INTRODUCTION

Philip Shapira and Jan Youtie

Public policies to promote manufacturing modernization – the application of improved technologies and business practices to strengthen industrial competitiveness, particularly among small and mid-sized industrial enterprises – have expanded significantly in the United States (as well as in other countries) in recent years.[1] The policies have resulted in an increased level of federal and state resources being allocated to manufacturing technology centers, industrial extension programs, industrial networking projects, and other initiatives. These programs employ a range of methods to assist manufacturers, including information provision, assessments, demonstrations, brokering, field agent services, qualified referrals, group projects, and training. Throughout the country, non-profit organizations, colleges and universities, state agencies, industrial associations, and private consultants are now engaged in providing manufacturing modernization services. The U.S. Department of Commerce's National Institute of Standards and Technology (NIST) has emerged as a major sponsor of many of these manufacturing modernization programs.[2] By the end of 1994, NIST had awarded federal funds (matched by state, local and industry contributions) to more than 45 manufacturing technology centers

[1]For more detailed discussions of the development of U.S. modernization efforts, see: Stuart Rosenfeld, *Competitive Manufacturing: New Strategies for Regional Development,* New Brunswick, NJ, Center for Urban Policy and Research Press, 1992; Gene Simons, "Industrial Extension and Innovation," in Lewis M. Branscomb, editor, *Empowering Technology: Implementing a U.S. Strategy*, Cambridge, MA, MIT Press, 1993; and Philip Shapira, J. David Roessner, and Richard Barke, "Public Infrastructures for Industrial Modernization in the United States," *Entrepreneurship and Regional Development* (forthcoming, 1995).

[2]NIST was charged with the mandate of promoting civilian manufacturing technology deployment under the 1988 Omnibus Trade and Competitiveness Act.

(MTCs) or manufacturing outreach centers (MOCs). NIST coordinates these centers through its Manufacturing Extension Partnership (MEP), with the aim of combining government, industry, and academic resources to foster technological modernization.[3] Numerous additional manufacturing industry assistance projects are underway, sponsored by other federal agencies, states, and industrial groups.

With this growth in efforts to promote manufacturing modernization has come greater attention to issues of performance measurement and program evaluation. Funders are concerned to know whether their dollars are being deployed effectively. Policymakers are asking whether these programs are generating the promised improvements in competitiveness and whether there are worthwhile effects on jobs, wages, technology, and business and economic development. Industry groups and companies seek evidence about how the programs might assist their business and manufacturing operations. Program managers and staff are keen to learn about the impacts of different types of services and how they can become better performing organizations, just as they are encouraging their manufacturing customers to improve their own business practices.

The increased interest in evaluation has been influenced by recent developments at the national level. Federal funds for manufacturing modernization have been enlarged as part of the Clinton administration's technology policy commitment to establish a network of more than 100 manufacturing technology centers by 1997.[4] In 1994 and 1995, much of the funding for these centers has been provided by the federal Technology Reinvestment Program (TRP) – an initiative whose aims include transitioning defense suppliers to civilian markets and strengthening the nation's industrial base.[5] NIST has used TRP allocations to establish new centers under the MEP program, with the intent of providing a subsequent round of civilian-side funding from the Department of Commerce's account to those centers with demonstrated effectiveness. The increase in the scale of the MEP program, coupled with the importance of defining clear standards of center performance, has obliged NIST to consider and revamp the evaluation of the individual and collective accomplishments of its manufacturing modernization centers and programs. A series of earlier national assessments had found the manufacturing modernization programs sponsored by NIST to be helpful in assisting small firms to improve their business practices and upgrade technology.[6] A handful of state or multi-state

[3]National Institute of Standards and Technology, *Manufacturing Extension Partnership*, U.S. Department of Commerce, Gaithersburg, MD, December 1994, electronic document available through NIST's gopher server (telnet: gopher.nist.gov).

[4]W.J. Clinton and A. Gore, Jr., *Technology for America's Economic Growth: A new Direction to Build Economic Strength*, Executive Office of the President, Washington, DC, February 22, 1993.

[5]Advanced Research Projects Agency, *Technology Reinvestment Project: Program Information Package*, U.S. Department of Defense, Arlington, VA, 1993.

[6]Visiting Committee on Advanced Technology, *The Manufacturing Technology Centers Program, Report to the Secretary of Commerce*, Gaithersburg, MD, National Institute of Standards and Technology, U.S. Department of Commerce, 1990; U.S. General Accounting Office, *Technology Transfer: Federal Efforts to Enhance the Competitiveness of Small Manufacturers*, Washington, DC, U.S. General Accounting Office, GAO/RCED-92-30, 1991; Manufacturing Technology Centers, Third Year Review Panel, *Manufacturing Technology Centers: Broad Programmatic Issues*, Gaithersburg, MD, National Institute of Standards and Technology, U.S. Department of Commerce, 1992; and National Research Council, Commission on Engineering and Technical Systems, Manufacturing Studies Board, *Learning to Change. Opportunities to Improve the Performance of Smaller Manufacturers.*

studies have also been conducted.[7] However, as the scale and scope of modernization efforts has grown, it has become clear that there is much to be done in further strengthening evaluation practices and methods. The interest in evaluation has become keener as changes after the Fall 1994 election in the composition of the U.S. Congress have generated new questions about the effectiveness and justification of federal support for manufacturing modernization.

Yet, while concern about the evaluation of industrial modernization programs has grown, it has also become clear that developing robust evaluation approaches – as in most other fields of public policy – is not an easy task. Perspectives vary on what should be measured and how. NIST has required its MEP centers to establish program monitoring systems and report information about services provided, clients served, program linkages and referrals, staffing, and revenue and expenditures. While this provides a basic information base, there seems to be a consensus that evaluation needs to go beyond simple counts of the number of firms served or types of services delivered. However, there is much debate about how best to gauge program impacts on firms, technology adoption, employees, and returns to local and national economies. A wide range of actual or potential measures of program effect have been advocated, including profitability, value-added, sales, exports, wages, jobs, taxes, machine use, quality, training, investment, defense conversion, business stability, and customer-supplier links. Issues have also arisen about the role of comparison groups of non-customers, about the dangers of imposing too many information burdens on both firms and programs, and about the implications of evaluation findings.

It is to these questions of practice, methodology, and results in the evaluation of manufacturing modernization programs that this volume is addressed. Contained within are a series of papers and commentaries which examine existing evaluation studies of modernization programs, evaluations in progress, and many of the broader strategic challenges facing both the producers and users of evaluative analysis in the modernization field. The papers were prepared for a workshop held at Aberdeen Woods, Atlanta, Georgia in September 1994. The workshop was conducted by the School of Public Policy and the Economic Development Institute at Georgia Institute of Technology, with the sponsorship of the National Institute of Standards and Technology. Workshop participants were drawn from a range of perspectives and positions, including program management and field staff, program sponsors, federal and state agency management, industry, executive and legislative policy and oversight agencies, consulting, academic research, industry, and other organizations. The papers presented at the workshop are included in this collection, along with subsequent points of discussion. The volume is the second of its kind – an earlier collection of papers was published following a workshop in 1994.[8]

The workshop had three primary aims. First, to consider critical methodological issues in the evaluation of manufacturing modernization and

Washington, DC, National Academy Press, 1993.

[7]See, for example, Nexus Associates, *Evaluation of the New York Industrial Technology Service*, Prepared for the New York State Science and Technology Foundation, Cambridge, MA, 1994; Sheila A. Martin, *The Effectiveness of State Technology Incentives: Evidence from the Machine Tool Industry*, Center for Agricultural and Rural Development, Iowa State University, Ames, IA, 1994; and Terrance Rephann and Philip Shapira. *New Technology Adoption in W. Virginia: Implications for Manufacturing Modernization Policies*, WP9403, School of Public Policy, Georgia Institute of Technology, Atlanta, GA, 1994.

[8]Philip Shapira, Jan Youtie, and J. David Roessner, *Evaluating Industrial Modernization Programs: Issues, Practices, & Strategies*, WP 9401, School of Public Policy, Georgia Institute of Technology, Atlanta, GA, January 1994.

recent advances in evaluation practice. Second, to review the insights and results from evaluations now in progress and their methodological and policy implications. Third, to consider ways in which existing evaluation practices could be improved and how such "best practices" might be broadly disseminated. Through paper presentations and discussions over the two-and-one-half day workshop, the participants addresses these themes in substantive and constructive ways. This volume now makes the workshop materials and debate available to a wider audience.

Workshop Participants

Workshop on Manufacturing Modernization: Evaluation Practices, Methods and Results.
September 18-20, 1994, Aberdeen Woods, Atlanta, GA.

Sherman Dudley – Manager and Associate Director, Industrial Extension Service, Georgia Tech Regional Office, Douglas, GA.

John Dugger – Chair, Industrial Education and Technology, Iowa State University, Ames, IA.

Kitty Gillman – Special Assistant, Defense Conversion, Office of Science and Technology Policy, Washington, DC.

Ruth Haines – Associate Director for Program Quality, Manufacturing Extension Partnership, National Institute of Standards and Technology, Gaithersburg, MD.

Eric Heller – Director of Research and Evaluation, Donahue Institute, University of Massachusetts, Amherst, MA.

Janet Jones – Team Leader, Key Industry Development, Oregon Economic Development Department, Salem, OR.

Terri Kaufman – Director, Office of Technology Development, Pennsylvania Department of Commerce, Commonwealth of Pennsylvania, Harrisburg, PA.

Aaron Leventhal – Manufacturing Extension Partnership, National Institute of Standards and Technology, Gaithersburg, MD.

Dan Luria – Manager, Industry Affairs/Public Policy, Industrial Technology Institute, Ann Arbor, MI.

Edward Malecki – Professor, Department of Geography, University of Florida, Gainesville, FL.

Melvin Mark – Professor, Department of Psychology, Pennsylvania State University, University Park, PA.

Lee Martin – President, Telerobotics International, Knoxville, TN.

Sheila Martin – Senior Economist, Center for Economic Research, Research Triangle Institute, Research Triangle Park, NC.

Allan Mendelowitz – Managing Director for International Trade, Finance, and Competitiveness Issues, U.S. General Accounting Office, Washington, DC.

Eric Oldsman – President, Nexus Associates, Belmont MA.

Paul Osterman – Professor, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

Jan Pounds – Director, Massachusetts Manufacturing Partnership, Bay State Skills Corporation, Boston, MA.

Andrew Reamer – Principal, Mt. Auburn Associates, Somerville, MA.

John Redman – Manufacturing Extension Partnership, National Institute of Standards and Technology, Gaithersburg, MD.

Jack Russell – President, The Modernization Forum, Dearborn, MI.

Charles Sabel – Professor, Department of Political Science, Massachusetts Institute of Technology, Cambridge, MA.

Philip Shapira – Associate Professor, School of Public Policy, Georgia Institute of Technology Atlanta, GA.

David Swanson – Senior Demographic Specialist, Arkansas Institute for Economic Advancement, University of Arkansas at Little Rock, Little Rock, AR.

Mark Tebbano – Director, Northeast Manufacturing Extension Partnership, Troy, NY

Jan Youtie – Senior Research Associate, Economic Development Institute, Georgia Institute of Technology, Atlanta, GA.

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