

## AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

*Science* serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

### Editorial Board

1983: FREDERICK R. BLATTNER, BERNARD F. BURKE, CHARLES L. DRAKE, ARTHUR F. FINDEIS, E. PETER GEIDUSCHEK, GLYNN ISAAC, MILTON RUSSELL, WILLIAM P. SLICHTER, JOHN WOOD

1984: ARNOLD DEMAIN, NEAL E. MILLER, FREDERICK MOSTELLER, ALLEN NEWELL, RUTH PATRICK, BRYANT W. ROSSITER, VERA C. RUBIN, SOLOMON H. SNYDER, PAUL E. WAGGONER

**Publisher:** WILLIAM D. CAREY  
**Associate Publisher:** ROBERT V. ORMES

**Editor:** PHILIP H. ABELSON

### Editorial Staff

**Assistant Managing Editor:** JOHN E. RINGLE  
**Production Editor:** ELLEN E. MURPHY  
**Business Manager:** HANS NUSSBAUM  
**News Editor:** BARBARA J. CULLITON  
**News and Comment:** COLIN NORMAN (deputy editor), JEFFREY L. FOX, CONSTANCE HOLDEN, ELIOT MARSHALL, R. JEFFREY SMITH, MARJORIE SUN, JOHN WALSH

**European Correspondent:** DAVID DICKSON  
**Contributing Writer:** LUTHER J. CARTER  
**Research News:** ROGER LEWIN (deputy editor), RICHARD A. KERR, GINA KOLATA, JEAN L. MARX, THOMAS H. MAUGH II, ARTHUR L. ROBINSON, M. MITCHELL WALDROP

**Administrative Assistant, News:** SCHERRAINE MACK;  
**Editorial Assistant, News:** FANNIE GROOM  
**Senior Editors:** ELEANORE BUTZ, MARY DORFMAN, RUTH KULSTAD

**Associate Editors:** SYLVIA EBERHART, CAITILIN GORDON, LOIS SCHMITT  
**Assistant Editors:** MARTHA COLLINS, STEPHEN KEPPLER, EDITH MEYERS

**Book Reviews:** KATHERINE LIVINGSTON, **Editor:** LINDA HEISERMAN, JANET KEGG

**Letters:** CHRISTINE GILBERT  
**Copy Editor:** ISABELLA BOULDIN  
**Production:** JOHN BAKER, SUSANNAH BORG; HOLLY BISHOP, ELEANOR WARNER; JEAN ROCKWOOD, SHARON RYAN, BEVERLY SHIELDS

**Covers, Reprints, and Permissions:** GRAYCE FINGER, **Editor:** GERALDINE CRUMP, CORRINE HARRIS

**Guide to Scientific Instruments:** RICHARD G. SOMMER  
**Assistant to the Editor:** SUSAN ELLIOTT

**Assistant to the Associate Publisher:** ROSE LOWERY  
**Assistant to the Managing Editor:** NANCY HARTNAGEL

**Membership Recruitment:** GWENDOLYN HUDDLE  
**Member and Subscription Records:** ANN RAGLAND

**EDITORIAL CORRESPONDENCE:** 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Area code 202. General Editorial Office, 467-4350; Book Reviews, 467-4367; Guide to Scientific Instruments, 467-4480; News and Comment, 467-4430; Reprints and Permissions, 467-4483; Research News, 467-4321. Cable: *Advancesci*, Washington. For "Information for Contributors," write to the editorial office or see page xi, *Science*, 30 September 1983.

**BUSINESS CORRESPONDENCE:** Area Code 202. Membership and Subscriptions: 467-4417.

### Advertising Representatives

**Director:** EARL J. SCHERAGO  
**Production Manager:** GINA REILLY  
**Advertising Sales Manager:** RICHARD L. CHARLES  
**Marketing Manager:** HERBERT L. BURKLUND  
**Sales:** New York, N.Y. 10036: Steve Hamburger, 1515 Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHICAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772); DORSET, Vt. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581).

**ADVERTISING CORRESPONDENCE:** Tenth floor, 1515 Broadway, New York, N.Y. 10036. Phone: 212-730-1050.

## Quality: The Competitive Strategy

In technology and innovation—long considered our trump cards in the international market—the United States is facing mounting competition from abroad. A declining percentage of high-technology exports and Japan's incursion into our semiconductor and consumer electronics markets are but two indicators of the trend. Scientists and engineers should be most troubled by our declining competitiveness. Our ability to fund R & D depends most heavily on success in selling the results of innovation—high-technology products.

Many factors contribute to the decline in the U.S. position. Among them are high interest rates and the strength of the dollar, the strained resources of our university systems, our sometimes outdated production processes, and the slowness of our public and private sectors to respond to strategies used by our international competitors. Many of these factors are related to public policy issues that must be addressed. Yet I think it important that at the same time we focus on a key factor that falls squarely within the responsibility of the private sector: the cost and quality of our products.

Historically, American industry has viewed quality improvement and cost control as separate and conflicting goals. Although this can be the case if quality improvements are made by implementing expensive test and inspection procedures, these goals need not be mutually exclusive. American companies are coming to realize that doing everything right the first time is a sound strategy for meeting our competition.

At Hewlett-Packard, for example, some years ago we analyzed in detail our methods and costs of achieving good product quality. We found that as much as 25 percent of our manufacturing assets were actually tied up in reacting to quality problems, and we decided that through pursuing quality we could achieve lower production costs and improve our competitiveness.

In the past 3 years, several experiments have been conducted to test this strategy. In our Loveland Instrument Division, aggressive goals were set to produce a voltmeter made with defect-free parts, processes, and design and to achieve just-in-time delivery. The result was that cost goals were met while, compared to the previous generation of the product, manufacturing cycle time was reduced by a factor of 10, inventory cut in half, and field failure rates cut by a factor of 3 to 5.

Our Avondale Division began its focus on quality at the design stage of a recently introduced high-performance gas chromatograph. The product requires two-thirds fewer parts and 60 percent less labor to manufacture than the one it replaced, the production cost was cut in half, and field failure rates are expected to be three to five times lower. The result is a product that is extremely competitive in terms of price and performance.

Our Japanese subsidiary, Yokagawa-Hewlett-Packard (YHP), was honored last year with the Deming Prize, Japan's highest prize for overall quality. The award recognized a 5-year program that reduced production costs by one-third and inventory by two-thirds, the length of the product development cycle by one-third, and warranty failure rates by more than half. During the 5-year period, YHP almost tripled its market penetration.

These examples show that pursuing quality is a cost-competitive strategy and that efforts to achieve quality must begin in the design phase of a product. Some of our greatest improvements have been the result of designers working closely on processes with people in manufacturing, on parts specifications with our vendors, and on applications needs with our customers.

In formulating a strategy to meet the competitive challenges we face, a logical first step is to take stock of our strengths. Science and innovation have made us leaders in high-technology markets, but we cannot remain competitive if others can duplicate our products and improve on the production process. In order to meet the challenge from abroad we must also focus on reducing the cost and improving the quality of the products we offer.—JOHN A. YOUNG, *President and Chief Executive Officer, Hewlett-Packard, Palo Alto, California 94303-0890*

# Science

## Quality: The Competitive Strategy

JOHN A. YOUNG

*Science* **222** (4623), 461.

DOI: 10.1126/science.222.4623.461

### ARTICLE TOOLS

<http://science.sciencemag.org/content/222/4623/461.citation>

### PERMISSIONS

<http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

---

*Science* (print ISSN 0036-8075; online ISSN 1095-9203) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. The title *Science* is a registered trademark of AAAS.

1983 by the American Association for the Advancement of Science.