two-tailed test. The winners' higher mean change in operating income can be attributed to their higher growth and improved efficiency. The mean change in sales is about 26% higher than that of the controls (significantly different from zero at the 1% level). On the efficiency side, winners improve more than controls. The cost per dollar of sales for winners

decreased by 1.22% (significantly different from zero at the 2.5% level). Overall, winners outperform their controls. The key implication of these results is that firms that have effectively implemented TQM improve their financial performance. We next examine how this improvement in financial performance is related to the characteristics of award winners.

4.1.1. Firm size (Hypothesis 1)

Table 5 presents the results for the subsamples of smaller and larger firms. The mean percent change in operating income of smaller firms is 65.30% compared to 12.88% for larger firms. The difference is significant at the 1% level in a two-tailed test. Smaller firms also experienced higher growth in sales when compared to the larger firms. Smaller firms had a 38.37% increase in sales compared to 13.66% for larger firms. The difference is significant at the 2.5% level. Smaller firms appear to do better in improving efficiency. Smaller firms' cost per dollar of sales improved by 1.66% compared to a 0.80% improvement for larger firms. However, the difference is not statistically significant. The results also indicate that smaller as well as larger firms outperform their respective controls on changes in operating income and sales. While both subsamples show improvement in cost per dollar of sales relative to their controls, only the improvement for smaller firms is statistically significant.

A key implication of these results is that TQM does have a positive impact on the profitability of both smaller and larger firms. More significantly, smaller firms tend to benefit more from TQM when compared

Table 5
Mean percent changes in the smaller versus larger award winners^{a,b}

Performance measure	Smaller winners		Larger winners		t-value for difference in means
	Number of observations	Mean (%) (t-value)	Number of observations	Mean (%) (t-value)	
Percentage change in operating income	186	65.30 (4.20) a	186	12.88 (1.67) d	3.02 a
Percentage change in sales	205	38.37 (4.75) a	206	13.66 (2.50) b	2.54 b
Percentage change in cost per dollar of sales	205	-1.66 (-2.14) c	206	-0.80 (-1.26)	0.86

^a The changes are the mean of the paired-differences between the performance of the winners and their respective controls. The numbers in parentheses are the t-values to test whether the mean percent changes for each subsample are different from zero. The t-value for difference in means test whether the mean percent changes across subsamples are different.

^b Firms with sales less (greater) than US\$ 917 million are classified as smaller (larger) award winners. Letters 'a', 'b', 'c', and 'd' denote significantly different from zero at the 1, 2.5, 5, and 10% levels, respectively, for two-tailed tests.

Table 6
Mean percent changes in the lower versus higher capital-intensive winners^{a,b}

Performance measure	Lower capital-intensive winners		Higher capital-intensive winners		<i>t</i> -value for difference in means
	Number of observations	Mean (%) (<i>t</i> -value)	Number of observations	Mean (%) (<i>t</i> -value)	
Percentage change in operating income	186	58.11 (3.93) a	186	20.08 (2.17) c	2.18 b
Percentage change in sales	205	33.33 (4.44) a	206	18.67 (2.96) a	1.50
Percentage change in cost per dollar of sales	205	−1.41 (−1.91) d	206	−1.04 (−1.54)	0.37

^a The changes are the mean of the paired-differences between the performance of the winners and their respective controls. The numbers in parentheses are the *t*-values to test whether the mean percent changes for each subsample are different from zero. The *t*-value for difference in means test whether the mean percent changes across subsamples are different.

^b Firms with net property, plant and equipment per employee less (greater) than US\$ 25,000 are classified as lower (higher) capital-intensive award winners. Letters 'a', 'b', 'c', and 'd' denote significantly different from zero at the 1, 2.5, 5, and 10% levels, respectively, for two-tailed tests.

to larger firms. This is an important observation since there is a perception among many managers that TQM is less beneficial to smaller firms (Struebing and Klaus, 1997). The basis of this perception could be due to the fact that smaller firms may be discouraged by the upfront implementation costs such as additional training, investment in process improvement, and hiring of consultants to drive the quality management philosophy. We have argued that the smaller firms will do better than larger firms, as many elements of successfully implementing TQM are already present in smaller firms. For example, smaller size could facilitate better understanding of key customers' needs, and transfer and share organizational learning more effectively. Our results show that smaller firms that have invested in effectively implementing TQM are able to improve their profitability significantly, thereby dispelling the notion that TQM is only beneficial to larger firms. Also the fact that smaller firms show significant improvement in cost reduction suggests that continuous improvement activities are more effective in smaller firms than larger firms.

4.1.2. Degree of capital intensity (Hypothesis 2)

Table 6 presents the results for lower and higher capital-intensive firms. The mean percent change in operating income of lower capital-intensive firms is 58.11% and is 20.08% for higher capital-intensive firms. The difference is significant at the 2.5% level in a two-tailed test. Sales at lower capital-intensive

firms grew by 33.33% versus 18.67% at higher capital-intensive firms (difference significant at the 13% level). Both lower and higher capital-intensive firms show improvement in cost per dollar of sales. However, the difference is not statistically significant. The results also indicate that lower as well as higher capital-intensive firms outperform their respective controls on changes in operating income and sales. Although both subsamples show improvement in cost per dollar of sales relative to their controls, only the improvement for lower capital-intensive firms is statistically significant.

A clear implication of the above results is that higher capital-intensive firms do not benefit as much from TQM as lower capital-intensive firms. This could be a direct result of the cost of quality concept, which predicts that as conformance quality increases the cost of poor quality decreases at a decreasing rate. A higher capital-intensive environment is likely to start off with a higher conformance level as the conformance aspect of quality might already be imbedded in the highly automated and specialized equipment. This is likely to result in smaller benefits from improving conformance quality.

Although the gains from implementing TQM vary by the degree of capital intensity, both higher and lower capital-intensive firms show improved performance relative to their respective benchmarks. The greater gains enjoyed by lower capital intensive firms is not surprising given the critical role employees play in successfully implementing and driving TQM. This

Table 7
Mean percent changes in the less and more diversified award winners^{a,b}

Performance measure	Less diversified winners		More diversified winners		<i>t</i> -value for difference in means
	Number of observations	Mean (%) (<i>t</i> -value)	Number of observations	Mean (%) (<i>t</i> -value)	
Percentage change in operating income	186	53.93 (3.97) a	186	24.26 (2.20) c	1.70 d
Percentage change in sales	206	33.84 (4.40) a	205	18.10 (2.99) a	1.61
Percentage change in cost per dollar of sales	206	−1.63 (−2.03) c	206	−0.82 (−1.37)	0.81

^a The changes are the mean of the paired-differences between the performance of the winners and their respective controls. The numbers in parentheses are the *t*-values to test whether the mean percent changes for each subsample are different from zero. The *t*-value for difference in means test whether the mean percent changes across subsamples are different.

^b Firms with Herfindahl index less (greater) than 0.5 are classified as more (less) diversified award winners. Letters 'a', 'b', 'c', and 'd' denote significantly different from zero at the 1, 2.5, 5, and 10% levels, respectively, for two-tailed tests.

should provide additional motivation for firms operating in labor-intensive environments to adopt and implement TQM.

4.1.3. Degree of diversification (Hypothesis 3)

Table 7 presents the results for the subsamples of less and more diversified firms. Less diversified firms have higher change in operating income (mean of 53.93%) than more diversified firms (mean of 24.26%). The difference is significant at the 10% level in a two-tailed test. Sales at less diversified firms grew by 33.84 versus 18.10% at more diversified firms (difference significant at the 11% level). Although, both subsamples show improvement in cost per dollar of sales, the difference (−1.63 versus −0.82%) is not statistically significant. The evidence also indicates that both subsamples outperform their respective controls on growth in operating income and on growth in sales. Although both subsamples show improvement in cost per dollar of sales relative to their controls, only the improvement for less diversified firms is statistically significant.

The results support our hypothesis on the relation between effectively implementing TQM and firm diversification. As we had argued, more focused firms will benefit more from TQM because of easier repeatability and transferability of TQM implementation approaches, and the low cost transfer and sharing of learning and knowledge across similar units. A key implication of this result is that managers may want to consider increasing the focus of their firm, division, or plant as they implement TQM. This is likely to result

in higher gains. Note, however, that more diversified firms also benefit from TQM as they also outperform their respective controls.

4.1.4. Independent versus supplier award winners (Hypothesis 4)

The results of Table 8 confirm our hypothesis about independent versus supplier award winners. The mean percent change in operating income is 64.29% for independent award winners and is 28.24% for supplier award winners. The difference is significant at the 10% level in a two-tailed test. Independent award winners experience higher growth in sales (36.59%) when compared to supplier award winners (21.41%). The difference in sales growth is significant at the 16% level. Independent award winners also appear to do better on cost per dollar of sales when compared to supplier award winners (difference significant at the 13% level). The results also show that independent award winners as well as supplier award winners outperform their respective controls on growth in operating income and growth in sales. Independent award winners also show significant improvement in cost per dollar of sales.

These results have important implications for managers as they contemplate which quality award and certification they should use to benchmark the effectiveness of their TQM system. Managers can choose from basic quality certification such as ISO 9000, or supplier awards given by customers, or independent awards at the state or national levels. Our results clearly indicate that there is value in aiming for sup-

Table 8
Mean percent changes in the independent and supplier award winners^{a,b}

Performance measure	Independent award winners		Supplier award winners		<i>t</i> -value for difference in means
	Number of observations	Mean (%) (<i>t</i> -value)	Number of observations	Mean (%) (<i>t</i> -value)	
Percentage change in operating income	112	64.29 (3.71) a	260	28.24 (2.81) a	1.89 d
Percentage change in sales	124	36.59 (3.99) a	287	21.41 (3.70) a	1.42
Percentage change in cost per dollar of sales	124	−2.38 (−2.64) a	287	−0.74 (−1.23)	1.50

^a The changes are the mean of the paired-differences between the performance of the winners and their respective controls. The numbers in parentheses are the *t*-values to test whether the mean percent changes for each subsample are different from zero. The *t*-value for difference in means test whether the mean percent changes across subsamples are different.

^b Firms that won an independent award anytime over the period covered are classified as independent award winners. The remaining firms are classified as supplier award winners. Letters 'a', 'b', 'c', and 'd' denote significantly different from zero at the 1, 2.5, 5, and 10% levels, respectively, for two-tailed tests.

plier awards given by customers. In fact winning such awards is a direct reflection of how well firms are satisfying their customers, which should be a key objective of any firm. Our results indicate that supplier award winners outperform their respective controls. Having won a supplier award, firms should attempt to improve the maturity of their TQM implementation by aiming to win national or state level quality awards. As we have discussed, the criteria used for independent awards is more comprehensive than supplier awards, and the evaluation and competition for these awards is more stringent than supplier awards. The value of the comprehensiveness and stringency associated with national and state quality awards is reflected in the fact that such award winners outperform firms that have only won supplier awards.

These results should help counter the negative publicity associated with quality awards. Negative publicity may have created uncertainty among many managers about the value of adopting various award criteria while implementing TQM. Our results clearly indicate that current quality award criteria are a source of value creation.

4.1.5. Earlier versus later implementers (Hypothesis 5)

Table 9 presents the results for earlier and later implementers. The results do not support our hypothesis that earlier implementers are likely to do better than later implementers. The 36.29% change in operating income for earlier implementers is not statistically different from the 40.25% change for later implementers

Table 9
Mean percent changes in the earlier and later award winners^{a,b}

Performance measure	Earlier award winners		Later award winners		<i>t</i> -value for difference in means
	Number of observations	Mean (%) (<i>t</i> -value)	Number of observations	Mean (%) <i>t</i> -value	
Percentage change in operating income	109	36.29 (2.34) b	263	40.25 (3.79) a	−0.20
Percentage change in sales	119	36.59 (3.99) a	292	29.83 (5.03) a	1.22
Percentage change in cost per dollar of sales	119	−1.20 (−1.28)	292	−1.23 (−2.08) c	0.02

^a The changes are the mean of the paired-differences between the performance of the winners and their respective controls. The numbers in parentheses are the *t*-values to test whether the mean percent changes for each subsample are different from zero. The *t*-value for difference in means test whether the mean percent changes across subsamples are different.

^b Firms that won their first quality awards in 1987 or earlier are classified as earlier winners, and the others are classified as later winners. Letters 'a', 'b', 'c', and 'd' denote significantly different from zero at the 1, 2.5, 5, and 10% levels, respectively, for two-tailed tests.

(*t*-statistic of 0.20). The differences in sales growth and improvement in cost per dollar of sales are also not statistically significant. However, the results indicate that the subsamples of the earlier as well as the later implementers outperform their respective controls on the various performance measures.

Given that earlier as well as later implementers outperform their respective controls, a key implication is that it is never too late to adopt and implement TQM. Unlike a product or process technology where timing can be critical and being late to market can be catastrophic, the same is not true for TQM. This makes intuitive sense if one views TQM as a set of management practices that focus on customers, employees, continuous improvement, and building partnerships with key stakeholders. These are good practices and concepts, which do not get obsolete like a product or process technology. Our results imply that firms that are contemplating adopting TQM or feel that it is too late to adopt because their competition has already successfully adopted TQM, should seriously reconsider their plans about implementing TQM. Furthermore, the performance of the later implementers suggests that the proclamation made by many that TQM is dead is premature.

A more general and broader implication of our results is that TQM is valuable for a wide spectrum of firms. The fact that various subsamples of award winners (large versus small, capital versus labor intensive, and focused versus diversified) consistently outperform the controls suggests that most types of firms are likely to benefit from effective implementation of TQM. However, managers must realize that the extent of gains is a function of specific firm characteristics. This knowledge can be very useful for managers to make a case to senior executives about the relevance of TQM, setting realistic expectations of what to expect from TQM, justifying investments in TQM, and in dealing with skeptics.

4.2. Sensitivity analyses

We next discuss the results of the various sensitivity analyses that we did to test the robustness of our univariate results. Due to length constraints these results are briefly summarized here. The details are available from the authors on request.

The univariate results presented above could depend on how well the award winners and control firms are matched. Although we use multiple control samples, matching on firm size, industry, and other factors may not be sufficient. The results would be stronger if they still hold in the presence of variables representing the mismatch between the winners and controls. To test this, we repeat all of the univariate tests using ANCOVA techniques with mismatch variables as the covariates. To keep the analyses manageable, we chose three firm macro-variables that should be strongly correlated with, and proxy for multiple measures of differences between winners and controls. These variables are firm size, debt/equity ratio, and capital intensity. For each of these variables, the covariate is the difference (or mismatch) between the winner and its control on that variable. Although some covariates have significant coefficient estimates for some performance measures, the main results are still consistent with the results from the univariate analyses. Smaller firms do better than larger firms; lower capital-intensive firms do better than higher capital-intensive firms; less diversified firms do better than more diversified firms; and independent award winners do better than supplier award winners. Consistent with the earlier results there is no difference between the performance of the earlier and later implementers.

As a further sensitivity check, we repeat our univariate and ANCOVA analyses using three other performance measures: (1) the change in the level of the operating income, (2) operating cash flow, and (3) free cash flow which is operating income before depreciation minus taxes minus interest minus preferred dividends minus common dividends plus changes in deferred taxes. The results using these measures are similar to the results for percent change in operating income.

An implicit assumption in our univariate analysis is that other variables are held constant. However, because of the correlation between firm size, degree of capital intensity, and degree of diversity, we cannot be sure that when performing the univariate tests on firm size other variables such as the degree of capital intensity and/or the degree of diversification have been held constant. A multivariate approach is needed to try and separate these effects, if possible.

We develop three different regression models to test the robustness of our univariate results. Model I uses continuous versions of the variables for firm size, capital intensity, and diversification along with the indicator variables for award type and time of adoption. Model II uses the same set of variables except that firm size has been transformed by the natural logarithm, a transform that is commonly used to remove the skew in the distribution of firm size. Model III uses indicator versions of all the variables. In all three models the dependent variable is the difference in the percent change in operating income between award winners and their respective controls.

The regression results are generally consistent with our univariate hypotheses. In Model I the percent change in operating income decreases with increasing firm size, decreases with increasing capital intensity, increases with increasing firm focus, and is higher for early adopters and independent award winners. One-tailed tests show that the estimated coefficients are weakly significant for size (12% level) and capital intensity (6.5% level), and highly significant for degree of diversification (1.5% level) and independent award winners (1% level), and statistically insignificant for early adopters. Results of Models II and III are similar to Model I in terms of the sign of the estimated coefficients. However, in Model II only the transformed size variable and the independent award variables are statistically significant. In Model III firm size and award type are highly significant, while the degree of capital intensity and degree of diversification are weakly significant (12 and 16% in one-tailed tests). The three regression models generally support the univariate results to one degree or another.

5. Summary

This paper provides evidence on the relation between the financial performance from effective implementation of TQM to characteristics such as firm size, the degree of capital intensity, the degree of firm diversification, the maturity of the TQM implementation, and the timing of the TQM implementation. We find that smaller firms do significantly better than larger firms. Firms that have won awards from independent award givers do better than the supplier

award winners. This is consistent with our conjecture about costs and benefits associated with the comprehensiveness of the criteria used by independent award givers to judge TQM. The evidence weakly supports the hypotheses that less capital-intensive firms do better than more capital-intensive firms, and more focused firms do better than more diversified firms. We also do not observe any significant differences between the performance of earlier and later implementation of effective TQM. Finally, whichever characteristic is used to segment the full sample, individual subsamples generally do better than their respective controls.

The key managerial implications of these results are that many organizational characteristics impact the benefits from effective TQM implementations. Although not all of these characteristics are controllable by managers, managers must set rational expectations for the degree of benefits from TQM based on their firm's characteristics. The results for size and capital-intensity validate the importance of TQM practices for smaller firms and environments that are more labor intensive. Investing to achieve a broader, deeper, and more mature TQM implementation (possibly by targeting an independent TQM award) should also result in higher benefits from TQM implementation. The results also indicate that it is never too late to invest in TQM. Finally, the results imply that the positive impact of TQM is widespread across a spectrum of firms with differing characteristics.

There are a number of other avenues for future research. It would be interesting to study why some firms do better than others. For example, are the quality management practices significantly different in firms that do better or is it that TQM is more useful for firms with certain characteristics. Our results suggest that research on identifying 'best' practices should attempt to control for firm characteristics. Future research could also examine the impact of other firm characteristics on the gains from TQM. In particular, it would of interest to see whether variables that proxy for managerial incentives affect the gains from TQM.

Uncited reference

Anderson et al. (1995).

References

- Adams, G., McQueen, G., Seawright, K., 1996. Quality awards and stock prices: a microanalysis. Working Paper, Marriott School of Management, Brigham Young University, Provo, UT.
- Aldrich, H.E., Austen, E., 1986. Even dwarfs started small: liabilities of size and age and their strategic implications. In: Staw, B., Cummings, L. (Eds.), *Research in Organizational Behavior*, Vol. 8. JAI Press, Greenwich, CT, pp. 16–98.
- Anderson, J.C., Rungtusanatham, M., Schroeder, R.G., Devaraj, S., 1995. A path analytic model of a theory of quality management underlying the Deming management method: preliminary empirical findings. *Decision Sciences* 26 (5), 637–658.
- Barber, B.M., Lyon, J.D., 1996. Detecting abnormal operating performance: the empirical power and specification of test statistics. *Journal of Financial Economics* 41, 359–399.
- Byrne, J.A., 1997. Management theory or fad of the month? *Business Week* 6, 47.
- Chen, M., Hambrick, D.C., 1995. Speed stealth, and selective attack: how small firms differ from large firms in competitive behavior. *Academy of Management Journal* 38 (2), 453–482.
- Christiansen, J.S., Lee, W.Y., 1994. Total quality management and corporate performance: an empirical investigation. Working Paper, Ford Motor Co. and Kent State University.
- Crosby, P.B., 1984. *Quality Without Tears*. McGraw-Hill, New York.
- Daft, R.L., 1995. *Organization Theory and Design*, 5th Edition. West Publishing Company, Minneapolis, St. Paul, MN.
- Dann, L.Y., Masulis, R., Myers, D., 1991. Repurchase tender offers and earnings information. *Journal of Accounting and Economics* 14, 217–251.
- Datta, D.K., Rajagopalan, N., Rasheed, A.M.A., 1991. Diversification and performance: critical review and future directions. *Journal of Management Studies* 28, 529–558.
- Dean, T.J., Robert, L.B., Bamford, C.E., 1998. Differences in large and small firm responses to environmental context: strategic implications from a comparative analysis of business formations. *Strategic Management Journal* 19, 709–728.
- Deming, E.W., 1986. *Out of Crisis*. MIT Center for Advanced Engineering, Cambridge, MA.
- Denis, D.J., Denis, D.K., 1993. Managerial discretion, organization structure, and corporate performance: a study of leveraged recapitalizations. *Journal of Accounting Economics* 16, 209–236.
- Easton, G.S., 1993. The 1993 state of US total quality management: a Baldrige examiners' perspective. *California Management Review* 35 (3), 32–54.
- Easton, G.S., Jarrell, S.L., 1998. The effects of total quality management on corporate performance: an empirical investigation. *Journal of Business* 71 (2), 253–307.
- Flynn, B.B., Schroeder, R.G., Sakakibara, S., 1994. A framework for quality management research and an associated measurement instrument. *Journal of Operations Management* 11, 339–366.
- Flynn, B.B., Schroeder, R.G., Sakakibara, S., 1995a. Determinants of quality performance in high- and low-quality plants. *Quality Management Journal* 4 (Winter), 8–25.
- Flynn, B.B., Schroeder, R.G., Sakakibara, S., 1995b. The impact of quality management practices on performance and competitive advantage. *Decision Sciences* 26 (5), 659–691.
- Fuchsberg, G., 1992a. Total quality is termed only partial success. *Wall Street Journal* 10, B1.
- Fuchsberg, G., 1992b. Quality programs show shoddy results. *Wall Street Journal* 5, B1.
- Garvin, D.A., 1991. How the Baldrige award really works. *Harvard Business Review* 69 (6), 80–94.
- Ghosh, S., Handfield, R.B., Caltone, R., 1997. A structural model analysis of the Malcolm Baldrige national quality award framework. Working Paper, DuPree School of Management, Georgia Institute of Technology, Atlanta, GA.
- Haim, A., 1993. Does quality work? A review of relevant studies. Conference Board, Report no. 1043, New York.
- Hannan, M.T., Freeman, J., 1984. Structural inertia and organizational change. *American Sociological Review* 49 (2), 149–164.
- Hendricks, K.B., Singhal, V.R., 1996. Quality awards and the market value of the firm: an empirical investigation. *Management Science* 42 (3), 415–436.
- Hendricks, K.B., Singhal, V.R., 1997. Does implementing an effective TQM program actually improve operating performance? Empirical evidence from firms that have won quality awards. *Management Science* 43 (9), 1258–1274.
- Hendricks, K.B., Singhal, V.R., 1999. The long-term stock price performance of firms with effective TQM programs. Working Paper, Georgia Institute of Technology, Atlanta, GA.
- Hoskisson, R.E., Hitt, M.A., 1990. Antecedents and performance outcomes of diversification: a review and critique of theoretical perspectives. *Journal of Management* 16, 461–509.
- Ittner, C.D., Larcker, D.F., 1996. Measuring the impact of quality initiatives on firm financial performance. In: Fedor, D.F., Ghosh, S. (Eds.), *Advances in Management of Organization Quality*, Vol. 1. JAI Press, Greenwich, CT, pp. 1–37.
- Juran, J.M., Gryna, F.M., 1980. *Quality Planning and Analysis*. McGraw-Hill, New York.
- Kaplan, S., 1989. The effect of management buyouts on operating performance and value. *Journal of Financial Economics* 24, 217–254.
- Kelly, K., 1992. Quality: small and midsize companies seize the challenge — not a moment too soon. *Business Week* 11, 66–69.
- Lederer, P.J., Rhee, S., 1995. Economics of total quality management. *Journal of Operations Management* 12, 353–367.
- Meyer, M.W., Zucker, L.G., 1989. *Permanently Failing Organization*. Sage, Beverly Hills, CA.
- Miller, D., Chen, M., 1994. Sources and consequences of competitive inertia: a study of the US airline industry. *Administrative Science Quarterly* 39 (1), 1–30.
- Mintzberg, H., 1979. *The Structuring of Organizations: A Synthesis of the Research*. Prentice-Hall, Englewood Cliffs, NJ.
- Palepu, K., 1985. Diversification strategy, profit performance and entropy measure. *Strategic Management Journal* 6, 239–255.
- Ramanujam, V., Varadarajan, P., 1989. Research on corporate diversification: a synthesis. *Strategic Management Journal* 10, 523–551.

- Starbuck, W.H., 1985. Acting first and thinking later: theory versus reality in strategic change. In: Pennings, J., et al. (Eds.), *Organizational Strategy and Change*. San Francisco, pp. 336–372.
- Stimpert, J.L., Duhaime, I.M., 1997. Seeing the big picture: the influence of industry, diversification and business strategy on performance. *Academy of Management Journal* 40 (3), 560–583.
- Struebing, L., Klaus, L.N., 1997. Small businesses thinking big. *Quality Progress* 2, 23–27.
- The Economist, 1992. The cracks in quality. April 18, pp. 67–68.
- The Economist, 1995. The straining of quality. January 14, pp. 55–56.
- USA Today, 1995. Is TQM dead? October 17, pp. B1–B2.