# A Note on Quality-related Action Programs: Their Impact on Quality Performance and Firm Performance

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## ABSTRACT

From analyses of the direct effects of 10 quality action programs on six firm performance outcomes, as well as their indirect effects through eight quality performance dimensions, two routes from action programs through quality performance to firm performance in the automotive supply industry are identified. The first is the product quality route, whose landmarks are superior quality performance on Conformance and Design Quality dimensions; the second is the relationship quality route, with superior Customer Responsiveness and Service. Both the product quality and the relationship quality routes lead to superior ROI; the former also leads to enhanced ROA, and the latter to enhanced market share performance. Associated key action programs are Committed Leadership, Cross-Functional Quality Teams, Employee Empowerment, Supplier Development, and Closer Customer Relationships. The first three are internally focused, while the latter two are boundary-spanning supply chain programs.

*Subject Areas: Automotive Supply Industry, Manufacturing Strategy, Quality, and Survey Research.*

## INTRODUCTION

Based on the pioneering work of Deming (1982, 1986), "Total Quality Management" (TQM) has become pervasive; over 90% of America's largest 500 firms have adopted TQM methods (Arthur D. Little, Inc., 1992; Benson, 1993). Several studies posit that unless the principles of TQM are adopted as a set, firms will be unable to compete globally (Womack, Jones, & Roos, 1990; Sluti, 1992; Shetty, 1993; Handfield, 1993; Powell, 1995; Easton & Jarrell, 1998). In addition, the Malcolm Baldrige Award (U.S.), and others all identify sets of practices. Recent research poses questions, however, about whether TQM practices are really so interdependent and whether they really impact performance outcomes. For example, Powell (1995) found that only executive commitment, open organization, and

employee empowerment—out of 12 TQM factors—were actually correlated with firm performance. Building on this work, Dow, Samson, and Ford (1999) found that only workforce commitment, shared vision, and customer focus related with conformance (their one quality performance outcome), and only customer focus was significant in the baseline model with all nine original dimensions.

Our research extends this recent work by (1) identifying the direct effects of 10 quality-related action programs on eight quality performance measures (not just conformance) and (2) identifying the direct and indirect effects of these 10 action programs on six firm performance measures through the relevant quality performance dimensions. Quality performance measures are viewed as intermediate outcomes, since ultimately it is overall firm performance that matters (see Figure 1). We sample the automotive supply industry to test our model.

This paper is organized as follows. The relevant literature is reviewed to identify key variables as well as the effects of TQM programs on quality versus firm performance. The research methodology is described next, and the results of correlations and standardized partial beta analyses are presented. Finally, managerial implications are explored.

## MODEL VARIABLES

The next section draws upon the literature to describe the variables used in our research model. These variables include quality action programs (the independent variables), the quality performance variables, and the firm performance variables.

### Quality Action Programs: The Independent Variables

Three different streams of TQM literature were reviewed: (1) anecdotal (e.g., Deming's Management Methods, 1986; Juran's Quality Trilogy, 1993; Crosby's 14 Quality Steps, 1979); (2) empirically based research (e.g., Saraph, Benson, & Schroeder, 1989; Flynn, Schroeder, & Sakakibara, 1994; Powell, 1995; Ahire, Golhar, & Waller, 1996; Dow et al., 1999); and (3) formal assessment processes (e.g., ISO 9000, The Deming Award, Malcolm Baldrige National Quality Award; see Curkovic & Handfield, 1996). Ten key action programs resulted, thoroughly covering the people, process, and integration aspects of TQM (see Table 1). Industry experts from the Automotive Industry Action Group (AIAG), in Southfield, Michigan, confirmed their relevance to the first tier automotive suppliers whom we later sample. These 10 programs are the independent variables in our study.

### Quality Performance

Garvin (1984b, 1987, 1988) identified eight "competitive dimensions of quality," which we adapted taking into account subsequent empirical work and consultations with our panel of AIAG experts (see Table 2). Product Reliability, Product Durability, and Conformance to Specifications were taken directly from Garvin (1987). Garvin's Performance, Features, and Aesthetics were combined to form a single quality dimension called Design Quality (see Forker, Vickery, & Dröge, 1996). Company Reputation was seen as an appropriate proxy for Garvin's Perceived Quality dimension because "reputation is the primary stuff of perceived

**Table 1:** Quality-related action programs.

| Program | Description | Source | Mean (SD) |
|---|---|---|---|
| Committed Leadership | Top level management commitment to total quality management | Crosby, 1979; Curkovic, Melnyk, Calantone, & Handfield, 2000; Deming, 1986; Flynn, Schroeder, & Sakakibara, 1994; Ham & Williams, 1986; Juran, 1993; Kennedy, 1989; Powell, 1995; Saraph, Benson, & Schroeder, 1989; Tregoe, 1983; Wheelwright, 1981. | 5.895 (1.160) |
| Employee Empowerment | Allowing employees to decide on their own how to go about doing their work and ensuring action is taken on employee input | Ahire, Golhar, & Waller, 1996; Ebrahimpour, 1985; Powell, 1995. | 4.947 (1.084) |
| Cross-Functional Quality Teams | Cross-functional teams to support TQM initiatives | Bognossian, 1988; Crosby, 1979; Deming, 1986; Dow, Samson, & Ford, 1999; Ebrahimpour, 1985; Garvin, 1984b; Juran, 1981a, 1981b; Stein, 1991; Taguchi & Clausing, 1990. | 6.000 (1.086) |
| Quality Training | Formal employee training to support total quality management | Ahire et al., 1996; Curkovic et al., 2000; Dawson & Patrickson, 1991; Deming, 1982; Dow, Samson, & Ford, 1999; Ebrahimpour, 1985; Feigenbaum, 1991; Flynn, Schroeder, & Sakakibara, 1994; Harber, Burgess, & Barclay, 1993; Longnecker & Scazzero, 1993; Malcolm Baldrige Award, 1999; Powell, 1995; Saraph, Benson, & Schroeder, 1989. | 5.614 (1.373) |
| Measurement | Goal-orientation and zeal for performance data, with constant performance measurement | Crosby, 1979; Feigenbaum, 1991; Fisher, 1992; Flynn, Schroeder, & Sakakibara, 1994; Fortuin, 1988; Malcolm Baldrige Award, 1999; Powell, 1995; Saraph, Benson, & Schroeder, 1989. | 5.649 (1.302) |
| Statistical Process Control | The monitoring of a process by analyzing outputs using statistical techniques that provide feedback for maintaining or improving process capability | APICS Dictionary, 1992; Benton, 1991; Deming, 1986; Flynn, Schroeder, & Sakakibara, 1994; Ishikawa, 1985; Juran, 1993; Roth & Miller, 1992; Schonberger, 1990; Shingo, 1988; Stein, 1991. | 5.456 (1.283) |

**Table 1:** (continued) Quality-related action programs.

| Program | Description | Source | Mean (SD) |
|---|---|---|---|
| Benchmarking | Selecting data and information for competitive comparisons to support performance planning, evaluation, and improvement | Ahire, Golhar, & Waller, 1996; Babbar, 1992; Garvin, 1984b; Malcolm Baldrige Award, 1999; Powell, 1995; Zairi, 1992. | 4.536 (1.250) |
| Continuous Improvement | A never-ending effort to expose and eliminate root causes of problems in an incremental manner | APICS Dictionary, 1992; Chase & Aquilano, 1992; Imai, 1986; Juran, 1981a, 1981b. | 5.895 (1.080) |
| Supplier Development | Policies, procedures, and practices for assessing and improving supplier capability and performance in multiple areas such as quality, design support, and delivery | Juran, 1993; Juran & Gryna, 1988; Newman, 1989; Powell, 1995; Roth & Miller, 1992; Saraph, Benson, & Schroeder, 1989. | 4.607 (1.303) |
| Closer Customer Relationships | Determining customers' requirements (both inside and outside the firm), then meeting those require-ments no matter what it takes | Baum, 1990; Dow, Samson, & Ford, 1999; Flynn, Schroeder, & Sakakibara, 1994; Juran 1981a, 1981b, 1993; Malcolm Baldrige Award, 1999; Powell, 1995; Saraph, Benson, & Schroeder, 1989. | 5.579 (0.905) |

*The extent of use scale was a 7-point scale with the endpoints *Extremely Low Use of Action Program* (1) and *Extremely High Use of Action Program* (7). If an action program was not being used, then the respondent was asked to circle "Not Used."

quality" (Garvin, 1987, p. 107). Garvin's serviceability dimension was divided into Pre-Sale Customer Service and Product Support (or post-sale customer service) based on advice from our AIAG panel. In addition, Responsiveness to Customers extends Garvin's conceptualization of customer service to encompass responsiveness to potential customers, and fits the quality literature's current emphasis on customer-related performance (e.g., Dow et al., 1999). Thus, we extend current literature by considering three different customer-related quality performance measures.
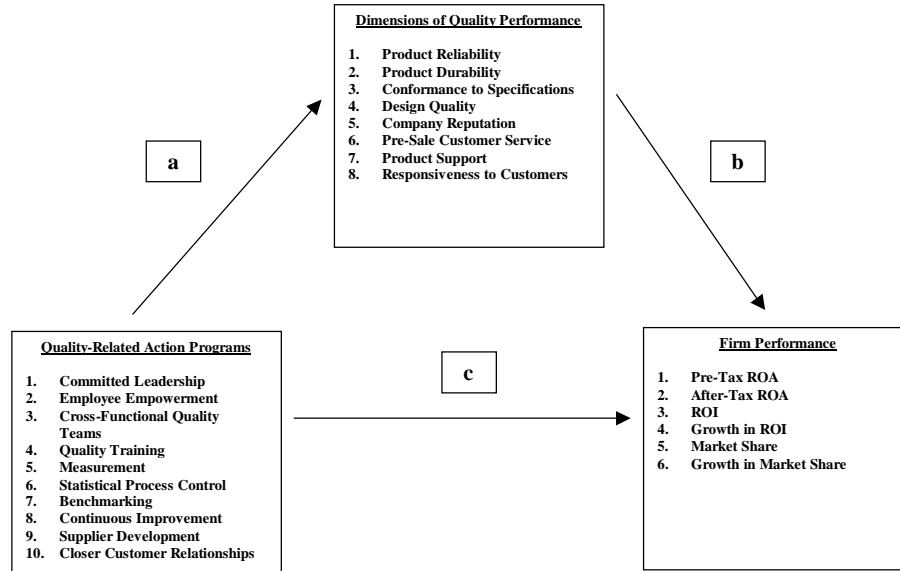
**Firm Performance**

We examine six measures of overall firm performance (see Figure 1). The first four measures are financially based (e.g., ROI, ROA), while the last two are market-share based. It was important to have different firm performance measures because firms' strategic emphases are different (Dröge, Vickery, & Markland, 1994; Miller & Roth, 1994). For example, a penetration strategy may sacrifice ROI for market share.

**Table 2:** Dimensions of quality performance.

| Dimension | Description | Source | Mean | Standard Deviation |
|---|---|---|---|---|
| Product Reliability | The ability to maximize the time to product failure or malfunction | Garvin, 1984b, 1987, 1988 | 5.877 | 0.908 |
| Product Durability | The ability to maximize the time to product replacement | Garvin, 1984b, 1987, 1988 | 5.754 | 1.023 |
| Conformance to Specifications | The ability to manufacture a product whose operating characteristics meet established performance standards | Garvin, 1984b, 1987, 1988 | 5.947 | 0.915 |
| Design Quality | The ability to provide a product with capabilities, features, styling, and/or operating characteristics that are either superior to those of competing products or unavailable with competing products | Garvin, 1984b; Forker, Vickery, & Dröge, 1996 | 5.579 | 1.068 |
| Company Reputation | The ability to create a positive or favorable image in the customer's mind when he/she hears the company's name | Garvin, 1987 | 5.649 | 1.316 |
| Pre-Sale Customer Service | The ability to service the customer during the purchase decision process (i.e., before the customer buys the product | Garvin, 1987 | 5.474 | 1.020 |
| Product Support | The ability to service the customer in providing product support after the sale of the product to ensure continuing customer satisfaction | Garvin, 1987 | 5.614 | 1.082 |
| Responsiveness to Customers | The ability to respond in a timely manner to the needs and wants of the company's customers including potential customers | Garvin, 1987; Juran, 1993 | 5.393 | 1.039 |

*Scale was 1 to 7 and measured quality performance relative to major competitors.
  *Poor* (1) and *Excellent* (7).

**Figure 1:** The overall conceptual model.



a = effects of quality-related action programs on dimensions of quality performance.
b = effects of dimensions of quality performance on firm performance.
c = direct effects of quality-related action programs on firm performance.
a, b = indirect effects of quality-related action programs on firm performance.

## MODEL RELATIONSHIPS

The next section describes the different relationships hypothesized within our research model. These include: (1) the relationship of action programs to quality performance; and (2) the relationship of action programs to overall firm performance.

### The Relationship of Action Programs to Quality Performance

TQM pioneers such as Deming, Juran, and Crosby devoted considerable attention to identifying key practices that impact quality performance. Other authors also focused on anecdotal examples and case studies (e.g., Pegels, 1995; Thomas, 1989; George & Weimerskirch, 1994). Some empirical studies compared U.S. versus Japanese quality management practices (Garvin, 1984a, 1986; Ebrahimpour, 1985), while others (e.g., Ferdows & DeMeyer, 1990) compared high versus low performers to identify sets of individual quality action programs. Other studies related aggregate use of action programs to overall quality performance (e.g., Saraph et al., 1989; Flynn et al., 1994).

However, two recent studies question the assumption that quality action programs have to be implemented together. First, Powell (1995) examined TQM performance (as well as firm performance) and 12 TQM programs. Only executive commitment, open organization, and employee empowerment produced significant partial correlations with performance. Building on Powell's work, Dow et al.

(1999) empirically developed nine dimensions from a sample of 698 from a variety of industries. Only the "workforce commitment," "shared vision," and "customer focus" dimensions were significant individual predictors of a conformance construct. Also, Dow et al. concluded that the "best practices" model, which aggregates action programs as was done in past research, was the weakest of all; however, in the best fitting model, only "customer focus" was significantly related to quality. Dow et al. (p. 25) stated: "if too many nonessential practices are attached to an overall quality improvement agenda, this may disillusion people and undermine the support for the overall program."

Overall, anecdotal evidence and, certainly, the extensive use of TQM by industry suggest payoffs exist, but past empirical research has found mixed results. Not all action programs appear to be related to quality performance outcomes, but aggregates (means, sums, or weighted sums of action program measures) usually are related to quality outcomes. However, a very limited list of quality performance outcomes (usually only conformance) has been scrutinized in the past, and Dow et al. (1999) called for research using other outcomes. We propose to examine which of 10 quality action programs affects which of eight dimensions of quality performance. Thus,

> H1: Each quality action program is positively related to each dimension of quality performance (see Figure 1).

## The Relationship of Action Programs to Overall Firm Performance

Results from past research, most of which has been case studies, have been equivocal at best. Some studies have shown TQM to have no effects or even negative effects on firm performance (Tornow & Wiley, 1991; Burrows, 1992; Fuchsberg, 1992a, 1992b; Mathews, 1992). For example, 80% of over 100 British firms and close to two-thirds of 500 U.S. companies experienced no competitive gains from TQM (*The Economist*, 1992). Other studies claim to find positive effects on firm performance (e.g., Adam, 1994), at least for some quality action programs. For example, corporate culture was found significant by Handfield and Ghosh (1994), and executive commitment, open organization, and employee empowerment were found significant by Powell (1995).

One difficulty is measuring or detecting the impact of action programs on corporate profitability or other firm-level performance outcomes (Bowels & Hammond, 1991; Evans, 1992; Hiam, 1992). The effect of a quality action program on firm performance (which is the final outcome) could be indirect through quality performance, which is an intermediate performance outcome. Thus,

> H2: Quality-related action programs are positively related to firm performance either (a) directly, or (b) indirectly through quality performance, or (c) both (see Figure 1).

We extend past research by basing our approach on a two-prong analysis. First, we examine the relationship of each action program with each of six measures of firm performance using $R^2$ analysis from simple regressions. This is equivalent to correlational analysis. Second, we examine the relationship of each action program to each measure of firm performance after controlling for the effect

of quality performance on firm performance. This analysis of standardized partial betas from hierarchical regression takes into account that (1) action programs can have a direct effect on either quality performance or firm performance (or both) and (2) action programs can have an indirect effect on firm performance (i.e., final outcome measures) through quality performance (i.e., intermediate outcome measures).

## METHODOLOGY

The next section describes the methodological issues such as sample selection, the research questionnaire, and measurement.

### Sample

The sampling frame was defined as the top 150 (in terms of annual sales) independently owned first-tier suppliers to General Motors, Ford, and Chrysler. These 150 suppliers account for over 90% of the purchasing sales volume by North American automakers. The automotive industry was selected because it is a major "battlefield" in the quality wars (Cole, 1990; Eastman, 1995; Ahire et al., 1996). First-tier suppliers were selected because: (1) they represent a wide variety of process types and technologies; (2) they compete against each other, forming a distinct open market; and (3) they are under great pressure to meet quality standards such as QS-9000.

The unit of analysis is the Strategic Business Unit (SBU). Chief Executive Officers (CEOs) were mailed questionnaires (accompanied by explanatory letters), and repeated follow-up telephone calls were used. The most often-cited reason for noncompletion was lack of time, followed by company policy. Also, early versus late respondents were compared (Armstrong & Overton, 1977), and no differences were found at $\alpha = .05$.

The sample size was 57 firms (response rate = 38%). Mean sales were $501,516, and the mean number of employees was 2,810 . The mean percentage of SBU sales direct to North American OEMs was 83.67%.

### Research Questionnaire and Measurement

Our AIAG panel of experts assisted in the development and pre-testing of the survey instrument. Respondents were asked to indicate the extent to which each of the 10 programs listed in Table 1 was being used (or to circle "Not Used"). The 7-point scale had endpoints of 1 for *Extremely Low Use of Action Program* and 7 for *Extremely High Use of Action Program*. Descriptive statistics are listed in Table 1.

Quality performance relative to major competitors was measured on scale with endpoints of 1 for *Poor* and 7 for *Excellent*. The results are found in Table 2. Conformance quality and product reliability have the highest means, which is consistent with past research (e.g., the 1996 Manufacturing Futures survey; see Kim, 1996).

Firm performance was measured using six common financial and/or marketing indicators: (1) pre-tax return on assets (pre-tax ROA mean = 4.904); (2) after-tax return on assets (after-tax ROA mean = 4.962); (3) return on investment (ROI

mean = 5.078); (4) growth in ROI (mean = 4.528); (5) market share (mean = 4.850); and (6) growth in market share (mean = 4.818). Performance evaluation was a subjective assessment: the 7-point scale had endpoints of 1 for *Worst In Industry* and 7 for *Best In Industry*. The validities of these six scales were verified by correlation analyses with objective measures (e.g., actual ROI), which were obtained from about half the sample.

## RESULTS

The next section describes the results of our empirical analysis. The results focus on the following model relationships: (1) quality-related action programs and the eight dimensions of quality performance; (2) quality-related action programs and six measures of firm performance; and (3) whether the action programs affect firm performance after controlling for quality performance.

### Quality-related Action Programs and the Eight Dimensions of Quality Performance

The ordinary correlations are listed in Table 3a. We can obtain a rough index of the pervasiveness of an action program's impact by simply counting column-wise the number of significant correlations: Committed Leadership, Cross-Functional Quality Teams, Closer Customer Relationships, and Supplier Development are related to four or more of the eight quality performance dimensions (supporting H1). A second way to interpret Table 3a is to do a row-wise count, indicating how many of the 10 action programs actually have an impact on a particular dimension of quality performance. Conformance, being correlated with 8 of 10 programs, stands out. Responsiveness to Customers is at 7 of 10, Company Reputation at 5, Design Quality at 4, and the others at less than 4 of 10.

### Quality-related Action Programs and Six Measures of Firm Performance

The ordinary correlations of each of the 10 action programs with each of the six firm performance measures are shown in Table 3b. Looking at this table column-wise first, two patterns that stand out: (1) Committed Leadership, Measurement, Quality Training, and SPC are correlated with none of the firm performance measures; (2) Continuous Improvement is correlated with every financial measure as well as market share. If we examine Table 5b row-wise, a third pattern stands out: 5 in 10 programs affect market share and 3 in 10 affect its growth, while only 1 in 10 affect ROI, 2 in 10 for ROI growth, 3 in 10 for Pre-Tax ROA, and 2 in 10 affect After-Tax ROA.

### Do Action Programs Affect Firm Performance After Controlling for Quality Performance?

We now turn to the question of whether action programs affect firm performance (final outcomes) after controlling for the indirect effects through quality performance (intermediate outcomes). The eight quality performance measures and six firm performance measures are themselves related (see Table 4). To illustrate our approach, consider Cross-Functional Quality Teams. The use of teams is correlated

**Table 3:** Correlations of quality action programs usage with eight dimensions of quality performance and six measures of firm performance.

| Quality Action program➜ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **a. Quality Performance** | | | | | | | | | | |
| Product Reliability | .276** | −.007 | .163 | .090 | .023 | .172 | .028 | .059 | .121 | .197 |
| Product Durability | .158 | .133 | .080 | .135 | .068 | .169 | .151 | .057 | .262* | .118 |
| Conformance to Specifications | .466*** | .141 | .486*** | .396*** | .359*** | .325** | .140 | .320** | .297** | .253* |
| Design Quality | .252* | .096 | .293** | −.052 | .097 | .012 | −.065 | .178 | .267** | .312** |
| Company Reputation | .279** | .300** | .175 | .270** | .146 | .171 | .184 | .313** | .132 | .428*** |
| Pre Sale Customer Service | .028 | .233* | .177 | .031 | .168 | −.004 | .248* | −.019 | .049 | .162 |
| Product Support | .337** | .173 | .289** | .211 | .118 | .181 | .200 | .194 | .209 | .360*** |
| Responsiveness to Customer | .318** | .274** | .271** | .145 | .236* | .054 | .135 | .358*** | .250* | .330** |
| **b. Firm Performance** | | | | | | | | | | |
| Pre-Tax ROA | −.024 | .170 | .089 | .060 | .063 | .217 | .247* | .270* | .245* | .058 |
| After-Tax ROA | −.043 | .153 | .040 | .034 | .069 | .202 | .280** | .261* | .192 | .034 |
| ROI | −.005 | .113 | .182 | .103 | .030 | .156 | .166 | .277** | .110 | .060 |
| Growth in ROI | −.081 | .256* | .083 | .090 | −.067 | −.055 | −.144 | .238* | .175 | .010 |
| Market Share | .128 | .223 | .240* | .170 | .142 | .229 | .368*** | .291** | .341** | .355*** |
| Growth in Market Share | .030 | .356*** | .097 | .138 | −.008 | .047 | .110 | .172 | .237* | .306** |

***, **, and * significant at the .01, .05, and .10 levels, respectively.

| | |
|---|---|
| 1 = Committed Leadership | 6 = Statistical Process Control |
| 2 = Employee Empowerment | 7 = Benchmarking |
| 3 = Cross-Functional Quality Teams | 8 = Continuous Improvement |
| | 9 = Supplier Development |
| 4 = Quality Training | 10 = Closer Customer Relationships |
| 5 = Measurement | |

**Table 4:** Correlations of quality performance with firm performance measures.

| Quality Performance (Intermediate Outcome Measures) | Firm Performance (Final Outcome Measures) | | | | | |
|---|---|---|---|---|---|---|
| | Pre-Tax ROA | After-Tax ROA | ROI | ROI Growth | Market Share | Market Share Growth |
| Product Reliability | .314** | .306** | .347** | .190 | .241* | .187 |
| Product Durability | .212 | .192 | .280** | .195 | .285** | .321** |
| Conformance to Specifications | .193 | .205 | .254* | .114 | .076 | .083 |
| Design Quality | .270* | .272* | .309** | .115 | .118 | .126 |
| Company Reputation | .247* | .271* | .266* | .223 | .359*** | .402*** |
| Pre-Sale Customer Service | .210 | .215 | .235* | .275** | .229 | .233* |
| Product Support | .381*** | .387*** | .375*** | .305** | .371*** | .399*** |
| Responsiveness to Customers | .204 | .224 | .233* | .235* | .314** | .260* |

*** , **, and * significant at the .01, .05, and .10 levels, respectively.

with: (a) the four intermediate-level, quality performance outcomes of Conformance, Design Quality, Product Support, and Responsiveness to Customers (Table 3a); and (b) the firm performance outcome of Market Share (Table 3b). However, Table 4 shows that Product Support and Responsiveness to Customers are correlated with Market Share at .371 ($p < .01$) and .314 ($p < .05$), respectively. A hierarchical regression was run with Market Share as the dependent variable, the four intermediate outcomes as independent variables, followed by Quality Teams as the last independent variable. The standardized partial beta estimate for Quality Teams was .239, which is significantly greater than zero at $p = .062$.

The Quality Teams analysis is summarized in Table 5. Note that Table 5 has "n.a." for "remaining direct effects" under all columns except Market Share, since the analysis was done only for the one dependent variable significant in Table 3b. For Continuous Improvement, in contrast, five regressions were conducted, one for each of Pre-Tax ROA, After-Tax ROA, ROI, ROI Growth, and Market Share (the five significant in Table 3b). The independent variables were Conformance, Company Reputation, and Responsiveness to Customers (the three significant in Table 3a), followed by Continuous Improvement. Only for Market Share was the standardized partial beta for Continuous Improvement significantly greater than zero (std. beta = .199, $p = .085$); for Pre-Tax ROA (.195), After-Tax ROA (.173), ROI (.170), and ROI Growth (.169), all had $p > .10$ (n.s. in Table 5). Thus, for Market Share there is a direct effect after controlling for the relevant intermediate quality performance outcomes (indicated by "x" in Table 5), but the effects of Continuous Improvement on the other firm measures are indirect only. Similar regression analyses were conducted for the other action programs.

**Table 5:** Direct and indirect effects of quality action programs on firm performance.

| Effects of Quality Action Programs | Pre-Tax ROA | After-Tax ROA | ROI | ROI Growth | Market Share | Market Share Growth |
|---|---|---|---|---|---|---|
| **Committed Leadership** | | | | | | |
| Through Product Reliability | x | x | x | | x | |
| Through Conformance to Specifications | | | x | | | |
| Through Design Quality | x | x | x | | | |
| Through Company Reputation | x | x | x | | x | x |
| Through Product Support | x | x | x | x | x | x |
| Through Responsiveness to Customers | | | x | x | x | x |
| **Employee Empowerment** | | | | | | |
| Through Company Reputation | x | x | x | | x | x |
| Through Pre-Sale Customer Service | | | x | x | | x |
| Through Responsiveness to Customers | | | x | x | x | x |
| Remaining Direct Effects* | n.a. | n.a. | n.a. | x | n.a. | x |
| **Cross-Functional Quality Terms** | | | | | | |
| Through Conformance | | | x | | | |
| Through Design Quality | x | x | x | | | |
| Through Product Support | x | x | x | x | x | x |
| Through Responsiveness to Customers | | | x | x | x | x |
| Remaining Direct Effects* | n.a. | n.a. | n.a. | n.a. | x | n.a. |
| **Quality Training** | | | | | | |
| Through Conformance to Specifications | | | x | | | |
| Through Company Reputation | x | x | x | | x | x |
| **Measurement** | | | | | | |
| Through Conformance to Specifications | | | x | | | |
| Through Responsiveness to Customers | | | x | x | x | x |
| **Statistical Process Control** | | | | | | |
| Through Conformance | | | x | | | |
| **Benchmarking** | | | | | | |
| Through Pre-Sale Customer Service | | | x | x | | x |
| Remaining Direct Effects* | x | x | n.a. | n.a. | x | n.a. |

**Table 5:** (continued) Direct and indirect effects of quality action programs on firm performance.

| Effects of Quality Action Programs | Pre-Tax ROA | After-Tax ROA | ROI | ROI Growth | Market Share | Market Share Growth |
|---|---|---|---|---|---|---|
| **Continuous Improvement** | | | | | | |
| Through Conformance to Specifications | | | x | | | |
| Through Company Reputation | x | x | x | | x | x |
| Through Responsiveness to Customers | | | x | x | x | x |
| Remaining Direct Effects* | n.s. | n.s. | n.s. | n. s. | x | n.a. |
| **Supplier Development** | | | | | | |
| Through Product Durability | | | x | | x | x |
| Through Conformance to Specifications | | | x | | | |
| Through Design Quality | x | x | x | | | |
| Through Responsiveness to Customers | | | x | x | x | x |
| Remaining Direct Effects* | n.s. | n.a. | n.a. | n.a. | x | n.s. |
| **Closer Customer Relationships** | | | | | | |
| Through Conformance to Specifications | | | x | | | |
| Through Design Quality | x | x | x | | | |
| Through Company Reputation | x | x | x | | x | x |
| Through Product Support | x | x | x | x | x | x |
| Through Responsiveness to Customers | | | x | x | x | x |
| Remaining Direct Effects* | n.a. | n.a. | n.a. | n.a. | x | n.s. |

*Direct effects remaining after the listed intermediate outcomes were partialled out; n.a. means the analysis is not applicable because the quality action program is not related to that firm performance measure (see Table 3b); n.s. means the analysis was done, but the remaining direct effects were nonsignificant.

For Empowerment, with ROI Growth as the dependent variable, the standardized partial beta was .187 ($p = .098$); with Market Share Growth, it was .254 ($p = .030$). Thus, Empowerment had a direct effect even after controlling for the relevant intermediate outcomes. For Benchmarking: (1) for Pre-Tax ROA the standardized partial beta was .209 ($p = .075$); (2) for After-Tax ROA it was .242 ($p = .047$); and (3) for Market Share it was .333 ($p = .009$). Thus, Benchmarking had positive direct effects even after controlling for the one relevant control variable. Concerning the analyses involving Supplier Development: for Pre-Tax ROA and Market Share Growth, respectively, the standardized partial betas were .129 and .139 ($p > .10$), but for Market Share, the beta was significantly greater than zero (.239, $p = .048$). For

Closer Customer Relationships, the standardized partial beta was .204 ($p$ =.084) in the regression involving Market Share, and .146 ($p$ > .10) in the regression involving Market Share Growth. Overall, there is some support for H2.

## DISCUSSION

In the discussion that follows, we highlight some of the patterns observed from our analyses; that is, some "paths" of impact that were observed frequently. Overall, we must echo Powell (1995) and Dow et al. (1999) in saying that not all action programs have pervasive direct effects, but many have indirect effects.

### Product Quality: Conformance and Design

One "path" of impact that stands out can be described as follows: action program usage affects Conformance, which in turn affects ROI. This pattern of direct impact on Conformance and indirect impact on ROI was observed for 8 of the 10 action programs (only for employee empowerment and benchmarking was this sequence not observed).The importance of Conformance comes as no surprise since automotive manufacturers have been pressuring first-tier suppliers for years to significantly reduce defects. Furthermore, virtually every researcher in quality includes Conformance as a key dimension of quality performance (e.g., Garvin, 1987), and often it is the only one actually measured. However, the empirical evidence that all or most action programs affect Conformance has not been overwhelming. For example, Dow et al. (1999) found that only three of nine were correlated with conformance, compared to the 8 of 10 found in this research on automobile OEM suppliers.

In conjunction with Conformance, the intermediate outcome of Design Quality deserves mention. Together, these constitute the core of product quality since conformance to a poor design can hardly be expected to have a positive impact on firm performance. Four of the action programs affect both Conformance and Design Quality: Cross-Functional Quality Teams, Committed Leadership, Closer Customer Relationships, and Supplier Development. Design Quality in turn affects ROA and ROI. Note that: (1) product quality as reflected in both Conformance and Design Quality affects primarily financial (as opposed to market) measures; and (2) the action programs affecting both span the supply chain from supplier to internal to customer locus, but they reflect the "soft aspects of the quality management practices" (Dow et al., 1999, p. 23).

Finally, consider Product Reliability and Product Durability, which taken together affect five of six firm performance measures (the exception is ROI Growth). These are mentioned frequently in the quality literature (Garvin, 1987, 1988; Ahire et al., 1996) and are certainly relevant to our sample of auto suppliers. However, only Committed Leadership affected Reliability, and only Supplier Development affected Durability. We can speculate that auto suppliers may be targeting prespecified reliability and durability levels, and that the goal in implementing action programs is to achieve conformance to these prespecified levels. Our result may be specific to industries structured similarly to the automotive supplier industry, or it may be that there is reason to question the relationships of action programs to these dimensions of quality performance.

### Relationship Quality: Responsiveness and Service

Another path of impact that was observed frequently was the following: usage of the action program affects Responsiveness to Customers, which in turn affects ROI, ROI Growth, Market Share, and Market Share Growth. This sequence was seen for 7 of the 10 action programs (exceptions are Quality Training, SPC, and Benchmarking). The importance of Responsiveness to Customers, as it relates to relationship quality, is clear: if action programs are a "strategic resource" set (Powell, 1995), then their impact should extend beyond product quality alone. Our results demonstrate the extensive impact on relationship quality (and through this, on firm performance) and, thus, we confirm links often hypothesized in the literature (Crosby, Evans, & Cowels, 1990; Noordewier, John, & Nevin, 1990; Leuthesser & Kohli, 1995; Dow et al., 1999).

Pre-Sale Customer Service and Product Support (or post-sale customer service) are additional aspects of relationship quality: together, these affected every measure of firm performance, and were affected by half of the action programs. For Cross-Functional Quality Teams, Committed Leadership, Closer Customer Relationships, and Employee Empowerment, paths existed through both Responsiveness to Customers and either Pre- or Post-Sale Customer Service. For managers, this implies that customers are not the domain of marketing or sales departments alone. Rather, certain quality action programs can impact the entire exchange between organizations.

### Quality Products, Quality Relationships

We have argued that Conformance and Design Quality are two key dimensions of quality products, and that Responsiveness to Customers along with Pre-Sale Service and Product Support are key dimensions of quality relationships. Some action programs' effects on firm performance are through both the "product quality" route and the "relationship quality" route. In particular, the following action programs affect both dimensions of product quality and two of the three dimensions of relationship quality: Cross-Functional Quality Teams, Committed Leadership, and Closer Customer Relationships. These three tap the same types of dimensions found in Powell (1995) and/or Dow et al. (1999) (who especially focused on the latter). We support their contention that not all quality action programs are equally important in terms of their effects on performance. In addition, for our sample of auto OEM suppliers, (1) Supplier Development affects both dimensions of product quality and only the Responsiveness dimension of customer relationship quality; and (2) Employee Empowerment, while it has no impact on product quality, affects two of the three dimensions of quality relationships.

Together, the five action programs identified above tap internal management for quality (Teams, Empowerment, Leadership), as well as management of the supply chain for quality (both upstream as reflected in Supplier Development and downstream as reflected in Closer Customer Relationships). A supply chain perspective, comprising suppliers➔the firm itself➔customers, is becoming increasingly relevant to managers and researchers alike. In the marketplace, one can view competition itself as competition between supply chains.

The impact of these five action programs is ultimately seen on every firm performance measure, with paths through "product quality" dimensions targeted at ROI and ROA, and paths through "relationship quality" dimensions targeted at ROI and Market Share. Only by measuring different aspects of firm performance (or any other type of performance) can such patterns be detected. The multidimensional nature of performance, with different aspects being differently affected by key antecedents, is an important consideration both in the design of academic research and in the design of performance feedback control systems.

## LIMITATIONS

Because this was a single-industry study, we did not consider environmental uncertainty, competitive intensity, or industry munificence. Future studies might also focus on objective rather than subjective data. Caution must be exercised in assuming that our results would hold for objective quality performance data (e.g., defective parts per million), objective productivity measures, or objective firm performance (such as actual ROI).

A final comment is in order concerning the external validity of our study (i.e., the ability to generalize its results). A drawback of this study is its relatively small sample size in a single industry, since external validity is more easily achieved in a cross-industry study. However, a profile of the firms within the automotive supply industry highlights the diversity of the products manufactured. Firms in the sample ranged from manufacturers of entire seating systems to manufacturers of anti-lock braking systems. Thus, the external validity of the results is not as severely compromised by our single-industry focus as it would be for a more homogeneous industry group. [Received: March 4, 1998. Accepted: October 22, 2000.]

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