

A Performance Assessment of the US Baldrige Quality Award Winners

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Introduction

The US market gains by foreign producers have become evident in the recent past as the US has slipped into economic recession, causing a loss of jobs and a plea to “buy American” by some US politicians, firms and workers. But the problem of decreased consumer confidence and accompanying market share losses have been evident to US producers for a number of years. Long before the current recession, domestic firms were attempting to remain profitable in an increasingly competitive environment by reducing costs. This strategy often resulted in a further weakening of the ability to compete – by laying off workers for instance, a firm’s most valuable resource was lost, resulting in loss of motivation among remaining employees, lower levels of customer service, and a reduction of innovative ideas and products. This has been called the productivity paradox[1].

Another strategy to increase a firm’s ability to compete has proved to be much more effective, namely increasing the value of a product through attention to quality. Previous research reveals that firms providing high quality products at competitive prices relative to industry norms typically find financial success relative to their competitors[2]. For example, as quality programmes are implemented, production costs decrease and productivity increases when scrap, reworks and warranty repairs are reduced.

The US Malcolm Baldrige Quality Award, established by legislation in 1987, seeks to increase management’s quality awareness and recognize accomplishments in product quality improvement among US businesses. Another objective of the award is to provide ideas to US firms which are considering ways to improve product quality. If the award accurately recognizes producers of high quality products, then a performance assessment of these firms should result in findings consistent with those of previous research. Specifically, the Baldrige Award winners should be found to be industry leaders in terms of product quality, market share growth and profit growth.

This article discusses the Malcolm Baldrige Quality Award and provides a competitive analysis of the award winners. Particular attention is paid to financial characteristics of the four publicly held award winners which are not subsidiaries or divisions of other firms, financial and competitive performance information gathered on three privately held firms, and key performance improvement information on all of the award winners obtained through company documents.

The findings indicate that, while winning the Baldrige Award has not guaranteed financial success, the award winners are generally recognized as profitable producers and exhibit strength in terms of market share, product quality and other performance benchmarks. Of particular importance to practitioners is that the Baldrige Award winners provide examples that investments in quality programmes can result in cost savings, market share improvement, and impressive improvements in manufacturing and service performance.

A discussion of the quality literature focusing on financial and market share performance is presented next, followed by discussions of the Malcolm Baldrige Quality Award and the 17 award winners through 1992. Finally, a competitive analysis of the award winners is presented, followed by the concluding remarks.

A Literature Review of the Quality-Performance Relationship

A number of US businesses hold the opinion that high quality products add to a firm's total costs since more costly methods, materials, equipment and labour are required to produce a higher quality product. The literature, however, supports the opposite view of the quality-total cost relationship. Most of the research suggests that successful implementation of quality improvement programmes will reduce total costs and increase productivity, providing the firm with a greater level of profitability. The research with respect to this relationship is reviewed below.

In a study of US and Japanese air conditioner manufacturers, Garvin[2] finds that savings in the internal (scrap and rework) and external (field service) costs associated with the higher quality manufacturers more than offset quality control costs (prevention and inspection). In Crosby's[3] text on the costs of quality, he describes firms which have measured the costs of quality (failure and control costs) and finds the total costs of quality to be typically 20-40 per cent of sales. Since profit margins are frequently less than this range, a reduction in costs associated with poor quality can be shown to increase profitability. Gale and Klavans[4] discuss a study performed by the Strategic Planning Institute (the Profit Impact of Market Strategy or PIMS Study), showing that high quality products and services are among the most profitable. The study also finds that improvements in product quality lead to market share increases. Additionally, the study concludes that quality improvements increase profits by increasing customer-perceived value. A number of other articles also use the PIMS study and find a positive relationship between quality and profitability[5-7].

The Japanese concept of just-in-time (JIT) production is often cited in the quality literature and several researchers use the philosophies of JIT to discuss the correlation between product quality and market success. For example, Schonberger[8] argues that the JIT system leads to less scrap, better quality and higher productivity. Since by definition a JIT producer uses small lot sizes, defects are noticed sooner, leading to higher overall quality levels, less scrap, fewer hours spent on reworks and consequently greater productivity. Producing at higher levels of quality also means less buffer inventory is needed to keep downstream processes fed with materials. Other examples of this type of descriptive research are Hall[9], Suzaki[10] and Shingo and Robinson[11]. Finally, in a comparative study of the Toyota and Nissan JIT systems and US automobile manufacturers, Cusumano[12] finds that Japanese automakers require half the workers of US manufacturers to produce the same number of automobiles, even though the level of capital productivity is equal. Toyota and Nissan are thus able to offer higher quality products at comparable or lower prices, causing US automakers to encounter marketing difficulties.

The literature confirms a strong positive correlation between product quality and financial or market share performance. It follows that if the Baldrige National Quality Award is a good indicator of product quality, the award winners should be examples of firms that stand out as performance leaders in their respective industries.

The US Malcolm Baldrige Quality Award

In an effort to restore America's ability to compete, the US government recently undertook a programme to promote quality awareness and publicly recognize domestic firms achieving success through quality improvement programmes. The Malcolm Baldrige Quality Award, created in 1987 in memory of the late Secretary of Commerce and managed by the US Department of Commerce, seeks to spotlight American businesses excelling in high quality products and services. Similar to the Deming Application Prize in Japan, the Baldrige Quality Award has quickly become a highly regarded and sought-after prize among US producers (over 800 applications per day were requested in 1990). The award has been given to 17 American businesses through 1992. Table I is a description of the Baldrige Quality Award winners.

The Malcolm Baldrige National Quality Award Consortium, formed by the American Society for Quality Control and the American Productivity and Quality Center, administers the application evaluation process for the Department of Commerce. The award applicants are judged by a board of examiners in seven categories relating to quality: leadership, information and analysis, strategic quality planning, human resource development and management, process quality management, quality and operational results, and customer focus and satisfaction. The board of examiners is comprised of quality experts from industry, professional and trade organizations, and universities. Once the written application evaluation is complete, the highest scoring firms are visited by one or more teams of examiners to verify

Company	Award year	Ownership	Business description
Motorola, Inc., Schaumburg, IL	1988	Public	Manufacturer – electronic equipment
Westinghouse CNFD, Pittsburgh, PA	1988	Public	Manufacturer – nuclear fuel products
Globe Metallurgical, Inc., Cleveland, OH	1988	Private	Manufacturer – ferrosilicon and silicon metal products
Milliken and Co., Spartanburg, SC	1989	Private	Manufacturer – apparel and automotive fabrics, and speciality chemical products
Xerox Corp., Stamford, CN	1989	Public	Manufacturer – business products and systems
Cadillac Company Detroit, MI	1990	Public	Manufacturer – luxury automobiles
Federal Express Corp., Memphis, TN	1990	Public	Transporter – express delivery service
IBM Rochester, Rochester, MN	1990	Public	Manufacturer – intermediate computer systems and hard disk storage devices
Wallace Co., Inc., Houston, TX	1990	Private	Distributor – industrial pipe, valves, and fittings
Solectron Corp., San Jose, CA	1991	Public	Manufacturer – printed circuit boards, systems assembly and testing services
Zytec Corp., Eden Prairie, MN	1991	Private	Manufacturer – computer power supplies and repair facility
Marlow Industries, Inc., Dallas, TX	1991	Private	Manufacturer – thermoelectric cooling devices
AT&T Transmission Systems Business Unit, Morristown, NJ	1992	Public	Manufacturer – telecommunication transmission equipment
AT&T Universal Card Services, Jacksonville, FL	1992	Public	Service-credit and long distance calling card
Granite Rock Co., Watsonville, CA	1992	Private	Manufacturer – concrete and road treatments; also building materials retailer
Texas Instruments Defense Systems and Electronics Group, Dallas, TX	1992	Public	Manufacturer – defence electronics equipment
The Ritz-Carlton Hotel Co., Atlanta, GA	1992	Private	Service – hotel management

Table I.
The Baldrige Quality
Award Winners

information from the application and answer questions surfacing during the review of the application. A final panel of judges from the board of examiners then recommends award winners.

Up to two firms in each of the following areas can receive awards in a given year: manufacturing, service, and small business (500 employees or less). Privately- or publicly-held businesses located in the US are eligible for the award. Participating in the award application process is an effective method for firms to audit their quality systems and become involved in continuous quality improvement. One benefit to the winners is that the award represents government certification of product quality. A side benefit, available to all businesses, is that award winners must share their quality improvement strategies. Historically, about five per cent of the applicants for the Baldrige Quality Award have actually won the award.

The Baldrige Quality Award Winners

As diverse as the Baldrige Quality Award winners are, there are many similarities between these firms in terms of their quality initiatives, objectives and achievements. All of the 17 winners place extremely high customer satisfaction as their overriding objective. Another common link between these firms is the use of statistical quality control techniques. Additionally, all 17 businesses have formal quality improvement programmes and commit significant resources to these programmes to assure success in implementation and employee acceptance. Finally, communication between management and line workers and a commitment to quality at all levels is seen as a necessary element to achieving quality goals and continued improvement. A brief description of the quality programmes of the 17 award winners follows.

Cadillac Motor Car Company

Cadillac won the 1990 Baldrige Award by emphasizing “design for manufacturability” and “simultaneous engineering” in their auto designs. Their old system lacked integration between design, engineering, manufacturing and procurement. Cadillac’s new quality system, DFM (design for manufacturability), stresses the links between automobile design, manufacturing capabilities and customer requirements. Every step in the assembly process is monitored by visual quality checks and other quality checks performed by computers. Cadillac also regularly obtains feedback from dealers on their products. While General Motors has been losing money due to the depressed automobile market, Cadillac has managed to increase its market share since 1988. Employee training plays a major role in Cadillac’s quality efforts – in 1990, hourly employees received at least 80 hours of quality-related training. Cadillac has also held the top domestic position on J.D. Powers and Associates’ Customer Satisfaction Index[13].

Federal Express Corporation

Federal Express was the first service firm to receive the Baldrige Award. While their profit performance has deteriorated over the past five years, annual

revenues have more than doubled to over \$7.5 billion and market share has reached approximately 43 per cent (17 points higher than their nearest competitor). The Federal Express business philosophy is to emphasize people, service and profit, in that order. They continually monitor service performance with their electronic despatching/tracking network to spot potential problem areas. This system allows Federal Express to communicate a service quality performance index to all employees on a daily basis. Since 1987, this customer service index has consistently averaged over 95 per cent. Executive bonuses are tied to meeting performance goals, and bonuses are withheld if an annual survey measuring employees' satisfaction with management shows a performance decrease from the previous year. Over the past 13 years, Federal Express has won over 195 awards for their quality efforts[14].

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Globe Metallurgical Inc.

Prior to 1985, Globe's quality efforts consisted primarily of 100 per cent inspection. At that time, a formal quality improvement programme (called QEC, for quality, efficiency and cost) was formed and the training of Globe employees and its vendors in statistical process control was started. The programme grew and was modified as Globe's customers made suggestions for improvement. Globe's QEC programme involves the entire organization, from top officials acting as the QEC steering committee, to workers participating in weekly quality circle meetings. Globe places a tremendous emphasis on satisfying the customer – for example, it has a commitment to respond to customer complaints received by their external sales agents within 24 hours. Since 1988, Globe has received numerous quality awards and recognitions including the Shingo Prize for Manufacturing Excellence, Ford and General Motors quality awards, and the European ISO 9000 Quality Certification[15].

IBM Rochester

IBM Rochester attributes its quality success to control of design and manufacturing. Defects caught in the design stage benefit the firm in terms of savings in the testing phase of new products, savings in customer installation costs, and an increase in customer satisfaction. Their quality strategy since 1986 has been market-driven. This approach utilizes both customer and supplier input from early planning to product installation. This input allows changes in the product to be made at every stage in product development, substantially reducing design change costs and new product cycle times. As a result of IBM Rochester's quality improvement efforts, IBM has seen worldwide product installations increase by 50 per cent from 1987 to 1990 and has become the undisputed leader in customer satisfaction in numerous in-house surveys, consultant reviews, and industry-accepted reports[16].

Marlow Industries Inc.

In 1987 Marlow started its Total Quality Management (TQM) programme to improve its manufacturing and service operations. Since then, employee productivity has increased by an average of 10 per cent per year and they now

enjoy a market share of greater than 50 per cent, with 15 per cent of sales coming from exports. Complete employee involvement in quality is stressed at Marlow. In 1990, 88 per cent of Marlow's personnel participated in teams that concentrated on attaining performance goals and preventing potential work problems. These teams make periodic presentations to the TQM Council, consisting of the CEO and other senior executives at Marlow. The TQM Council provides the five-year strategic business plan, oversees progress towards these goals, and has daily responsibility for quality-related matters. Worker representatives are included in the weekly Council meetings. Additionally, training programmes covering topics such as quality awareness and quality control tools average 32 hours per year for all employees. Since 1988, Marlow has won six major quality awards, and in 1990 Marlow's top ten customers rated the quality of their thermoelectric coolers a perfect 100 per cent[17].

Milliken and Co.

Since 1981, Milliken's Pursuit of Excellence (POE) programme has been used to improve quality and reduce costs. In the past ten years, their performance improvement has been impressive and has placed Milliken ahead of their competition in independent surveys of customer satisfaction. The firm is now a major supplier of upholstery to Japanese and Korean car manufacturers. Milliken's CEO and COO devote more than half their time to the POE programme. Production employees are organized in self-managed teams and can undertake training as necessary and establish individual performance measures if desired. Consequently, mid-level management levels have been reduced significantly, freeing these people to become process improvement specialists. Milliken also measures product performance of 400 competitors, giving them a basis for comparison and an opportunity to identify potential markets. Milliken is widely recognized as the outstanding residential carpet manufacturer in the US and has received five General Motors Mark of Excellence manufacturing awards[18].

Motorola Inc.

Motorola's quality improvement programme started in 1981 and is now referred to as their Six Sigma Quality programme (six sigma refers to their goal of defect-free production). The use of a common quality measurement, total defects per unit, provides a common denominator for driving the quality improvement process. All operations are able to use the same measurement, and goals for percentage defect reduction can be uniformly applied to all processes. Motorola tracks performance characteristics of over 125 competitor products. Motorola has already achieved a goal of a hundredfold company-wide reduction in defect rates since inception of their Six Sigma programme. Motorola's quality efforts have allowed them to capture the largest market share in Japan's pager market and have also resulted in the winning of more than 50 quality awards and citations from customers such as Ford and Chrysler[19].

Solectron Corporation

Since much of Solectron's business is composed of contract manufacturing, service and quality play a major role in repeat business. The company performs a weekly survey of its customers to measure customer service. This information is conveyed during a weekly planning meeting with Solectron's CEO and other top executives. The customer service information is also used to measure performance in each of Solectron's divisions. Corporate quality objectives are established by an executive committee and the committee then works with company teams to set up supporting goals in each functional area. Solectron's strong family orientation and open communication system are responsible for much of the success of their quality programmes. Statistical process control is used regularly in all departments, and performance measures are reviewed daily. Since 1987, product rejection rates have declined 50 per cent and Solectron is now known as the best contract manufacturer of electronic assemblies in the USA[20].

Wallace Co. Inc.

As a distributor of pipe fittings to Gulf Coast refineries, quality at Wallace is measured primarily in terms of delivery performance. Since 1987 when the company decided to formalize its quality improvement efforts, Wallace's on-time delivery performance has increased from 75 per cent to 92 per cent by concentrating improvement efforts on the delivery process. In 1989, Wallace associates used the Baldrige Quality Award application to grade their quality progress and to plan their short-term improvement efforts. As a result, Wallace has invested over \$700,000 and 19,000 hours into training, created Point Teams to oversee quality objectives, developed a new performance evaluation process, created a worker handbook, and started a new employee assistance programme. Wallace insists on high quality from its suppliers and has developed a Vendor Certification Task Force to communicate quality requirements to vendors. Wallace was forced to enter chapter 11, reorganization, in early 1992, due in part to spending too much time helping other firms improve quality, after winning the Baldrige Award. Still, Wallace's CEO attributes their survival to their quality improvement programme[21].

Westinghouse Commercial Nuclear Fuel Division

Before the early 1980s, Westinghouse quality goals were aimed at satisfying regulatory requirements. Since then, increased competition and customer demand have prompted Westinghouse to strive for extremely high quality nuclear fuel products. The Westinghouse "Total Quality" programme began in 1980 with the establishment of a Productivity and Quality centre at Westinghouse's corporate headquarters in Pittsburgh, Pennsylvania. Its programme is designed around four quality characteristics to meet quality objectives. The characteristics are management leadership, product and process leadership, human resource excellence, and customer satisfaction. Progress in these areas is measured using criteria in over 60 key performance areas. The

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results of the programme are impressive: product reworks have decreased 74 per cent and on-time deliveries have been 100 per cent for the past three years. Finally, Westinghouse has established its own quality award competition, resulting in two other Westinghouse subsidiaries reaching the finals for the Baldrige Award in 1989 and 1990[22].

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Xerox Corporation

In 1984, Xerox began a long-term quality improvement programme, called Leadership through Quality, in response to greater levels of competition and decreasing rates of return on assets. Over a 15-month period, top Xerox executives met and developed a quality policy with strategies and implementation plans for the quality improvement initiative. A five-year plan was laid out by the executive team for adapting Xerox culture to the new quality policy. Xerox now tracks over 240 company performance measures in its attempt to maintain world-class status. Results of the quality improvement efforts since 1984 are evidenced by the following: a monthly survey of 55,000 Xerox equipment owners to identify changing customer requirements; a four million hour investment in employee quality education; increased responsibility and problem-solving empowerment among employees; 75 per cent employee membership in more than 7,000 quality improvement teams; and a worldwide recognition as having the highest copy quality[23].

Zytec Corporation

Zytec organizes its quality improvement efforts around Deming's 14 points for managing quality. To monitor the transformation towards quality awareness and continuous quality improvement, an annual employee survey is conducted and employees are also involved in setting long range and annual improvement goals. Customers and suppliers are also asked to review and provide feedback on Zytec's long range quality improvement plans. Performance criteria are measured at all levels of the organization and benchmarked with competitors and industry leaders whenever possible. Interdepartmental teams review performance at four stages of product development and production: pre-design initiation, design initiation, prototype delivery and testing, and pre-production certification. Zytec also provides 72 hours of quality training to most employees, and rewards employees for additional skills acquired. Zytec's quality efforts have paid substantial dividends: in 1990 they were rated the number one power supply vendor by an independent research study and were rated the number one power supply repair operation by Service News[24].

AT&T Transmission Systems Business Unit

This AT&T business unit adopted the Baldrige criteria as quality benchmarks in 1989. An increased focus on customer needs produced major changes in the Transmission Systems Unit; for example, the organization has been restructured so that two executive teams now run the business. Management and union-represented employees jointly serve on teams with the common goal

of carrying out initiatives and serving customers. At least once per year, major customers are given “report cards” to grade the transmission systems supplier on product and service characteristics. This information guides AT&T’s strategic planning process. Continuing improvement in product quality has allowed them to offer a five-year warranty without increasing warranty costs and has also made them a high-growth exporter of transmission equipment[25].

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AT&T Universal Card Services

This bank card subsidiary was established in March 1990 and quality has been designed into the business since its beginning, focusing on the Baldrige Award criteria. Its quality structure revolves around eight categories of “satisfiers” including customer service and price. These categories are further broken down into 125 weighted criteria to track AT&T’s ability to “delight the customer”. A data and tracking system is used for continuous improvement efforts in customer relationships, internal operations, supplier partnerships, and business performance. Additionally, AT&T has eight customer-related databases and 11 monthly surveys which track satisfaction and service quality. Everyone in the organization has a list of the “ten most wanted” quality improvements. Employees are empowered to make spot decisions and undergo numerous hours of training and customer service orientations. Monthly surveys are also used to track employee satisfaction. AT&T Universal Card Services is now number two in the bank card industry in terms of accounts and cardholders[26].

Granite Rock Company

Granite Rock started its Total Quality Program in 1985, geared towards satisfying both its direct customers (commercial and residential builders and highway construction companies) and its indirect customers (the building and highway buyers). Its quality efforts are providing speedy service and high quality materials to its buyers, saving the company substantial rework and deterioration costs. Granite Rock periodically holds seminars for contractors, developers, architects, and suppliers to explain the benefits of its quality focus. During its annual quality planning process, top executives evaluate performance data and develop measurable goals to help the company achieve its quality objectives. Once these goals are set, the company expects branches and divisions to develop their own implementation plans. Ten quality committees oversee the implementation/improvement efforts. In 1991, Granite Rock averaged 37 hours of training per employee, 13 times greater than the construction industry average[27].

Texas Instruments Defense Systems and Electronics Group

This division of Texas Instruments began its quality improvement efforts in 1983 with a pilot group of four worker teams to execute the company’s quality strategies. Today, there are over 1,900 unsupervised teams at all levels and in all units, accomplishing the five- and ten-year quality goals set forth by top

Cadillac Motor Car Co. (1986-1989)	
27-71 per cent decrease in reliability durability problems	29 per cent decrease in warranty-related costs
16 per cent increase in customer satisfaction	29 per cent decrease in styling change time
56 per cent decrease in engineering changes	50 per cent decrease in parts and assembly times of many assemblies
Federal Express Corp.	
1,000 per cent increase in individual performance awards (1985-89)	22 per cent decrease in quality-failure index (1987-90)
71 per cent decrease in package expediting costs (1989-90)	12 per cent increase in customer satisfaction (1987-90)
Globe Metallurgical Inc. (1985-91)	
367 per cent increase in firm productivity	91 per cent decrease in customer complaints
\$10 million per year decrease of waste materials	\$1 million per year decrease in transportation costs
77 per cent decrease in inventory	700 per cent increase in international sales
Marlow Industries, Inc.	
56 per cent increase in productivity per employee (1987-91)	100 per cent increase in quality training hours per employee (1988-91)
49 per cent decrease in costs of non-conformance (1989-91)	66 per cent increase in material production yield (1988-91)
100 per cent increase in employee team membership (1989-90)	75 per cent decrease in waste disposal needs (1988-91)
Milliken and Co.	
72 per cent decrease in suppliers (1981-89)	77 per cent increase in ratio of production/management employees (1981-89)
60 per cent decrease in costs of non-conformance (1981-89)	32 per cent increase in on-time deliveries (1984-88)
42 per cent increase in productivity (1981-89)	
Motorola Inc. (1981-91)	
150-fold improvement in in-process defects	\$2.2 billion in cost savings due to quality improvements (1986-1991)
97 per cent decrease in cycle time for cellular phones	90 per cent increase in cellular phone reliability
93 per cent decrease in returned order costs	62 per cent decrease in part count for cellular telephones
IBM Rochester (1984-1990)	
47 per cent decrease in customer complaints	55 per cent decrease in product write-offs
45 per cent decrease in engineering change costs	70 per cent decrease in cycle time for AS/400
35 per cent increase in revenue per employee	
Soletron Corp.	
50 per cent decrease in average product rejection rate (1987-1991)	10 per cent per year average cycle time decrease (1987-1991)
Tenfold decrease in part defect rate (1984-1991)	
Wallace Co. Inc.	
77 per cent increase in market share (1987-90)	84 per cent decrease in suppliers (1987-90)
600 per cent increase in team participation (1985-90)	800 per cent increase in use of Electronic Data Interchange systems among Wallace suppliers (1988-90)
23 per cent increase in on-time deliveries (1987-90)	
Westinghouse Electric Corp. (1983-1991)	
50 per cent decrease in inventory (Eletromar Div.)	66 per cent decrease in design cycle time (CNFD)
25 per cent decrease in product defects (Thermo King Div.)	74 per cent increase in fuel rod manufacturing yields (CNFD)
50 per cent decrease in design cycle time (Assemblies Div.)	Tenfold increase in product reliability (CNFD)
Xerox Corp. (1985-1990)	
73 per cent increase in incoming supply quality	27 per cent decrease in service response time
78 per cent decrease in machined parts defectives	38 per cent increase in customer satisfaction
40 per cent decrease in unscheduled maintenance	17-fold increase in use of benchmark measurements
Zytec Corp.	
50 per cent increase in manufacturing yields (1988-91)	13 per cent increase in on-time deliveries (1989-90)
26 per cent decrease in manufacturing cycle time (1988-91)	Tenfold increase in mean time between failures (1987-91)
50 per cent decrease in design cycle time (1988-91)	48 per cent decrease in warranty costs (1988-90)

(Continued)

Table II.
Key Performance
Improvement
Indicators for the
Baldrige Award
Winners

AT&T Trans. Systems Bus. Unit (1989-92) Tenfold improvement in product quality 50 per cent decrease in manufacturing batch sizes \$400 million in cost savings	50 per cent decrease in new product development time 40 per cent decrease in inventories 100 per cent increase in international sales
AT&T Universal Card Services (1990-1992) 500 per cent increase in sales volume Five decreases in interest rate charged Number two in sales among 6,000 credit card issuers	Tenfold increase in employees 40 per cent increase in calling card revenues among universal card holders Threefold increase in employee suggestions
Granite Rock Co. (1985-1991) 34 per cent increase in on-time deliveries 63 per cent decrease in quarry-truck loading time	Revenue per employee is 30 per cent higher than industry average Three times more training hours per employee than industry average
Texas Instruments Defense Systems and Electronics Group (1987-1991) 72 per cent decrease in customer-conducted quality audits 62 per cent decrease in customer complaints 56 per cent increase in revenue/employee	Threefold increase in quality teams 66 per cent decrease in an average design cycle time 18 per cent decrease in suppliers
The Ritz-Carlton Hotel Co. (1989-1991) Threefold increase in TQM expenditures 47 per cent decrease in employee turnover 6 per cent increase in employee satisfaction	67 per cent increase in supplier on-time deliveries 100 per cent increase in predetermination of repeat customer needs 8 per cent decrease in hours worked per guest room

Table II.

executives. The quality strategies are driven by evaluations of customer needs. Customer information is gathered using surveys, interviews, customer site visits and customer provided documents. Key requirements are identified and translated into improvement goals for products, processes, and services. Performance measurement systems are then designed to measure progress towards those goals. Since 1986, the US Navy has designated 106 of Texas Instruments' processes and techniques as "best manufacturing practices" (more than any other company)[28].

The Ritz-Carlton Hotel Co.

While the reputation of Ritz-Carlton Hotels has always been one of the highest quality customer care, the recent recession has caused the Ritz-Carlton to become more formalized in its approach to quality, to reduce waste and service variabilities. An executive committee meets weekly to review the quality of products and services, guest satisfaction, market growth, and competitive status. Executives devote about one-quarter of their time to quality-related matters. Key customer requirements have been translated into "Gold Standards", and each employee is expected to understand and adhere to these standards. Employees are empowered to "move heaven and earth" to satisfy customers. Ritz-Carlton values are reinforced by giving frequent recognition for extraordinary employee achievements and annually surveying employees to determine their levels of satisfaction and understanding of quality standards.

Table III.
Financial Information
for Federal Express,
Motorola, Solectron and
Xerox

	Federal Express	Motorola	Industry ^a	Motorola	Industry ^b	Solectron	Industry ^c	Xerox	Industry ^d
Sales (million \$)									
1987	3,178	6,727				60		14,890	
1988	3,883	8,250				93		16,177	
1989	5,167	9,620				130		17,229	
1990	7,015	10,885				205		17,926	
1991	7,688	11,341				265		17,683	
1992	7,550	13,303				407		18,661	
Average sales growth (%/yr)	19.8	14.8				47.1		4.7	
Return on sales (%)									
1987	5.3	4.6	4.2			2.5	4.0	3.9	3.9
1988	4.8	5.4	5.3	3.5		3.2	4.3	2.4	4.0
1989	3.2	5.2	3.6	4.0		3.1	3.6	3.1	3.1
1990	1.7	4.6	4.4	3.2		3.7	2.8	3.6	2.7
1991	0.1	4.0	2.1	2.9		3.5	4.0	2.5	2.3
1992	0.0	4.3	4.2	4.5		3.6	2.1	0.0	3.6
Return on assets (%)									
1987	6.9	6.1	5.6	4.3		5.6	5.2	2.5	3.9
1988	6.7	7.4	5.0	5.0		7.5	7.5	2.0	5.0
1989	4.0	6.9	4.8	4.4		7.1	6.1	2.6	4.6
1990	2.1	6.0	5.8	5.8		8.3	4.5	2.0	5.9
1991	0.1	5.0	3.2	3.2		6.8	5.6	1.4	4.0
1992	0.0	5.7	15.8	6.1		14.7	3.5	0.0	4.4
Return on net worth (%)									
1987	15.3	10.6	12.1	7.7		11.5	11.0	11.3	7.5
1988	15.4	13.9	20.4	8.9		19.4	15.9	6.5	9.7
1989	11.9	13.8	13.9	8.3		22.1	16.4	9.8	7.9
1990	7.3	12.3	11.7	11.5		20.7	10.6	12.1	9.3
1991	6.3	10.2	11.0	7.0		19.6	15.6	8.4	8.7
1992	4.1	11.7	35.0	10.2		13.9	12.9	-0.6	11.3
Share price/earnings									
1987	19.5	22.7	19.3	27.2		--	27.2	13.3	13.6
1988	15.1	13.0	13.7	16.2		--	16.2	9.4	14.3
1989	13.8	12.6	13.1	13.1		7.0	13.1	3.6	12.0
1990	23.9	17.5	10.6	21.0		8.5	23.3	3.8	12.6
1991	19.2	18.0	NA	23.8		16.0	23.1	11.4	14.7
1992	34.7	13.7	NA	13.8		23.5	30.2	NA	17.4
Earnings/share									
1987	-3.2	2.4	2.0	0.4		0.2	0.4	5.3	2.0
1988	3.6	3.4	2.2	1.1		0.3	1.1	3.5	1.7
1989	3.2	0.0	0.9	0.0		0.5	0.0	6.6	2.1
1990	2.2	3.8	-0.6	NA		1.6	-0.6	3.5	1.8
1991	2.0	3.4	NA	NA		1.7	NA	3.9	NA
1992	1.2	2.2	NA	NA		0.9	NA	NA	NA
Average EPS Growth (%/yr)	-15.8	1.5	-20.1	6.7		36.6	6.7	2.2	-1.9

^a Air courier services; ^b Radio and TV equipment; ^c Printed circuit boards; ^d Photographic equipment and supplies

Financial characteristics	Combined response	Competitive characteristics	Combined response
<i>Overall financial performance</i>		<i>Current overall competitiveness</i>	
Change with respect to industry	+	Change with respect to industry	+
Amount of change due to quality programme	58%	Amount of change due to quality programme	84%
<i>Sales</i>		<i>Projected future competitiveness</i>	
Change with respect to industry	+	Change with respect to industry	+
Amount of change due to quality programme	73%	Amount of change due to quality programme	91%
<i>Previous five-year sales growth</i>		<i>Overall product quality</i>	
Change with respect to industry	+	Change with respect to industry	+
Amount of change due to quality programme	70%	Amount of change due to quality programme	98%
<i>Projected future sales growth</i>		<i>Innovative product offerings</i>	
Change with respect to industry	+	Change with respect to industry	+
Amount of change due to quality programme	80%	Amount of change due to quality programme	65%
<i>Return on sales</i>		<i>Product complaints/returns</i>	
Change with respect to industry	+	Change with respect to industry	+
Amount of change due to quality programme	70%	Amount of change due to quality programme	93%
<i>Return on assets</i>		<i>Employees' job satisfaction</i>	
Change with respect to industry	+	Change with respect to industry	+
Amount of change due to quality programme	50%	Amount of change due to quality programme	57%

Table IV.
Financial and
Competitive
Assessments of Four of
the Privately-held
Baldrige Award
Winners

As a result, the Ritz-Carlton received industry-best rankings by all three major hotel-rating organizations in 1991[29].

An Operations and Financial Review of the Baldrige Award Winners

Since the primary goal of implementing quality improvement programmes is to increase competitiveness, a review of some key operating and financial performance measurements of the Baldrige Quality Award recipients will shed light on the success of each recipient's quality improvement programme. Additionally, since the Baldrige Award is accepted as the indicator of product

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quality leadership among American firms, and since product quality has been shown in the literature to be directly correlated with financial success, a financial analysis of these firms will help determine if the Baldrige Award is a meaningful indicator of product quality leadership.

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Operating and Financial Performance Measures

Table II lists a number of key operating performance measures relating to quality improvement for each of the Baldrige Award winners. While several of the firms exhibit improvement characteristics unique to their respective industries, all or most of the 17 firms have shown impressive achievements in customer service, production costs, product reliability, defect or failure rates, and cycle time. Also notable are the increases in employee quality training, the decreases in the number of suppliers used, the decreases in warranty costs, and the increases in employee productivity. It is apparent that the quality improvement efforts of these 17 companies (all of which were formally initiated within the previous five to ten years) have had a positive effect on the operating characteristics of the firms.

Specific financial information for four of the Baldrige Award winners is presented in Table III. Motorola, Xerox, Federal Express and Solectron are the only award winners that are both publicly-held and are not subsidiaries or divisions of other firms, thus the financial information should provide some unbiased insights into the quality/financial performance relationship. Additionally, qualitative information regarding financial and competitive characteristics of four of the privately-held Baldrige Award winners appears in Table IV.

Financial performance is generally evaluated using trend and industry analyses. A trend analysis tracks a firm's financial performance over time, while an industry analysis compares a firm's financial performance to industry averages. Both approaches are utilized here. Comparing the profitability and market-based financial ratios of the award winners to their industry counterparts should provide insights into the value of their quality programmes and the ability of the Baldrige Quality Award Consortium to select industry leaders in product quality from among the award applicants.

Profitability and stock market-based ratios were used to assess financial performance for the four firms since 1987 (one year prior to the first Baldrige Award). The profitability data used were the annual sales, the average five year sales growth, the return on sales, the return on assets, and the return on net worth. The market-based data indicate the market's interpretation of the expected future performance of each firm by industry analysts and market investors. The market data used were the share price per earnings (P/E) ratio, the earnings per share (EPS), and the five year average EPS growth. *Value Line*, *Standard and Poor's*, and *Disclosure* were used as sources for the financial information.

The financial results were mixed when analysing Federal Express. While their 19.8 per cent average sales growth has been impressive, and EPS out-

performed the industry for the years in question, the profitability trends indicate a deteriorating performance, particularly in 1991 and 1992. Explanations for the weakened performance are the acquisition of Tiger International in 1989 and the prolonged recent recession. The acquisition of Tiger International made Federal Express the world's largest all-cargo airline. Once Tiger International is fully assimilated and the economy recovers, Federal Express will be well positioned for significantly higher profitability.

Motorola's profitability ratios were consistently higher than the industry ratios from 1987 to 1991, while EPS were also impressive when compared with industry averages over the same time period. The higher return on sales and return on assets indicate that Motorola has been operating relatively efficiently and has also been in a relatively better position to handle adverse economic conditions. Motorola's return on net worth was not only consistently above the industry norm, but also consistently above 10 per cent, which is commonly used as a benchmark figure for a desirable return on net worth. Motorola's P/E ratio has risen in recent years to approximately 20, indicating that investors are growing more confident of future earnings growth and stability. EPS has far outpaced the industry average, providing further proof of Motorola's competitive strength within its industry.

Soletron's profitability ratios indicate the firm has generally surpassed the industry norms. While the industry return on sales has been variable but above Soletron's return on sales in four of the last six years, Soletron's return on assets and return on net worth consistently exceeds industry averages. Furthermore, the return on net worth is substantially above the 10 per cent level. Soletron's annual sales growth has averaged an impressive 47 per cent, with sales increasing from \$60 million in 1987 to \$407 million in 1992. Soletron operates in the highly competitive field of printed circuit board manufacturing, and competes with Japanese manufacturers for sales to such large buyers as Sun Microsystems and IBM. The sales growth rate indicates the firm has operated very successfully in a highly competitive international market.

While the return on sales and return on net worth was higher than the industry average in three of the five years examined, the return on assets has been disappointing for Xerox. The return on assets figures were lower than the industry average in all six years examined. In 1990, Xerox absorbed a \$400 million pre-tax write off in connection with its investments in VMS Realty partners. The losses associated with this real estate undertaking combined with recessionary effects on the market were largely responsible for the weakening profitability ratios over the past two years. Nevertheless, Xerox has managed to increase sales by an average of 5 per cent per year the past five years and the P/E ratio has recently been increasing. This suggests the market anticipates improved performance in the future. Additionally, *Value Line* projects that over a three- to five-year investment horizon, Xerox will provide an attractive total return.

The financial performance of the four firms reviewed in Table III is mixed. During a period of economic recession, all four firms experienced significant

sales growth over the period of investigation. However, two of the four firms were not immune to market conditions, and experienced declining profitability from 1989 to 1992. Compared to industry averages, Motorola and Solectron performed substantially better, Xerox performed slightly better, while Federal Express performed somewhat worse.

Table IV presents the combined responses to a questionnaire regarding financial and competitive performance of four of the privately-held award winners. The four respondents consisted of a Chief Executive Officer, two Quality Managers, and a Marketing Vice President. Each of the respondents cited financial improvements with respect to their industry and attributed a significant portion of this improvement to their quality improvement programmes. The respondents also cited improvements in competitive characteristics with respect to their industry and attributed much of this improvement to their quality programmes, particularly in the areas of projected future competitiveness, overall product quality, and product complaints or returns. These findings tend to agree with previous research regarding the quality-performance relationship.

In summary, while Tables II and IV reveal a strong positive relationship between quality improvement programmes and the competitive attributes of the Baldrige Award winners, there is no guarantee that these improvements will result in continual financial success (as evidenced by the financial problems of Federal Express and the Wallace Co.). Quality improvement programmes should not be viewed as a panacea for businesses, but rather a means with which to build and maintain a strong competitive foundation that will insure the opportunity for financial success.

Conclusions

The Malcolm Baldrige National Quality Award has quickly gained recognition as the premier indicator of product quality among US businesses. The objective of the award is to recognize firms achieving world-class competitor status. Additionally, the award seeks to give other firms (non-winners and non-applicants) a basis for benchmarking their own quality efforts and give examples for quality improvement programmes.

One question that surfaces when considering the guidelines used to evaluate the Baldrige Award applications is whether the Baldrige Consortium identifies product quality leaders adequately among the applicants. The information in Tables II, III and IV generally supports this assumption. While the economic conditions have been poor for many industries in recent years, the firms studied in Table III generally appear to be performing financially as well or better than their competitors. Financial information on four of the privately-held award winners also tends to support the previous research. Additional future award winners will no doubt provide more information on the ability of the Baldrige Award to identify product quality leaders and also provide examples for other firms in their quality improvement efforts.

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