On the social value of quality: An economic evaluation of the Baldrige Performance Excellence Program.

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Link, A. N., & Scott, J. T. (October 01, 2012). On the social value of quality: An economic evaluation of the Baldrige Performance Excellence Program. *Science & Public Policy (spp), 39,* 5: 680-689.

Abstract:

This study estimates the net social value of the Baldrige Performance Excellence Program. It focuses specifically on a survey population of 273 applicants for the Malcolm Baldrige National Quality Award since 2006. Using a counterfactual evaluation method, social benefits have been quantified from the responses of 45 Award applicants to a web-based survey. We estimate the ratio of all measured social benefits to costs to be between 351:1 and 820:1. This finding certainly supports the belief that the Baldrige Program creates considerable value for the US economy.

Keywords: Baldrige Award | quality | performance excellence | program evaluation | social benefit | economics | US economy

Article:

1. Introduction

Productivity in the non-farm US economy fell in the early-1970s and then fell again in the early to mid-1980s.1 Associated with these declines was the loss of world market shares by firms in many critical industries. In response, a number of economic policy initiatives were introduced in the early-1980s in an effort to reverse the downward productivity trend by stimulating innovative activities within firms. These initiatives included: the Bayh–Dole Act of 1980 and the Stevenson–Wydler Innovation Act of 1980 to encourage technology transfer from universities and federal laboratories, respectively, to the private sector; the Economic Recovery and Tax Act of 1981 that contained provisions for a research and experimentation (R&E) tax credit; the Small Business Innovation Development Act of 1982 that established the Small Business Innovation

Research (SBIR) Program; and the National Cooperative Research Act of 1984 that encouraged collaborative research activity among firms.

Further, Congress declared as part of the Malcolm Baldrige National Quality Improvement Act of 1987 (US Public Law (PL) 100-107) that:

> … the leadership of the United States in product and process quality has been challenged strongly (and sometimes successfully) by foreign competition, and our Nation's productivity growth has improved less than our competitors over the last two decades; … a national quality award program … in the United States would help improve quality and productivity by:

A helping to stimulate American companies to improve quality and productivity for the pride of recognition while obtaining a competitive edge through increased profits,

B recognizing the achievements of those companies which improve the quality of their goods and services and providing an example to others,

C establishing guidelines and criteria that can be used by businesses, industrial, governmental, and other organizations in evaluating their own quality improvement efforts, and

D providing specific guidance for other American organizations that wish to learn how to manage for high quality by making available detailed information on how winning organizations were able to change their cultures and achieve eminence.

… [and] There is hereby established the Malcolm Baldrige National Quality Award …

The goal of the Malcolm Baldrige National Quality Improvement Act of 1987 was to enhance the competitiveness of US businesses. Applicants for the Award originally represented three categories of US firms: manufacturing firms, small businesses, and service sector firms.

The criteria for the Malcolm Baldrige National Quality Award have evolved over time. In 1997, the name of the Award Criteria was changed to the Criteria for Performance Excellence, and in 2010 the Program was renamed the Baldrige Performance Excellence Program.2 The name of the award has remained the Malcolm Baldrige National Quality Award. The scope of the Program has also evolved. It was expanded to include health care and education organizations in 1999 and nonprofit/government organizations in 2006. Table 1 shows the number of applicants, by year and by sector, for the Award.

Table 1.

Number of award applicants, by year and by sector

Year	Manufacturing	Service	Small business	Education	Health care	Nonprofit	Total
1988	45	9	12	n/a	n/a	n/a	66
1989	23	6	11	n/a	n/a	n/a	40
1990	45	18	34	n/a	n/a	n/a	97
1991	38	21	47	n/a	n/a	n/a	106
1992	31	15	44	n/a	n/a	n/a	90
1993	32	13	31	n/a	n/a	n/a	76
1994	23	18	30	n/a	n/a	n/a	71
1995	18	10	19	n/a	n/a	n/a	47
1996	13	6	10	n/a	n/a	n/a	29
1997	9	7	10	n/a	n/a	n/a	26
1998	15	5	16	n/a	n/a	n/a	36
1999	4	11	12	16	9	n/a	52
2000	14	5	11	11	8	n/a	49
2001	7	4	8	10	8	n/a	37
2002	8	3	11	10	17	n/a	49
2003	10	8	12	19	19	n/a	68
2004	8	5	8	17	22	n/a	60
2005	1	6	8	16	33	n/a	64
2006	3	4	8	16	45	10	86
2007	2	4	7	16	42	13	84
2008	3	5	7	11	43	16	85
2009	2	4	5	9	42	8	70
2010	3	2	7	10	54	7	83
Total	357	189	368	161	342	54	1,471

The Program is a public–private partnership (Link 2006). The public aspect of the Program involves its reliance on governmental resources to support the Program Office within the National Institute of Standards and Technology (NIST). The private aspect of the partnership involves monetary and in-kind resource support (e.g. examiner's time to evaluate applications for the Award).

In 2001, we estimated the net social benefits associated with the Baldrige National Quality Program using interview data from members of the American Society for Quality (ASQ)3 (Link and Scott 2001, 2006). We concluded from that study that the ratio of ASQ benefits (i.e. benefits to the population of ASQ members) to the total social costs associated with the Program was

18.2:1. Projecting the benefits to the economy as a whole, the benefit–cost ratio was estimated to be 207:1. Thus, at one level, this paper represents a decennial re-evaluation of the Program given that scope of the Program has evolved. At another level, this paper represents an exercise to determine the accountability of public resources devoted to the Program.

On 7 October 2009, Peter Orszag, Director of the Office of Management and Budget (OMB), sent a memorandum to the heads of executive departments and agencies on the subject of increased emphasis on program evaluations. He wrote:

> Rigorous, independent program evaluations can be a key resource in determining whether government programs are achieving their intended outcomes … Evaluations can help policymakers and agency managers strengthen the design and operation of programs. Ultimately, evaluations can help the [Obama] Administration determine how to spend taxpayer dollars effectively and efficiently … (Orszag 2009)

The remainder of the paper is outlined as follows. In Section 2, the methodology used in this evaluation is overviewed and the counterfactual evaluation method which is used is discussed in detail. The process used to collect relevant benefit and cost data is described in Section 3. The data used in the economic evaluation are presented in Section 4 along with calculated benefit–cost ratios. Section 5 includes a discussion of the findings and a brief concluding statement.

2. Evaluation methodology

Traditional economics-based evaluation methods are frequently referenced to the research by Griliches (1958) and Mansfield et al. (1977). They pioneered the application of fundamental economic insights to the development of estimates of the private and social rates of return to investments in R&D. Streams of investment outlays through time (the costs) generate economic surplus through time (the benefits). Once identified and measured, these streams of costs and benefits are used to calculate rates of return, benefit–cost ratios, and other related metrics.

In a broad sense, the Baldrige Performance Excellence Program is a measurement-and-standards infrastructure R&D investment program. Publicly funded, publicly performed infrastructure R&D developed the Baldrige Criteria. Continuing investments have occurred within the Program throughout the Baldrige Award process to measure business performance and apply the Criteria.

The Griliches–Mansfield model for calculating economic social rates of return is generally viewed as the traditional evaluation method to use when considering the impact of a publicly funded technology. However, following Link and Scott (1998, 2011, 2012), it is not the most appropriate model to use from a public accountability perspective and therefore it is not employed in this study. Rather, the counterfactual evaluation method is implemented, and the evaluation question asked is: What would the private sector have had to invest to achieve the same level of benefits as provided through the publicly funded Baldrige Performance Excellence Program?4

When there are shortfalls in benefits, despite such investment with the aim of achieving the same level of benefits, the counterfactual evaluation method is expanded here to also include the gains in producer and consumer surplus associated with a firm or organization (hereafter ‘firm’ in the theoretical discussion in this section) implementing the Baldrige Criteria rather than incurring costs to establish performance excellence in the absence of the Baldrige Program.

Fig. 1 shows a firm, with average cost AC and facing demand D, that sells its differentiated product or service in amount Q* at price P* in a market with other sellers.5 The area defined by the triangle ABP* represents the consumer surplus. Producer surplus is represented by the rectangle P*BEF.

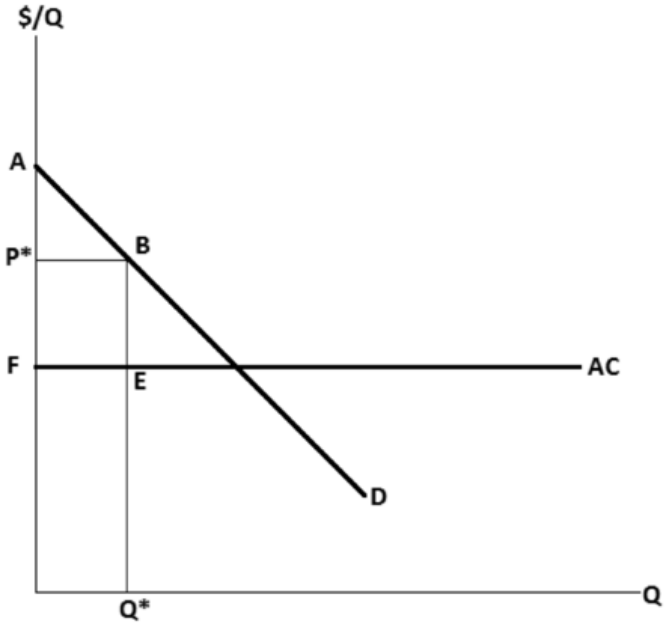

Figure 1. Consumer surplus and producer surplus.

Fig. 2 shows the same firm after it has implemented the Baldrige Criteria. The firm's demand has increased from D to D′ because of the firm's higher quality product, and its average cost has fallen from AC to AC′ because of more efficient operations. This firm's implementation of the Baldrige Criteria has created a net gain of HGJA in total surplus because of new consumer surplus and a net gain of JBEFKLG in total surplus because of new producer surplus.6

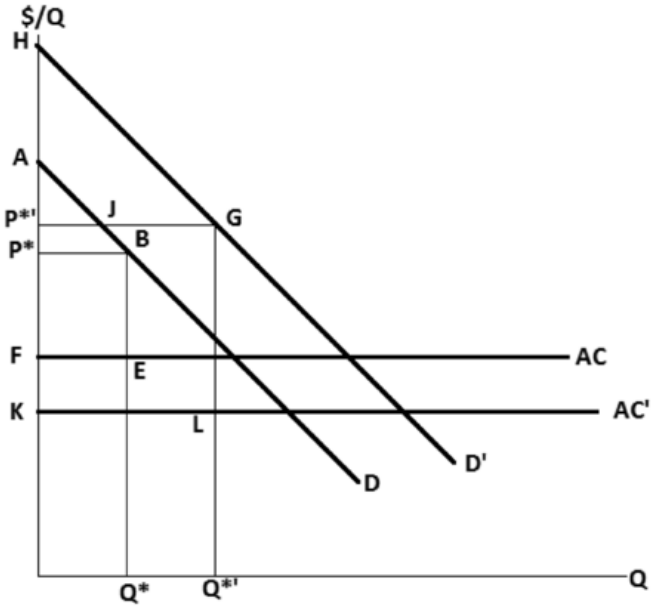

Figure 2. Consumer surplus and producer surplus from implementing Baldrige Criteria.

Fig. 2 depicts the annual effect resulting when the firm implements a performance excellence program using the Baldrige Criteria. Over time, other firms with competing differentiated products and efficient processes could erode the firm's profitability and hence the producer surplus. In a long-run equilibrium, producer surplus may even be eliminated by price competition among the sellers of the general type of differentiated product or service, although the benefits to consumers of higher quality products of that type will increase as prices fall and numerous competitors offer the higher quality products, resulting in more consumer surplus as the producer surplus is competed away.

Therefore, given the social costs—the public and private costs to operate the Baldrige Performance Excellence Program—the counterfactual evaluation method is used to estimate the three following public benefits of the Program:

The counterfactual cost savings as measured by what the private sector would have had to invest in its attempt to achieve the same level of benefits as provided through the publicly funded Baldrige Performance Excellence Program.

The annual shortfall from HGJA in Fig. 2, given the alternative performance excellence programs developed by firms in the absence of the Baldrige Criteria (i.e., the annual gains in consumer surplus because the Baldrige Criteria were available rather than the counterfactual alternatives).

The annual shortfall from JBEFKLG in Fig. 2, given the alternative performance excellence programs (i.e. the annual gains in producer surplus because the Baldrige Criteria were available rather than the counterfactual alternatives).

3. Data collection process

Two sets of data are needed to implement the counterfactual evaluation method. The first set of data relates to the costs to operate the Baldrige Performance Excellence Program. The second set relates to the three categories of benefits described above: the implementation costs (of performance excellence programs in the absence of the Baldrige Program) avoided by the private sector, the avoided shortfalls in the gains in consumer surplus, and the avoided shortfalls in the gains in producer surplus. The three categories of benefits—the avoided implementation costs and the avoided shortfalls in consumer and producer surplus gains—are costs avoided because of having the Baldrige Program rather than having to use the counterfactual alternatives to the Baldrige Criteria. Annual program costs for the period 1988–2010 were provided by the Baldrige Performance Excellence Program Office.

On the benefit side, the Program Office provided the email addresses of applicants to the Malcolm Baldrige National Quality Award for the period 2007–10, 2007 being the first application year after the scope of the Program was expanded. During the period 2007–10, there were 322 applications for the Malcolm Baldrige National Quality Award. These 322 applications were from 273 firms and organizations. The 49 additional applications were repeat applications from some of the 273 firms and organizations. The 273 firms and organizations that applied for the Award in the period 2007–10 were asked to complete a web-based survey instrument.7 A total of 45 firms and organizations responded to the survey request—a response rate of 16.5%—and the results from an evaluation analysis based on those responses were used to calculate the benefits associated with the Program.8

Because the survey respondents are all Award applicants, an additional cost was considered in the evaluation analysis. Specifically, the following question was asked about the costs of applying for the Award (see Box 1):9

Box 1

If your organization has been an Award applicant, what was the total monetary cost (fully burdened and in current dollars) to your organization to obtain, understand, collect relevant information, and comply with the Baldrige Award or state application requirements?

Approximately between $_____ and $_____(in current dollars) per year over the year(s) ____to _____.

Box 2

Please consider the following hypothetical or counterfactual situation. Assume the Baldrige Criteria and related processes had not been available, and as a result your organization could not have used the Baldrige Criteria or related criteria to perform an organizational performance self-assessment or submit an award application to receive feedback on organizational performance from a panel of trained Baldrige examiners. We would like to know how much your organization would have had to spend in the absence of the Baldrige Criteria or related criteria, and over what years, to achieve the same level of expertise in performance excellence that your organization now has.

Counterfactual Cost Savings

In the absence of the Baldrige Performance Excellence Program—and therefore without the information and assistance that it provides about performance excellence assessments and therefore with the need to incur expenditures to develop and acquire such knowledge and assistance from other sources—what expenditures (fully burdened and in current dollars) would your organization have incurred to achieve the same level of expertise in performance excellence that you now have?

Approximately between $_____ and $_____(in current dollars) per year over the years _____ to _____.

Box 3

Above, you estimated, in the hypothetical or counterfactual situation without the Baldrige Criteria or related criteria for guidance, the additional costs that your organization would have incurred to achieve same level of expertise in performance excellence that your organization has now achieved using these criteria. However, even with such additional effort, if performance excellence were achieved in the absence of the Baldrige Criteria, customers may have undervalued the products and services of your organization and investors may have not recognized as fully the performance excellence achieved. Or, possibly, despite efforts to achieve the same level of performance excellence, there would have been a performance shortfall without the Baldrige Criteria to guide organizational self-assessment and improved performance. This question allows you to quantify any such shortfalls in quality performance that would have been experienced in the hypothetical situation where your organization had not had the Baldrige Criteria or related criteria and instead used the substitution of additional efforts to make up for the loss of the Criteria to organize the management of performance excellence.

Consumer Surplus

Because a key aspect of quality performance is ensuring customer satisfaction, it is expected that the value customers place on your organization's products or services increased because of performance improvement efforts. Because of the competition your organization faces, customers' willingness to pay for the products or services of your organization will typically exceed what they actually do pay. If the Baldrige Criteria or criteria based on them had not been available as a guide, and instead your organization had incurred the costs for improvement as reported above, as a percentage of your organization's total sales/revenues or the appropriate analogous measure, what would have been the approximate reduction annually in the excess amount (beyond what they actually paid) in your customers' collective willingness to pay for your organization's products or services because improvement took place in the absence of the Baldrige Criteria? Please mark the most appropriate answer:

0% 5%-10% 10%-20% 20%-30% 30%-40% 40%-50%

50%-60% 60%-70% 70%-80% 80%-90% 90%-100% other__%

Producer Surplus

If your organization had not had the Baldrige Criteria as a guide, and instead had incurred the costs for quality improvement as reported above, as a percentage of your organization's total sales/revenues or the appropriate analogous measure (for example, for a health care organization, revenues might include third party reimbursements, or for an organization in education the tuition fees and grants, or for a public school perhaps simply the annual budget, or for a charitable organization the donations and grants it receives, and so forth), what would have been the shortfall in annual earnings before interest and taxes (or the most appropriate analogous measure reflecting the difference between revenues and costs for your organization) for your organization because improvement took place in the absence of the Baldrige Criteria? Please mark the most appropriate answer:

0% 5%-10% 10%-20% 20%-30% 30%-40% 40%-50%

50%-60% 60%-70% 70%-80% 80%-90% 90%-100% other __%

The counterfactual cost savings, as measured by what the private sector would have had to invest in an attempt to achieve the same level of benefits as provided through the publicly funded Baldrige Performance Excellence Program, were obtained from responses to the survey question given in Box 2:

The avoided shortfalls (of what would be obtained with the counterfactual effort to replace the Baldrige Criteria from what was obtained with the Baldrige Criteria) in consumer surplus and producer surplus were measured from responses to the survey questions given in Box 3:10

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4. Estimation of net social benefits

One method, and clearly the most conservative method, for calculating the net social benefit associated with the Baldrige Performance Excellence Program is to employ a cluster approach.11 A cluster approach to evaluation compares the benefits for a sample of identified private-sector benefit recipients from the population of potential benefit recipients to the total operating costs of

the publicly funded, publicly performed program. Stated differently, a cluster approach in effect assumes that the subset of affected parties for which benefit information is available is the entire population of affected parties. Thus, while we noted above that our survey response rate was on par with other studies of innovative and competitive behavior, our response rate is not relevant in the sense that we are comparing the benefit responses from 45 firms to the total Quality Award budget.

In addition to the pronounced conservative (i.e. downward biased) basis from using the cluster approach focused on only the applicants for the Baldrige National Quality Award, an even more conservative measure of social benefits associated with the Baldrige Performance Excellence Program would be to use for the cluster of applicants only the sum of implementation cost savings (category 1, see numbered list in Section 2) obtained from the sample of 45 survey respondents. Thus, a decidedly lower bound estimate of benefits associated with the Baldrige Performance Excellence Program is the ratio of the present value of implementation cost savings for the 45 survey respondents to the present value of total Program operating costs. Below we present evaluation metrics using only implementation cost savings as well as metrics adding the consumer and producer surplus benefits.

Program costs, provided by the Program Office, are reported in Table 2 in 2010 US dollars ($2010). The present value of total Program operating costs is derived from Table 2. Each annual value of operating costs, in 2010 dollars ($2010), is referenced forward to 2010 by a 7% real rate (see column (3) of Table 3).12 The application costs, as quantified from the survey of Award applicants, and the present value of those costs are also included in Table 3 (columns (4) and (5)).

Table 2. Baldrige Performance Excellence Program operating costs ($2010 thousands)[a]

(1) Fiscal year	(2) NIST allocations	(3) Foundation allocations[b]	(4) Firm reimbursed examiner expenses[b]	(5) Examiner time (hours)[b]	(6) Total operating costs[c]
1988	$249.67	*$749.01*	*$237.19*	*37,995*	$4,218.47
1989	$509.33	*$749.01*	*$237.19*	*37,995*	$4,478.13
1990	$609.19	*$749.01*	*$237.19*	37,995	$4,577.99
1991	$1,270.82	*$749.01*	*$237.19*	46,510	$5,908.04
1992	$1,850.05	*$749.01*	*$237.19*	49,763	$6,742.64
1993	$1,903.73	*$749.01*	*$237.19*	46,223	$6,518.43
1994	$3,570.27	$910.01	$237.75	45,944	$8,324.64
1995	$4,507.78	$867.19	$234.86	51,259	$9,633.66
1996	$3,576.51	$813.94	$200.02	44,143	$8,055.70
1997	$3,962.25	$971.96	$214.47	44,090	$8,609.75
1998	$3,757.52	$1,009.55	$197.09	43,662	$8,391.63
1999	$4,839.84	$1,447.25	$232.26	51,735	$10,580.55
2000	$6,658.68	$1,482.46	$200.19	51,349	$12,372.23
2001	$7,080.60	$1,807.14	$117.70	50,760	$12,990.10
2002	$6,786.43	$1,397.59	$94.54	48,720	$12,103.08
2003	$7,098.57	$1,134.57	$99.46	49,560	$12,223.05
2004	$6,691.37	$1,110.56	$104.34	52,800	$12,051.07
2005	$6,028.64	$841.24	$104.93	54,600	$11,260.91
2006	$7,863.71	$1,681.21	$253.48	63,840	$14,809.84
2007	$8,371.55	$1,133.21	$276.94	63,480	$14,764.89

2008	$8,636.94	$1,360.76	$318.63	66,600	$15,544.43
2009	$9,529.57	$993.49	$268.33	70,200	$16,302.10
2010	$9,907.60	$387.62	$291.52	68,880	$15,993.82

aCost data were provided by the Program Office in current dollars. These values were converted to $2010 using the chain-type price index for gross domestic product. See <http://www.gpoaccess.gov/eop/tables11.html>, Table B-7, accessed 27 June 2012.

bValues in italics were estimated by the Program Office. In addition to public funding through NIST, there are private sources of funds. The Program was initially endowed by private industry with $10 million. The Foundation for Malcolm Baldrige National Quality Award was established to manage these funds and to allocate the interest earned to the Program for award ceremonies, publication costs, and partial training and travel costs for examiners.

cThe value of examiner time is included. The value of a fully-burdened 2000-hour examiner year in $2010 is $157,000, as suggested by the Baldrige Program Office.

Table 3. Present value of Baldrige Performance Excellence Program operating costs and application costs

(1) Fiscal year	(2) Total operating costs ($2010 K)	(3) Present value of total operating costs ($K)	(4) Total application costs ($K)[b]	(5) Present value of application costs ($K)
1988	$4,218.47	$18,689.52[a]	$1,050.00	$4,651.92
1989	$4,478.13	$18,541.96	$1,050.00	$4,347.59
1990	$4,577.99	$17,715.39	$1,050.00	$4,063.17
1991	$5,908.04	$21,366.61	$1,050.00	$3,797.35
1992	$6,742.64	$22,789.66	$1,050.00	$3,548.93
1993	$6,518.43	$20,590.50	$1,050.00	$3,316.76
1994	$8,324.64	$24,575.69	$1,050.00	$3,099.77
1995	$9,633.66	$26,579.56	$1,050.00	$2,896.98
1996	$8,055.70	$20,771.90	$1,050.00	$2,707.46
1997	$8,609.75	$20,748.16	$1,275.00	$3,072.55
1998	$8,391.63	$18,899.56	$2,412.50	$5,433.41
1999	$10,580.55	$22,270.48	$3,987.50	$8,393.10
2000	$12,372.23	$24,338.04	$3,987.50	$7,844.02
2001	$12,990.10	$23,881.76	$4,100.00	$7,537.68
2002	$12,103.08	$20,795.35	$4,116.00	$7,072.05
2003	$12,223.05	$19,627.55	$4,453.50	$7,151.35
2004	$12,051.07	$18,085.40	$4,408.50	$6,615.97
2005	$11,260.91	$15,794.01	$3,498.50	$4,906.83
2006	$14,809.84	$19,412.68	$4,881.00	$6,398.00
2007	$14,764.89	$18,087.62	$5,241.00	$6,420.45
2008	$15,544.43	$17,796.82	$5,608.50	$6,421.17
2009	$16,302.10	$17,443.24	$5,416.00	$5,795.12
2010	$15,993.82	$15,993.82	$4,633.00	$4,633.00
Total	$236,455.13	$464,795.28	$67,468.50	$120,124.63

$4,218.47 \times (1.07)^{22} = $18,689.52.

[b]One firm/organization in sample first applied for the Award in 1988; no other firm/organization applied until 1997. The survey question asks for application costs per year.

The present value of counterfactual cost savings, in $2010, is similarly calculated by referencing forward annual counterfactual cost savings to 2010 by a 7% rate (see Table 4).

Table 4. Present value of counterfactual cost savings

(1) Fiscal year	(2) Counterfactual cost savings ($2010 K)	(3) Present value of counterfactual cost savings ($K)
1988	$5,500.00	$24,367.21[a]
1989	$5,500.00	$22,773.09

1990	$5,500.00	$21,283.26
1991	$13,000.00	$47,014.86
1992	$13,000.00	$43,939.12
1993	$13,000.00	$41,064.60
1994	$13,000.00	$38,378.13
1995	$14,000.00	$38,626.44
1996	$14,125.00	$36,421.79
1997	$14,917.50	$35,948.86
1998	$15,957.50	$35,939.35
1999	$16,032.50	$33,746.04
2000	$16,050.00	$31,572.78
2001	$20,775.50	$38,194.91
2002	$20,815.50	$35,764.90
2003	$20,748.00	$33,316.75
2004	$20,550.50	$30,840.76
2005	$18,350.50	$25,737.53
2006	$22,038.00	$28,887.32
2007	$23,088.00	$28,283.79
2008	$24,438.00	$27,979.07
2009	$23,988.00	$25,667.16
2010	$23,838.50	$23,838.50
Total	$378,213.00	$749,586.23

$\$5{,}500.00 \times (1.07)^{22} = \$24{,}367.21.$

Regarding the calculation of the shortfalls avoided in consumer surplus and producer surplus from responses to the respective questions above, it is assumed that both are social benefits of the Baldrige Program that should be accounted for, and it is assumed that both begin in the year that the firm applied for the Baldrige Award (see Table 5). However, as mentioned above, over time producer surplus is expected to decline because of market competition. Here, we conservatively assume that profits persist for 5 years, declining by 20% of the base year each year until in year 6 the producer surplus equals 0.13

Table 5. Present value of shortfalls avoided in consumer surplus and producer surplus

(1) Fiscal year	(2) Consumer Surplus ($2010 K)	(3) Present value of consumer surplus ($K)	(4) Producer Surplus ($2010 K)	(5) Present value of producer surplus ($K)
1988	$97,500.00	$431,964.17	$97,500.00	$431,964.17
1989	$97,500.00	$403,704.83	$78,000.00	$322,963.87
1990	$97,500.00	$377,294.24	$58,500.00	$226,376.54
1991	$97,500.00	$352,611.43	$17,289,000.00	$62,526,144.55
1992	$97,500.00	$329,543.40	$13,819,500.00	$46,708,974.08
1993	$97,500.00	$307,984.48	$10,350,000.00	$32,693,737.43
1994	$97,500.00	$287,835.97	$6,900,000.00	$20,369,929.87
1995	$97,500.00	$269,005.58	$3,450,000.00	$9,518,658.82
1996	$109,875.00	$283,316.44	$6,187.50	$15,954.68
1997	$145,475.00	$350,572.20	$31,750.00	$76,512.58
1998	$320,475.00	$721,771.10	$130,152.50	$293,128.37
1999	$320,475.00	$674,552.43	$102,555.00	$215,863.09
2000	$980,475.00	$1,928,742.73	$494,957.50	$973,656.32
2001	$1,141,725.00	$2,099,014.84	$565,610.00	$1,039,850.92
2002	$1,222,481.25	$2,100,450.39	$497,718.75	$855,173.48
2003	$1,222,481.25	$1,963,037.75	$340,485.00	$546,744.51
2004	$1,389,112.50	$2,084,683.29	$370,882.50	$556,594.62
2005	$1,407,487.50	$1,974,074.03	$201,322.50	$282,365.22
2006	$1,505,425.00	$1,973,305.08	$189,325.00	$248,166.45
2007	$1,537,587.50	$1,883,610.80	$144,915.00	$177,527.11
2008	$1,666,962.50	$1,908,505.37	$222,368.75	$254,589.98
2009	$1,666,962.50	$1,783,649.88	$144,572.50	$154,692.58
2010	$1,666,962.50	$1,666,962.50	$100,102.50	$100,102.50
Total	$17,083,962.50	$26,156,192.92	$55,585,405.00	$178,589,671.72

For the sample of 45 Award applicants, the ratio of all social benefits to social costs is calculated as the ratio of the sum of the present value (PV) of counterfactual implementation cost savings plus the PV of shortfalls avoided in consumer surplus plus the PV of shortfalls avoided in producer surplus to the sum of the PV of total operating costs plus the PV of application costs:

$$B/C_{n=45} = \frac{\left(\begin{array}{l}\text{PV counterfactual implementation cost}\\ \text{savings + PV counterfactual avoided}\\ \text{shortfalls in consumer surplus + PV}\\ \text{counterfactual avoided shortfalls in}\\ \text{producer surplus}\end{array}\right)}{\left(\begin{array}{c}\text{PV total operating costs}\\ \text{+ PV application costs}\end{array}\right)}$$

Based on the survey data from only the cluster of respondents (n = 45), the ratio of social benefits to total social costs is 351:1.

To generalize to the survey population of the 273 Baldrige applicants, the benefits of the preceding benefit–cost ratio and the application costs portion of the costs can be multiplied by the ratio of the total sales of the survey population of all 273 applicants to the total sales of the sample of 45 responding applicants (sales ratio = 3.563).14 Thus, the ratio of social benefits to social costs for the population of all Baldrige Award applicants in the period 2007–10 is 820:1.15

Table 6 compares these benefit–cost ratios for the cluster of 45 respondents and the generalization to the survey population of 273 applicants, which are based on all categories of benefits, to ratios calculated using subcategories of benefits. From an economic perspective, all of the benefit categories should be considered, but for purposes of comparison to related evaluation analyses, the other benefit–cost ratios are useful, especially those ratios which are calculated using only implementation cost savings.

Table 6. Disaggregated analysis of components of ratio of social benefits to social costs

Categories of benefits	**$B/C_{n=45}$**	**$B/C_{\text{Baldrige Award applicants}}$**
Counterfactual implementation cost savings	1.3:1	3.0:1[a]
Counterfactual implementation cost savings + avoided shortfalls in consumer surplus	46:1	107:1[b]
Counterfactual implementation cost savings + avoided shortfalls in consumer surplus + avoided shortfalls in producer surplus	351:1	820:1[c]

[a]($749,586.23 × 3.563)/($464,795.28 + ($120,124.63 × 3.563)).

[b](($749,586.23 + $26,156,192.92) × 3.563)/($464,795.28 + ($120,124.63 × 3.563)).

[c](($749,586.23 + $26,156,192.92 + $178,589,671.27) × 3.563)/($464,795.28 + ($120,124.63 × 3.563)).

As discussed above with reference to the expanded scope of the Program in 1999 and again in 2006 (see Table 1), we disaggregated the 45 responses by applicant sector. We found that 25 of the 45 applicants who responded, listed their primary sector of activity: 5 from education, 13 from health care, and 7 from manufacturing. In an exploratory manner, given the small sector samples, we calculated a benefit–cost ratio, by sector. For benefits, we considered the sum of the PV of implementation cost savings plus the PV of the avoided shortfalls in consumer and producer surplus; for costs, we considered the sum of the PV of total operating costs for the Award Program plus the PV of the application costs for the sample of sectorial respondents. Finally, we extrapolated these ratios to the survey population of all Award applicants, by sector. This analysis resulted in a benefit–cost ratio for the education sector of 119:1, for the health care sector of 456:1, and for the manufacturing sector of 357:1.16

We refrain from generalizing from these disaggregated calculations about the relative importance of the Baldrige application process to different sectors because of the limited number of responses, by sector. However, our findings do suggest that the net benefits to the Program as reported in Table 6 are not specific to any one sector but reflect benefits realized across all of the sectors.

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5. Discussion and conclusions

As reported in Table 6, even the most conservative estimates for the benefit–cost ratios show substantial benefits from the Baldrige Program. All of the ratios in Table 6 compare benefits for selected subsets of beneficiaries and categories of benefits to all of the Program costs. Were one to completely ignore consumer and producer surplus shortfall benefits, the ratio of just the category of social benefits for avoided implementation costs to social costs (including all of the Program's operating costs) for the survey population of applicants since 2006 is 3.0:1. Adding to the social benefits only the shortfalls in consumer surplus, under what might be viewed as a heroic assumption that producer surplus is immediately competed away, yields a ratio of social benefits–social costs of 107:1.

The most inclusive benefit–cost ratios are those that are based on the broadest categorization of benefits. And for those, the ratio of the sample of 45 firms is 351:1, and for all applicants it is 820:1. The lower bound on this range compares all of the social costs of the Baldrige Program to only the social benefits for the surveyed applicants for the Baldrige Award.17 The calculation also assumes that the producer surplus created by the use of the Baldrige Criteria to establish performance excellence is eroded quite rapidly by competition.18,19 The upper end of this range is based on an extrapolation from the sample of 45 firms to all award applicants based on the ratio of sales of all applicants to sales of the sample. We are aware that some may not appreciate such an extrapolation, but for those who do appreciate it, the upper end of the ratio range is an important datum.

As observed in Section 2, the Baldrige Performance Excellence Program is, in a broad sense, a measurement-and-standards infrastructure R&D investment program, with the associated investments in operations and maintenance. Publicly funded and publicly performed infrastructure R&D, and related operations and maintenance investments, occur within the Program in the sense that the Baldrige Criteria were originally developed in that context and, through the Baldrige Award process, appropriate applications of the criteria for performance excellence are evaluated.

In this broad sense, the Baldrige Performance Excellence Program is similar to a NIST laboratory that performs infrastructure technology R&D investments and sets performance standards (i.e. the Baldrige Criteria) and then continually calibrates bench standards used in private-sector laboratories to achieve a predetermined level of performance (i.e. the Baldrige Award process). As an infrastructure R&D investment program, it is therefore reasonable to ask how the benefit–cost ratio of 820:1 compares with the ratios estimated in several evaluations of economic impact of infrastructure technology investments in the laboratories at NIST.

Link and Scott (2012) have reviewed the previous evaluations of economic impact at NIST, and discussed six evaluations that have found benefit–cost ratios of 100:1 or greater. In all six cases, as with the present study, the evaluations were able to quantify the benefits from avoiding shortfalls in consumer and producer surplus. Apart from measuring the benefit of avoiding the costs of developing an alternative to NIST's program, typically the studies were able to measure portions of the reductions in costs for R&D, or for production, or for sales efforts that were made possible by having the NIST infrastructure technology project rather than the counterfactual alternative. Those reductions in costs were not simply a measure of greater producer surplus, but

instead a mixture of consumer and producer surplus because the lower costs are in part passed on as a benefit to consumers in the form of lower prices. The evaluations of economic impact with benefit–cost ratios of roughly 100:1 or greater included evaluations of NIST programs in: radiopharmaceutical research, standard reference materials for sulfur in fossil fuels, data encryption standards, role-based access control, wavelength references for optical fiber communications, and injectable composite bone grafts. All of these studies relate to public investments in infrastructure, as do the investments by the Baldrige Program.

To conclude, the benefit–cost ratio of 820:1 reported in Table 6 was developed from the responses to the survey of individual firms and organizations, all of which have shown great interest in management for performance excellence given that they all have applied for the Malcolm Baldrige National Quality Award, and those individual responses are all sensible, believable, and entirely credible. Examining those observations and thinking about the expected benefits for an organization intent on pursuing performance excellence with the implementation of the Baldrige Criteria, the benefit–cost ratio of between 351:1 and 820:1—using only the benefits for the group of surveyed applicants for the National Quality Award since 2006 but using all of the social costs of the Baldrige Program—is not surprising. If the social costs were compared to the benefits for the economy as a whole, the benefit–cost ratio would be considerably higher. The estimated range of benefit–cost ratios certainly supports the belief that the Baldrige Program creates great value for the US economy.

The Baldrige Performance Excellence Program is a public–private partnership that—with the imprimatur of national leadership and a prominent national award presented by the President—creates great value that could not be replicated by private sector actions alone. That said, the current economic conditions in the USA have necessitated Congressional budget cuts. On 18 November 2011, the Consolidated and Further Continuing Appropriations Act of 2012 (PL112-55) was signed into law. The Act eliminated public support for the Baldrige Program for the 2012 fiscal year, although the Program will continue to operate at a reduced level in the 2012 fiscal year through funding support from the Foundation for the Malcolm Baldrige National Quality Award.

Footnotes

1. See Link and Siegel (2007) for a detailed discussion of the productivity slowdown.

2. As stated: After 23 years as the ‘Baldrige National Quality Program,’ the nation’s public–private partnership dedicated to performance excellence has decided to highlight that mission with a new name—the Baldrige Performance Excellence Program. ‘Performance excellence’ describes a focus on overall organizational quality, and for years, followers of the Baldrige Criteria for Performance Excellence have indicated that this term best reflects what makes Baldrige work. <http://www.nist.gov/baldrige/baldrige_100510.cfm> accessed 27 June 2012.

3. For the earlier study, ASQ graciously agreed to send the survey instrument for the study to their institutional members, who cover a wide range of types of organizations. ASQ is a global community of experts and the leading authority on quality in all fields, organizations, and industries. As a professional association, ASQ advances the professional development, credentials, knowledge and information services, membership community, and advocacy on behalf of its more than 85,000 members worldwide. ASQ members are driven by a sense of responsibility to enrich their lives, to improve their workplaces and communities, and to make the world a better place by applying quality tools, techniques, and systems. Long-known as the American Society for Quality and established in 1946, ASQ has assisted NIST in the administration of the Malcolm Baldrige National Quality Program Award since 1991. <http://asq.org/about-asq/who-we-are/index.html> accessed 27 June 2012.

4. Many evaluation studies at NIST have been done using the counterfactual method. Link and Scott (2012) have reviewed these. See also Link and Vonortas (forthcoming) for additional examples of the application of the counterfactual approach.

5. The market might have so many other sellers that there is no strategic interaction among them, and in that case such markets with differentiated products are called ‘monopolistically competitive’ in the economics literature. If there are fewer competitors and strategic interaction, the economics literature typically describes the equilibrium price and output for the firm as an outcome in a Nash noncooperative equilibrium for price-setting oligopolists selling differentiated products. In either case, the depiction in Fig. 1 is appropriate.

6. The new consumer surplus is net of previously existing consumer surplus AJP*′. The new producer surplus is net of P*′JBP* which was previously existing consumer surplus and net of P*BEF which was the producer surplus existing before the performance excellence program. The movement from P* to P*′ reflects the movement to the new profit-maximizing equilibrium after the implementation of the Baldrige Criteria.

7. To assure the confidentiality of the respondents, our survey instrument was administered on the web by RTI International.

8. This response rate is on par with other studies that are related to innovation and competitive behavior. For example, the response rate for the congressionally mandated study of NASA SBIR award recipient firms by the National Research Council (2009) was 23%.

9. The mean value reported on this survey question, and on those that follow, was used in the evaluation analysis.

10. Recall that, for the counterfactual evaluation method, the consumer surplus benefits and producer surplus benefits of the Baldrige Program are not the areas HGJA and JBEFKLG identified in Fig. 2 (those would be the benefits in the traditional Griliches–Mansfield approach) but instead the shortfalls from those areas if the counterfactual replacement of the Baldrige Program is used rather than the Program itself.

11. Ruegg and Jordan (2011) advocated a cluster approach for the evaluation of the retrospective benefit-cost studies of technologies developed from the Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE). Ruegg and Jordan argue that one can compare the benefits for a cluster of technologies funded by EERE to the entire EERE budget in an effort to obtain a lower bound on a measure of net social benefits.

12. The use of a 7% real rate corresponds to the guidelines set forth by the Office of Management and Budget (1992) in Circular A-94:

Constant-dollar benefit-cost analyses of proposed investments and regulations should report net present value and other outcomes determined using a real discount rate of 7 percent.

Rather than discounting all operating costs to 1988, the first year of data on costs, and similarly discounting all benefits to 1988, we chose to bring all values forward for ease of interpretation.

13. For those firms for which producer surplus began in year 2007 or later, the straight line depreciation is truncated in year 2010.

14. This extrapolation, based on the distribution of firm size, from the sample to the population assumes that the sample of respondents is representative of the population of surveyed applicants. Of course, there will be differences in respondents apart from the differences in their sizes. For that reason, the 351:1 ratio is much more conservative than the 820:1 ratio.

15.

$$B/C_{\text{Baldrige Award Applicants}} = (B_{n=45} \times 3.563)/(\text{total program operating costs} + (\text{application costs}_{n=45} \times 3.563)) = 820:1.$$

16. More details on this exploratory analysis are available from the authors.

17. As Link and Scott (2001) showed, many firms that never apply for the Award, utilize the Baldrige Criteria.

18. Theory and evidence (Mueller 1977, 1986) in the economics literature about industrial organization show that the profitability of firms that establish competitive advantages persists over time. Indeed, graduate business schools teach executives ways to pursue sustainable competitive advantage (Porter 1985).

19. An earlier evaluation by Link and Scott (2001, 2006) of the Baldrige Program, based on ASQ members rather than Award applicants, yielded a 18.2:1 ratio. In that study, the narrowest category of benefit net of any application costs for 875 ASQ members was compared to all of the Program costs. Here, the same narrowest category of benefit, but not net of the applicant's application costs for 45 firms, is compared to all of the Program costs plus the application costs for the firms. Thus, for a rough comparison of the estimated benefits relative to the costs in the two studies, controlling for the different sample sizes and different treatment of application costs (i.e. 875 ASQ members compared to 273 Award applicants), we have the estimate of 18.2:1 in the first study and the extrapolated estimate of 15.5:1 for the second study. Projecting to economy-wide benefits from these similar findings for the two populations for the sampled

beneficiaries would yield similar findings for the economy-wide benefit–cost ratio. Given that in contrast to the earlier study which surveyed mostly industrial corporations, the present study reflects the composition of applicants for the Award and includes firms and organizations from the education, health care, and nonprofit sectors, the findings of the two studies are remarkably consistent.

References

Griliches Z. ‘Research costs and social returns: Hybrid corn and related innovations’. Journal of Political Economy 1958;66:419-31.

Link A N. Public/Private Partnerships: Innovation Strategies and Policy Alternatives. New York: Springer; 2006.

Link A N, Scott J T. Public Accountability: Evaluating Technology-Based Institutions. Norwell, MA: Kluwer; 1998.

Link A N, Scott J T. Gaithersburg, MD: National Institute of Standards and Technology; 2001. ‘Economic evaluation of the Baldrige National Quality Program’, NIST Planning Report 01-03.

Link A N, Scott J T. ‘An economic evaluation of the Baldrige National Quality Program’. Economics of Innovation and New Technology 2006;15:83-100.

Link A N, Scott J T. Public Goods, Public Gains: Calculating the Social Benefits of Public R&D. New York: OUP; 2011.

Link A N, Scott J T. Gaithersburg, MD: National Institute of Standards and Technology; 2012. ‘The theory and practice of public sector R&D economic impact analysis’, NIST Planning Report 11-1.

Link A N, Siegel D S. Innovation, Entrepreneurship, and Technological Change. Oxford, UK: OUP; 2007.

Link A N, Vonortas N S. Handbook on Program Evaluation. Cheltenham, UK: Edward Elgar; forthcoming.

Mansfield E, Rapoport J, Romeo A, Wagner S, Beardsley G. ‘Social and private rates of return from industrial innovations’. Quarterly Journal of Economics 1977;91:221-40.

National Research Council. An Assessment of the Small Business Innovation Research Program at the National Aeronautics and Space Administration. Washington, DC: National Academics Press; 2009.

Mueller D C. ‘The persistence of profits above the norm’. Economica 1977;44:369-80.

Mueller D C. Profits in the Long Run. Cambridge, UK: Cambridge University Press; 1986.

Office of Management and Budget. OMB Circular A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs. Washington, DC: Government Printing Office; 1992.

Orszag P R. Washington, DC: Office of Management and Budget; 2009. 'Memorandum for the Heads of Executive Departments and Agencies', Office of Management and Budget, Executive Office of the President, 7 October 2009.

Porter M E. Competitive Advantage: Creating and Sustaining Superior Performance. New York: Free Press; 1985.

Ruegg R, Jordan G. Washington, DC: US Department of Energy; 2011. 'Guide for conducting benefit-cost evaluation of realized impacts of public R&D programs,' Draft report prepared for the US Department of Energy, Office of Energy Efficiency and Renewable Energy