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The National Institute of Standards and Technology's Manufacturing Extension Partnership Program

Report 1
Re-examining the Core Premise of the MEP Program

Panel

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The views expressed in this document are those of the Panel. They do not necessarily reflect the views of the Academy as an institution.

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FOREWORD

The Manufacturing Extension Partnership (MEP) Program in the Department of Commerce's National Institute for Standards and Technology was established to meet a critical national need: To increase the competitiveness of small manufacturers throughout the United States. Manufacturers face constant challenges to cut costs, improve quality, meet environmental and international standards and get to market faster with new and improved products. They also face a larger and ever more competitive global playing field, and need to continually assess and improve their operations. This is especially true for America's small and medium-sized manufacturers, which typically do not have the expertise or resources to address these challenges.

In the interests of improving the performance of the MEP Program, the National Institute of Standards and Technology asked the National Academy of Public Administration to research and address several issues: the current barriers to productivity improvement that small manufacturers face; the extent to which the MEP Program is positioned to help reduce these barriers; and alternative business models for operating the Program. This phase of the study concerns the first two issues. The second phase is underway and will be completed in February 2004.

This report provides findings and conclusions for the first phase of this study and establishes a good foundation for second phase efforts. The Academy is pleased to undertake this effort. I want to thank the Fellows and other members who serve on the Project Panel overseeing this project. They have contributed excellent experience-based participation and keen insights. My special appreciation goes to NIST executives, employees and stakeholders for their time and cooperation. I also want to recognize and thank the project team for its efforts in producing this important report.

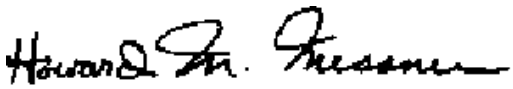

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Small manufacturing firms face huge challenges in this transforming world. Pressures to rapidly introduce new products and technology, reduce costs and increase quality leave many small firms struggling to survive. Today, many small firms operate well below their potential for reasons that are both within and outside their control. Although the challenges are significant and the competition fierce, small firms also have significant opportunities to improve their performance.

These firms, which employ seven million people, account for approximately $711 billion (7%) of the Gross Domestic Product.[1] Manufacturing generally has undergone enormous change in recent years, reflected by 36 consecutive months of job losses.[2] During the recent economic downturn, America's total manufacturing base has shrunk significantly; 2.7 million jobs have been lost since August 2000.[3]

For the last 15 years, a federal government program, the Manufacturing Extension Partnership (MEP) Program, has operated as a partnership among federal, state and local organizations and institutions, including the private sector, in an attempt to help small manufacturers improve their performance. Although the federal government provides funding for the program, the money is not used to subsidize small firms. Firms are expected to pay the incremental costs of direct services.[4]

A Panel of the National Academy of Public Administration was asked by the National Institute of Standards and Technology, the MEP Program's parent organization, to research three issues:

1. the current barriers to productivity improvement faced by small manufacturers
2. the extent to which the MEP Program is positioned to help with reducing barriers
3. alternative business models for operating the Program

This phase of the study concerns the first two issues. The second phase (alternative business models) is now underway and will be completed in February 2004.

This study found that barriers to improving the productivity of small manufacturers identified by earlier studies remain, although they have changed in their relative impacts. Additionally, several other factors have grown in importance and in some ways have made the challenges regarding small manufacturer improvement efforts more difficult. There are further opportunities for improving the way services are provided, yet the MEP Program does perform in a capable and effective manner, delivering impacts significantly beyond the costs of operating the program. The Panel finds that the core premise of the Program remains viable as it is fulfilling its mission by leveraging both public and private resources to assist the nation's small manufacturers.

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[1] U.S. Department of Commerce's Bureau of Economic Analysis was the source for GDP data regarding all manufacturers. These data were reduced by half, the estimated size of small manufacturing to the overall sector.
[2] Bureau of Labor Statistics Web Site. http://data.bls.gov/cgi-bin/surveymost.
[3] *In Rust Belt, Industrial Plight Drives Campaigns*. Washington Post, August 2, 2003; Page A01
[4] One third of funding for the program comes from the federal government, with one third coming from state or local sources and one third collected as fees from the small manufacturers helped by the program.

The following are the principal findings of this phase of the study:

FINDING 1

Barriers to productivity and performance improvement continue to challenge small manufacturers.

- The barriers identified in earlier studies still exist but the relative importance of each to small manufacturers has changed since the inception of the MEP Program.
- Additional factors affecting small manufacturer performance have grown in importance since the inception of the MEP Program, including rapidly increasing competition from low cost countries in terms of the number of competitors and the quality of that competitive output; the explosion in the availability of information and information technology; insufficient access to knowledge workers by small manufacturers; and the high cost of providing health insurance for employees.
- Over the last decade, the importance of leveraging technology has become even more critical to improving the performance of small manufacturers. The MEP Program needs to better focus its corporate strategy on facilitating technology implementation, technology integration and technology transfer for small manufacturers.

FINDING 2

The small manufacturing market is underserved in terms of assistance with productivity and performance improvement efforts.

- While there are individual consultants and firms and other private and public organizations that can and do provide services to small manufacturers, for the most part, this remains a largely underserved market.
- The MEP Program does not significantly displace these other entities in the marketplace but more typically serves as an enabler to link small manufacturers to their services.
- The MEP Program is uniquely situated to create the nationwide network and infrastructure that can provide systematic and comprehensive productivity improvement assistance to small manufacturers.

The Panel notes that given the wide range of performance and capabilities among MEP Centers, there are opportunities to improve the Program's service delivery, organizational structure and outcome and performance measures. These will be the focus of the next phase of this study, which will consider alternative business models for the Program.

METHODOLOGY

The study team focused on answering two primary questions: First, what are the barriers to improvement *currently* faced by small manufacturing firms? Second, considering contemporary barriers, how well positioned is the MEP Program in helping the firms overcome them?

The barriers noted in a 1993 National Research Council report[5] were an important starting point since they helped shape the change in the primary focus of the MEP Program in the mid to late 1990s. The study team's first task was to consider whether the NRC barriers were still present and identify new barriers, if any.

The study team approached the issue of barriers by conducting a series of interviews with individuals representing a variety of important perspectives, including manufacturing interests, private-sector consultants, subject matter experts and MEP leaders. Interviews were conducted and information was solicited from manufacturing trade organizations; various-sized consulting firms and professional organizations; subject-matter experts; MEP headquarters staff; MEP Center Directors at the local (state) levels; and various stakeholders, including congressional staff members.

While time and budget constraints did not allow for a large survey of small manufacturers, the study reviewed the findings of 13 previously conducted surveys and focus groups with small manufacturers, which focused on issues of concern to small manufacturers and potential sources of assistance. The results obtained from the interviews were compared to the survey results and literature reviews.

The Academy also created a web site (nistcomments@napawash.org) to solicit public comments on the project. MEP staff sent an e-mail notification of the study with instructions on accessing the site to a broad cross section of organizations involved in small manufacturing issues.

The study team reviewed written materials, including the original authorizing legislation as well as subsequent MEP-related legislation and resulting changes in policies; studies, reports and analyses pertaining to the MEP Program; studies and analyses of the small manufacturing industry; information and materials from manufacturing trade organizations; information from consulting industry professional organizations; academic literature; and information from such programs as the Small Business Administration's Small Business Development Centers and the Organization of Economic Cooperation and Development's information and studies on government support for small manufacturing in other countries.

[5] *Learning to Change: Opportunities to Improve the Performance of Smaller Manufacturers.* Manufacturing Studies Board. Commission on Engineering and Technical Systems. National Research Council. National Academy Press. 1993

INTRODUCTION

SMALL MANUFACTURERS

According to the Department of Commerce, 350,000 small manufacturing enterprises (SMEs) operate in the United States. Small manufacturers employ fewer than 500 people. They are defined as establishments engaged in mechanical or chemical conversion of materials or substances into new products and often are described as plants, factories or mills. Small manufacturers assemble component parts of manufactured products, blend materials such as lubricating oils, plastics, resins, or liquids into new products, and make products from materials obtained through agriculture, forestry, fishing, mining and quarrying. Increasingly, small manufacturers are called upon to meet the demands of large manufacturers as suppliers of parts and equipment, and manufactured goods are made by networks or "virtual corporations" consisting of many businesses, large and small. These networks provide much needed flexibility to manufacturing, where product variety and adaptability to circumstances are keys to competitiveness. Small manufacturing firms help support and preserve the U.S. industrial base, employing seven million workers, producing 50% of all value added in manufacturing and accounting for over one third of the value of exported goods.

In this study, the Academy Panel did not re-examine the issue of the importance of small manufacturing to the U.S. economy. The following summary of this issue has been compiled from existing studies.

U.S. small manufacturers are the supplier foundation upon which America's major manufacturers and original equipment manufacturers rely. Some of the key points made about the importance of a healthy manufacturing sector to the nation's overall economic performance were presented in a recent study conducted for the National Association of Manufacturers in June 2003.[6]

The study reported that:

- Manufacturing growth spawns more additional economic activity and jobs than any other economic sector. Every $1 of final demand for manufactured goods generates an additional $0.67 in other manufactured products and $0.76 in products and services from non-manufacturing sectors.
- Manufacturers are responsible for almost two-thirds of all private sector research and development– $127 billion in 2002.
- Manufacturing productivity gains are historically higher than those of any other economic sector. Over the past two decades, manufacturing averaged twice the annual productivity gains of the rest of the private sector.
- Manufacturing salaries and benefits average $54,000, compared to $45,600 for the private sector overall. Two factors in particular attract workers to manufacturing: higher pay and benefits and opportunities for advanced education and training.

[6] *Securing America's Future: The Case for a Strong Manufacturing Base*. Prepared for the NAM Council of Manufacturing Associations by Joel Popkin and Company. June 2003

Small manufacturers also play a role in national defense. While foreign sources constitute an important element of Department of Defense (DoD) procurements, "…greater reliance on foreign sources could threaten the security of product information and, in times of conflict, product sources."[7] Up to 80% of production of some DoD weapons' systems are being outsourced with much of the work done by small manufacturing enterprises.[8] The failure of U.S. SMEs to perform on a level comparable to manufacturers in low cost countries will result in further losses of domestic jobs and greater dependence by DoD on foreign sources.

A study conducted in 2002[9] concluded that:

- The SME base is an important component of defense production capabilities.
- Small businesses are a critical element of the production and knowledge base supporting the defense industrial base. In nine leading defense manufacturing sectors, firms employing fewer than 500 people represent 90% of firms.
- Small businesses are responsible for a significant share of defense contracting activity. They receive 21% of prime contracts and 41% of the subcontracts awarded to businesses by or on behalf of DoD.
- Other analyses of weapon systems' costs reveal that subcontractors account for a considerable portion of defense-related manufacturing. Studies suggest that subcontractors account for two-thirds of prime contractors' costs and supply 80% of the value to defense systems.

PRODUCTIVITY ISSUES FOR SMALL MANUFACTURERS

This sector of the U.S. economy is undergoing significant change. According to one analysis, "Manufacturing companies are facing the same realities that farmers faced 60 years ago when society changed. Fewer and fewer people wanted to work on the farm and today fewer and fewer want to work in the manufacturing sector. The social change that took place 100 years ago forced farmers to change their techniques, automate many of their activities and increase productivity of remaining workers."[10] These macroeconomic forces impact large and small manufacturing enterprises but it would be a mistake to see small manufacturers simply as smaller versions of large firms. While they share common goals, they often are shaped and influenced by very different factors and problems.

Between 1992 and 1997, productivity growth for small manufacturers grew at a rate (15.5%) well below that of larger firms (22.6%) as illustrated by the following graph.

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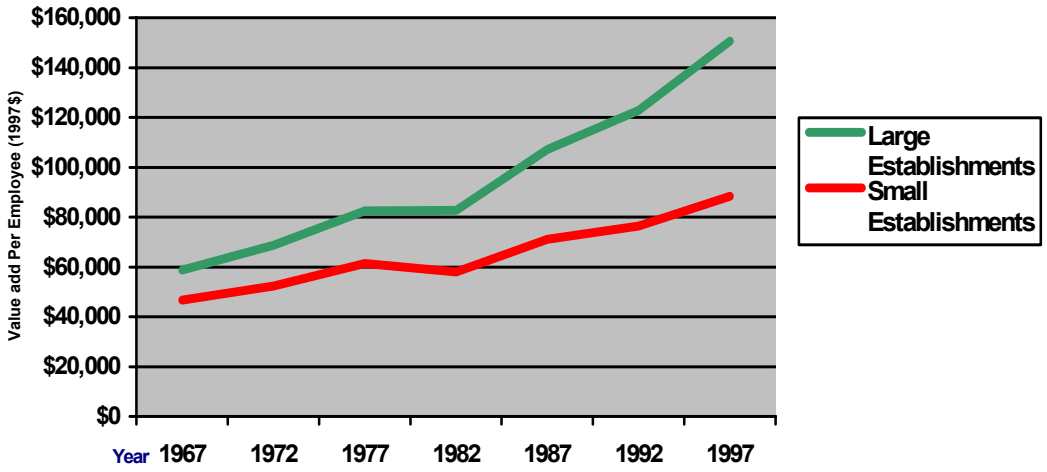
[7] *Defense Manufacturing in 2010 and Beyond. Meeting the Changing Needs of National Defense.* Board on Manufacturing and Engineering Design. Commission on Engineering and Technical Systems. National Research Council. 1999.

[8] Presentation given to Carnegie Mellon University Software Engineering Institute's Technology Insertion, *Demonstration and Evaluation (TIDE) Conference 2001*. Theodore J. Finnessy. Materials and Manufacturing Directorate, Air Force Research Laboratory Presentation.

[9] *Contributions of and Issues Concerning Small- and Medium-Sized Manufacturers in the Defense Industrial Base.* National Coalition for Advanced Manufacturing. June 2002

[10] *National Tool and Machining Association Environment Scan.* Prepared by Synthesis Consulting and Mira International August 18, 2000.

The Productivity Gap Between Large and Small Establishments Is Growing



Source: U.S. Census Bureau

A key element of the federal approach to dealing with this productivity gap stemmed from a study conducted by the National Research Council (NRC) of the National Academy of Sciences in 1993[11] which detailed the following barriers to performance improvement for small manufacturers:

1. The regulatory environment creates a disproportionate burden for smaller firms.
2. Smaller manufacturers often are unfamiliar with changing technology, production techniques and business management practices.
3. Smaller manufacturers generally are isolated and have too few opportunities for interaction with other companies in similar situations.
4. It is difficult for owners and managers of smaller companies to find high quality, unbiased advice and assistance.
5. Operating capital and investment funds for modernization are difficult for small and medium-sized manufacturing firms to obtain.

Another study on barriers to SME innovation, conducted by the Organization of Economic Cooperation and Development (OECD) in 1993,[12] showed similar findings to the NRC list: lack of capital; difficulties in predicting demand; apparent costs in developing the innovation; problems adapting their marketing function; costs of monitoring future applications; difficulties in finding technological information; employee skills; and government regulations.

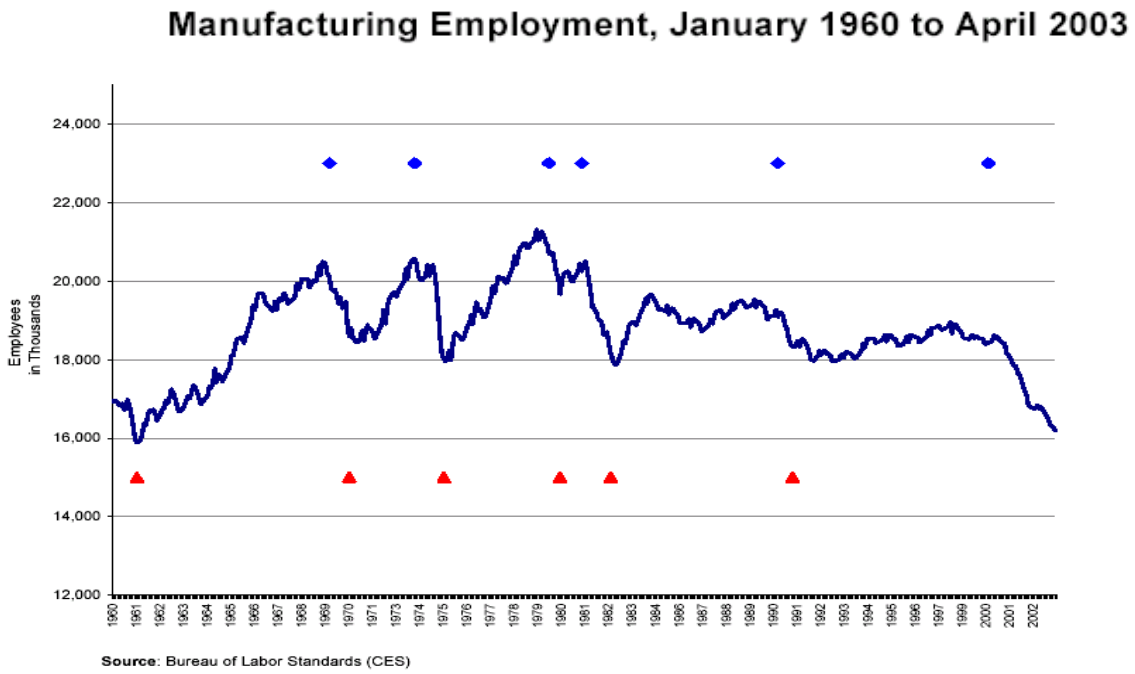
Small manufacturers represent a critical national economic resource. They account for 95% of all manufacturing establishments, half of all manufacturing employment, over half of total U.S. manufacturing value-added and a wide distribution of high-wage jobs across the United States.

[11] NRC Study.
[12] *Small and Medium Sized Enterprises: Technology and Competitiveness*. Organization for Economic Co-operation and Development (OECD). Paris, France: Commission of the European Communities.1993.

However, the NRC study concluded that small firms: "…are operating far below their potential; their use of modern manufacturing equipment, methodologies, and management practices is inadequate to ensure that American manufacturing will be globally competitive."[13]

Small manufacturers today are struggling. Among the most important indicators during the recent economic downturn is the continuing loss of manufacturing jobs, shown below,[14] most of which come from small firms.

Total Manufacturing Jobs along with the Peaks and Troughs of the Business Cycle



The barriers to small manufacturer productivity improvement efforts are central to this study because they provide the principal rationale for the types of assistance offered by the MEP Program.

BACKGROUND OF THE MANUFACTURING EXTENSION PARTNERSHIP PROGRAM

Public Law 100-418, The Omnibus Trade and Competitiveness Act of 1988, directed the Secretary of Commerce through the Director of the National Institute of Standards and Technology (NIST) to establish the Manufacturing Technology Centers (MTC) Program. The intent of the legislation was to make advanced technology developed in NIST labs available to small manufacturers as a way to improve productivity. Labs were to license the technology to state-based Centers which would in-turn charge a fee to the manufacturers. This was envisioned as a way to ultimately allow Centers to become self-sufficient.

[13] NRC Study.
[14] Popkin.

MTC Program officials were tasked with creating regional centers to support the transfer of manufacturing technology. The mission of these regional centers was to improve the productivity and technological capabilities of America's small business manufacturers. Congress urged participation from industry, universities, state governments and other federal agencies and, where appropriate, national labs that are part of NIST.

Proposals to establish Centers were solicited from qualified non-profit organizations and evaluated based on regional need, technology resources, technology delivery mechanisms and management and financial plans. Applicants were required to contribute 50% or more of the Centers' proposed capital and maintenance costs for the first three years and an increasing share up to 80% in the sixth year. Federal funding was to be eliminated ("sunsetted") after six years.

Early experience with the MTC program found that there was a technology gap between the technology developed in federal labs and the capabilities of many small manufacturers to utilize it. Said MEP Director Kevin Carr, "(We) learned early on that these companies were several generations behind in technology." In many cases these companies had more basic needs for management information technology, financial management systems and fundamental business processes that could improve their companies' profitability. As a result, a significant change in tactics and strategy took place during the 1990s to reorient the services provided by the Centers to assist these small companies with their productivity improvement efforts. The 1993 NRC study[15] helped to shape the perspective of program managers concerning the best way to implement a manufacturing extension program.

Among the most important changes was the evolution of the basic services offered by the Centers from technology transfer to consulting services. The number of Centers grew from seven in 1992 to 75 (with 400 satellite offices) in 1996, providing services to all 50 states and Puerto Rico. Funding from the Defense Advanced Research Projects Agency's Technology Reinvestment Project provided significant assistance with this Center expansion effort. Congress also enacted the Technology Administration Act of 1998, which eliminated the sunset provision of the initial legislation and allowed for ongoing federal funding of the Centers. The program name was changed to the Manufacturing Extension Partnership (MEP), and the funding formula mandated that only one-third of funding would be provided by the MEP Program, one-third would come from state or local sources, and one-third would be collected as fees from the small manufacturers helped by the program. State and local funding was important as a means of ensuring their involvement as stakeholders and providing linkages with state economic development plans.

NIST-MEP and the Centers have undergone an extensive evolution since the Program's inception. Two key areas that have done so are the national evaluation strategy and the nature of the non-financial support provided by NIST-MEP. Significant efforts at the national level are focused on ensuring that the performance of the centers continues to improve. This is done through oversight of center performance against plan and the design and implementation of strategies to assist individual centers.

[15] NRC Study.

THE MEP PROGRAM TODAY

The MEP Program consists of 60 manufacturing extension centers and 400 satellite locations throughout the United States and Puerto Rico. Each Center works directly with local firms to provide expertise and services tailored to their most critical needs, ranging from process improvements and employee training to new business practices and the application of information technology in their companies. Services are delivered through direct assistance from Center staff, outside consultants or a combination of both.

The Program provides services to approximately 15,000 different manufacturers each year, some more than once for a total of 21,000 times per year. Approximately 6,000 interactions are considered to have provided a significant measurable impact.

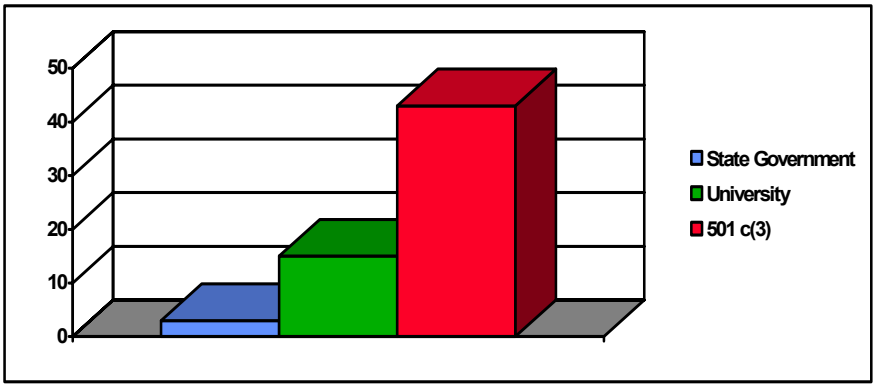
MEP has an operating budget of $105.9 million for FY 2003, approximately 10% of which funds MEP headquarters operations with the remaining 90% used to fund the Centers. Funding has been relatively flat since 1999. The President's FY 2004 budget request would provide $12.6 million for MEP. The request would return the MEP to its original funding plan, which called for the phase-out of federal monies to Centers after six years of funding. Only MEP central coordination activities and the federal share of the two Centers that have been operating for less than six years would continue to be funded. This proposed change to Center self-sufficiency would have serious impacts on federal-state partnerships, clients served and continued Center viability.

The NIST Manufacturing Extension Partnership National Advisory Board (MEPNAB) was established by direction of the Secretary of Commerce in October 1996 to provide guidance and advice on the MEP Program from the perspective of industrial extension customers and providers who have a vision of industrial extension with a national scope. The MEPNAB represents the views and needs of various stakeholders on MEP programs, plans and policies. The Board evaluates the soundness of MEP strategies, and assesses current performance of the Program against MEP goals.

MEPNAB consists of nine members with backgrounds in industrial extension who are appointed by the NIST Director to serve three-year terms. The members have a variety of manufacturing and manufacturing-related backgrounds in small and large manufacturing, labor, academia, economic development, consulting and state government. This mix provides MEP with the outside advice needed to strategically examine MEP's future directions while maintaining and enhancing the Program's focus on smaller manufacturers.

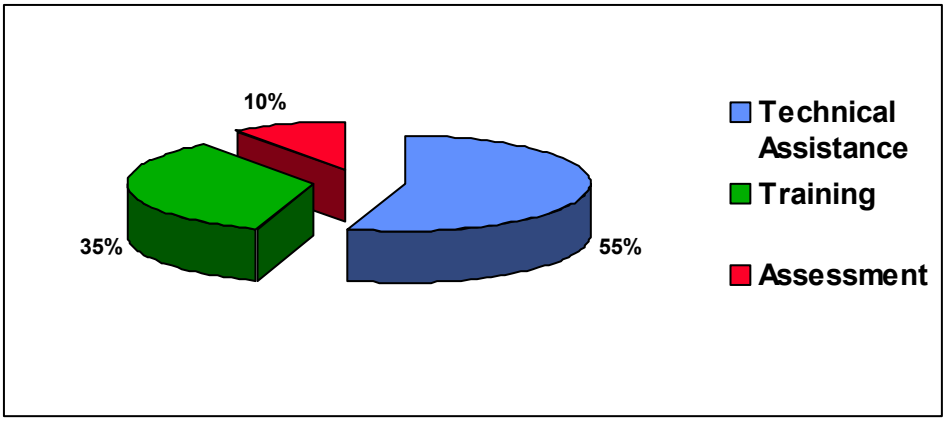
The MEP Centers are a diverse network of state-university-based, and freestanding nonprofit organizations (501c(3)). Each Center's size was established based largely on an individual Center's ability to match federal funding at the time of the initial award.

Number of Centers by Organizational Type for FY 2002



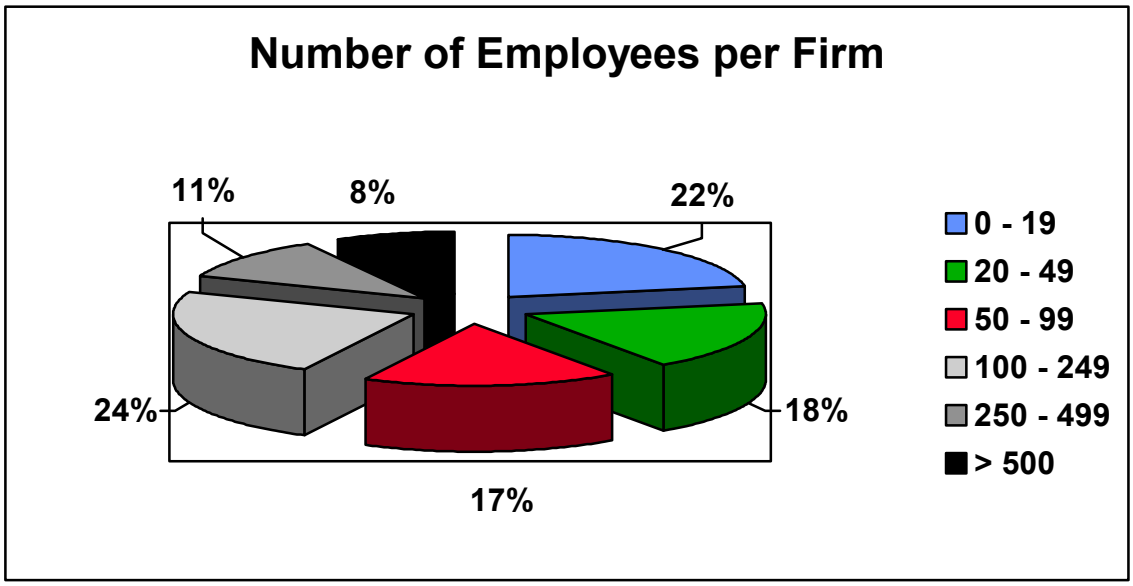
MEP service areas fall into three fundamental categories: assessments, training (management and workforce) and technical assistance.

Service Categories for FY 2002



MEP Centers work with various sized small firms.

Distribution of Clients by Size for FY 2002



With this overview of small manufacturing and the MEP Program as background information, the next section of the report will address the issue of the current barriers to productivity improvement faced by small manufacturers.

BARRIERS FACING SMALL MANUFACTURERS

Small manufacturers in the United States continue to face significant barriers to productivity improvements. There is almost universal agreement on this issue from manufacturers and their trade organizations, the organizations (both public and private) that provide advice and assistance to them, and academics and researchers who study this issue. Not surprisingly, the Academy Panel findings with regard to existing barriers are not identical to the findings in the 1993 NRC study findings but the differences are mainly of degree. All of the original major barriers continue to exist, but the extent to which each presents a problem has evolved over time.

Factors shaping the world of SMEs, which has grown significantly in importance since the NRC study was conducted, include the challenges of rapidly increasing competition from low cost countries; the explosion in the availability of information and information technology; the shortage of skilled employees on both the manufacturing floor and in the staff positions needed to implement new technologies; and the high cost of health insurance.

The following findings, concerning the extent to which the NRC barriers still exist and on new barriers that have emerged since the NRC study, are based on a review of the literature, including 13 surveys and focus groups of small manufacturers, and a series of interviews with stakeholders, including congressional staff, manufacturing trade organizations, consulting firms, representatives from the Small Business Administration, MEP Executive Staff, and MEP Center Directors.

BARRIER 1: THE REGULATORY ENVIRONMENT CREATES A DISPROPORTIONATE BURDEN FOR SMALLER FIRMS.

While this was reported as a barrier by some interviewees, it does not appear to be as important as it was a decade ago. There are several factors that could account for this, including the increasing amount of assistance from public and private organizations available to SMEs for dealing with regulatory requirements, a willingness on the part of regulatory agencies to work with SMEs to mitigate regulatory costs, and the increased experience and knowledge of SMEs on this issue.

In a 2001 National Association of Manufacturers survey[16] of 1,750 small and medium sized manufacturers, only 25% listed "environment, health, and safety compliance" as one of the major challenges facing their company or as being an area that required improvement in the next year.

In a recent survey of 345 small and mid-sized California manufacturers, "issues related to government regulations" was not even reported among the top ten issues/barriers facing companies.[17] The results of this survey are provided in the following chart.

[16] 2001 NAM Small Manufacturers Operating Survey Results, 1/04/02.
[17] *Barriers to Healthy Manufacturing*. California Manufacturing Technology Program 2002 Annual Survey Report, p. 13.

ISSUE	Rank	Percent
Increasing Production Cost Efficiencies	**1**	**31%**
Upgrading Employee Skills	**2**	**27%**
Developing Effective Marketing and Sales Strategies	**3**	**22%**
Production Planning and Scheduling	**4**	**19%**
Obtaining ISO 9000 Registration	**4**	**19%**
Learning and Implementing Lean Manufacturing Principles	**5**	**17%**
Strategic Planning	**5**	**17%**
Financial Issues	**6**	**16%**
Implementing Information System	**7**	**15%**
Long-term Business Strategies	**8**	**14%**

Source: California Manufacturing Technology Program 2002 Annual Survey Report

A study by MANTEC, Inc., one of seven industrial resource centers in Pennsylvania and an affiliate of the MEP Program, conducted a mail and focus group survey of the manufacturers in the area it serves. It found that among the "critical and very critical responses" it received on issues facing small manufacturers, government regulations ranked ninth.[18]

Similarly "regulatory environment" was not listed as one of the seven factors working against U.S. manufacturers in a presentation recently released by the Congressional Manufacturing Caucus, a nonpartisan group of representatives from the U.S. House of Representatives. There currently are 28 members, who, according to Representative Tim Ryan, will work to revitalize domestic companies while also supporting the needs of a global economy.[19]

In the interviews with MEP Center Directors, "regulatory environment" was still identified as a barrier, but it was not cited as one of the most significant. Many of the directors stated that they have been able to mitigate this barrier for their clients by helping them understand the requirements and implement shop-floor practices and waste removal processes to ensure they are in compliance. This was reinforced by an example provided in an interview with a congressional staff member who related a story about the assistance provided to a small manufacturer by the Environmental Protection Agency (EPA), which was brought in by an MEP Center. EPA was able to show the manufacturer how to reduce waste emissions and thereby eliminate considerable reporting requirements and attendant costs.

On the other hand, two representatives from the Small Business Administration's Small Business Development Centers, which have a relatively high percentage (16%) of clients from the small manufacturing sector, stated that the regulatory environment continues to be one of the primary issues facing companies with whom they work. One SBDC Centers stated that it probably deals with this issue more frequently because it is one of the services that it specifically offers to small businesses.

[18] *MANTEC Survey*, July 2002 results reported in a Power Point Survey titled "Defining the Marketplace for Delivery of High Impact Services."
[19] *Congress Gets Manufacturing Caucus*, TwinCities Pioneer Press, July 26, 2003.

BARRIER 2: SMALLER MANUFACTURERS ARE OFTEN UNFAMILIAR WITH CHANGING TECHNOLOGY, PRODUCTION TECHNIQUES AND BUSINESS MANAGEMENT PRACTICES.

This barrier was considered from three subject areas: technology, production techniques and business management practices.

Dr. Philip Shapira, a Professor at the School of Public Policy, Georgia Institute of Technology, stated in a recent publication that, "Smaller firms frequently lack information, expertise, time, money, and confidence to upgrade their manufacturing operations, resulting in under investment in more productive technologies and missed opportunities to improve product performance, workforce training, quality, and waste reduction."[20] Shapira teaches and conducts research on economic and regional development, industrial competitiveness and innovation and technology policy.

According to Mike Clark, Deputy Director of the Business Development Unit of the Educational Society for Resource Management, (formerly the American Production and Inventory Control Society), "Small manufacturers are focused on production issues and do not have the time or expertise (specialized staff) to keep abreast of or practice sound business techniques."

Paul Warndorf, Director of the Technology Department at the Association of Manufacturing Technology, whose membership consists of companies averaging 65 employees and 12 million in sales, said the MEP Program provides the specialization his member companies do not have. These companies cannot afford to carry the specialized staff or maintain a cadre to train employees.

In a survey (see the following chart) of 1,750 small and medium sized manufacturers conducted by the National Association of Manufacturers, "manufacturing processes and production" was ranked only behind "sales and marketing" as the area where companies have the most challenges or require significant improvements.[21]

[20] *Learning from Science and Technology Policy Evaluation: Experiences from the United States and Europe, Cheltenham, UK and Northampton.* Philip Shapira and S. Kuhlmann (editors), Edward Elgar Publishing Ltd. 2003 p. 263.
[21] 2001 NAM Small Manufacturers Operating Survey Results, 1/04/02.

In which of the following areas does your facility face major challenges or require significant improvements over the next year?	
Sales and marketing	72.0
Product development and design	30.2
Manufacturing processes and production	50.9
Quality assurance	19.9
Production planning	21.7
Logistics	6.4
Human resources	27.4
Management and strategy	25.6
Finance/accounting	7.4
Information technology/e-business	18.3
Purchasing	9.3
Energy costs and conservations	29.2
Environment, health an safety compliance	24.7
Exporting	10.7
Other	4.0

Source: 2001 NAM Small Manufacturing Operating Survey Results.

Information from small manufacturers on the barriers and issues facing them also has been gathered in surveys conducted by several MEP Centers. The survey data collected by the California Manufacturing Technology Program indicate that eight of the 10 most frequently cited barriers by small manufacturers fall into this broad category:

- increasing production cost efficiencies
- developing effective marketing and sales strategies
- production planning and scheduling
- learning and implementing lean manufacturing principles
- obtaining ISO 9000 registration

- strategic planning
- implementing information systems
- long-term business strategies

Interviews with MEP Center Directors[22] revealed general agreement that a lack of knowledge of improved production techniques was one of the most significant barriers to improving SME competitiveness. They stated that the knowledge gap is exacerbated by the fact that SME owners do not have the time to deal with strategic planning and business development issues. One director said, "They have a saying that many SME owners work *in* the business rather than *on* the business." Another said, "They're (the owners) so busy chasing pigs they don't have time to build fences."

The area deemed to represent the most significant barrier among MEP Center Directors was production techniques. The extent to which this represents the most significant barrier, or whether the views were shaped by the fact that "lean manufacturing" training represents one of the largest service components provided by MEP Centers, cannot be determined. Yet it was clearly seen as a major barrier to SME productivity improvement by the MEP Center Directors.

MEP headquarters' view with regard to this barrier is reflected in a report prepared by the NIST Director and the MEP Director for the Deputy Secretary of Commerce. The report stated that small manufacturers lack information, access and resources to adopt the technical and business solutions that can bring about dramatic increases in their business performance.[23]

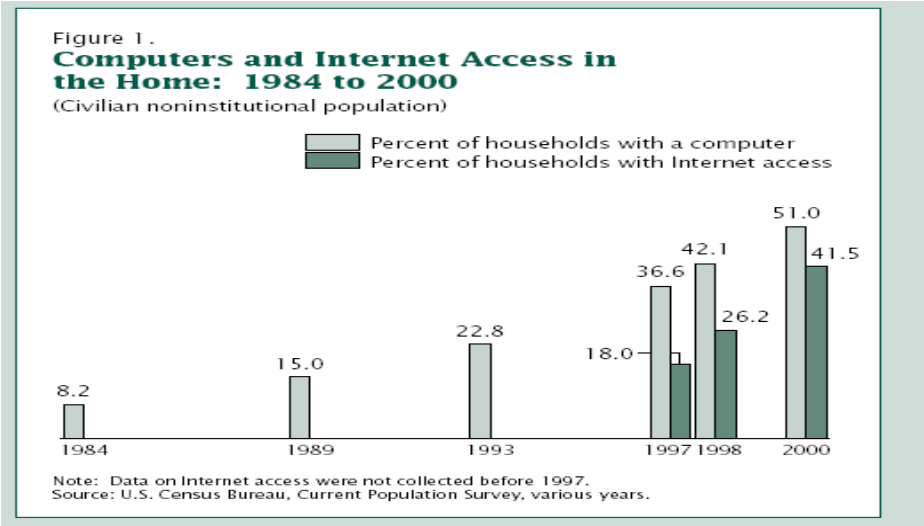
BARRIER 3: SMALLER MANUFACTURERS ARE GENERALLY ISOLATED AND HAVE TOO FEW OPPORTUNITIES FOR INTERACTION WITH OTHER COMPANIES IN SIMILAR SITUATIONS.

Isolation was cited as a problem by the Director of the Technology Department at the Association of Manufacturing Technology, who said that many of his 2,000 association members were geographically isolated and experienced difficulty maintaining the technical expertise and equipment, as well as the skills their employees required to stay competitive in today's work environment.

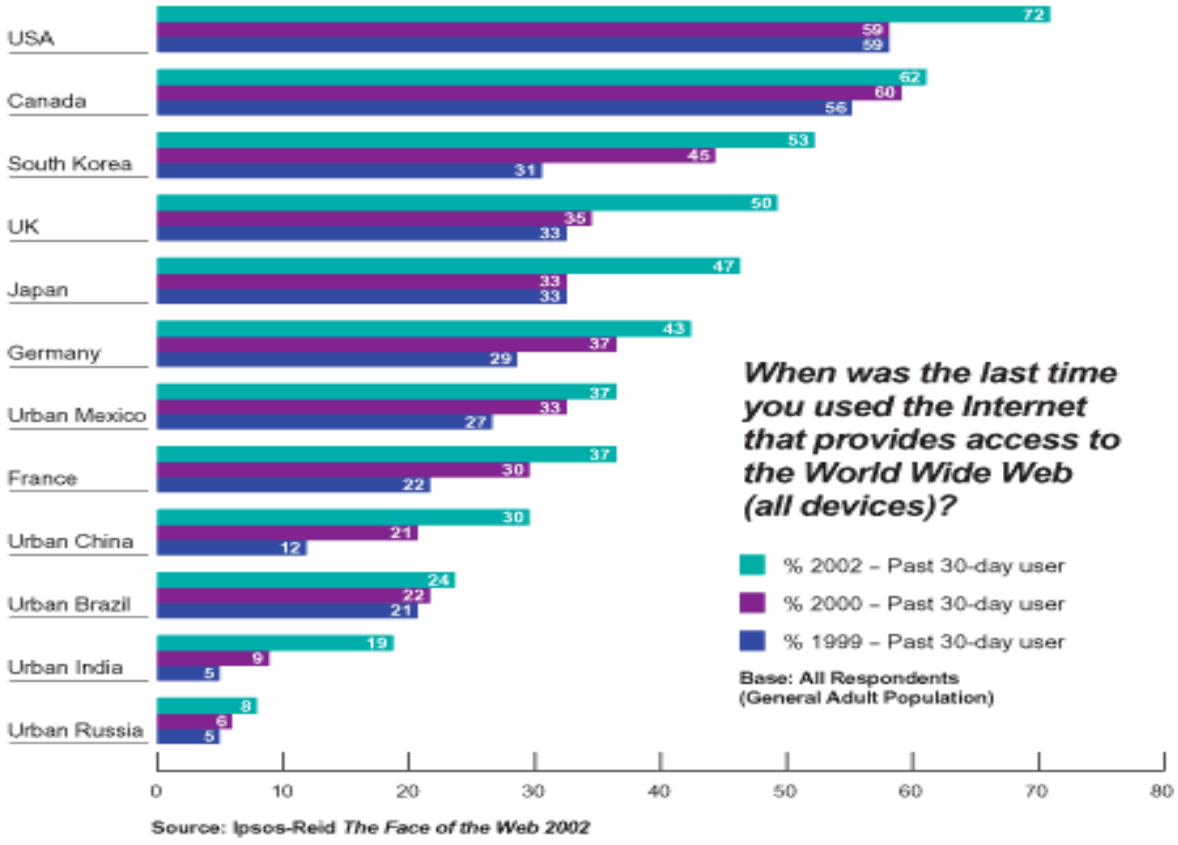
This isolation barrier also was viewed as an important issue by several of the MEP Center Directors interviewed. However, the availability of the Internet also shapes the extent to which this presents a barrier to SMEs today as compared to 10 years ago. While isolation will continue to be an issue for many SMEs given geography and cultural issues, the growth of an electronically interconnected world can only serve to reduce the significance of this barrier. The use of computer technology and the Internet has exploded throughout society and the small business community, as demonstrated by the charts below.

[22] Although they are all referred to in this study as *Center Directors*, several individuals pointed out that they were not directors but rather presidents and/or chief executive officers of the companies that they ran.

[23] *Manufacturing Extension Partnership: An Analysis of Center Performance and Review*, Report to Deputy Secretary of Commerce Sam Bodman, Prepared by the MEP. May 28, 2002, p. 3.



Global Internet Usage: 1999-2002



According to a 2000 Dun & Bradstreet Small Business Survey, 80% of U.S. small businesses have at least one computer on site used for business purposes, and in some sectors computer usage has almost reached saturation. The survey also found that two-thirds of all small businesses and approximately 85% of small business computer owners report having Internet

access, and more than half of those now have a web site.[24] Clearly, the ability to learn about developments in virtually any area of interest, as well as the possibilities for communicating with others, have grown exponentially for SMEs. Although many SME owners may not use the technology available to them to improve their firms' performance, the possibilities are considerable for those that do. The difficulty they face is that smaller firms also are the ones least likely to have the in-house resources to implement new technologies.

Another reason why small firms cannot afford to be isolated is found in a recent report prepared for the Council on Competitiveness, which stated that the vitality of the U.S. economy depends on creating innovation and competitiveness at the regional level. The report found that in healthy regions, competitiveness and innovation are concentrated in *clusters* or groups of interrelated firms and that U.S. ability to produce high value products and services that support high wage jobs depends on creating and strengthening these regional hubs of competitiveness and innovation.[25] The implication of this report is that for regions to be competitive, companies must recognize the competitive advantage that comes with actively participating in cluster activities to identify issues of common concern and opportunities for mutual gain (e.g. regulatory matters, new buyer needs and innovative supplier capabilities).[26]

An extensive report was issued in 2002 by the National Governors Association on Cluster-Based Economic Development. The report provides information on the benefits of clustering, how clusters grow and policy options to support competitive clusters.[27]

BARRIER 4: IT IS DIFFICULT FOR OWNERS AND MANAGERS OF SMALLER COMPANIES TO FIND HIGH QUALITY, UNBIASED ADVICE AND ASSISTANCE.

This difficulty for small manufacturers in finding consulting help is one of the fundamental premises for the current business-consulting service delivery model of the MEP Program. This also was one of the two most cited barriers during interviews with MEP Center Directors.

There are a number of potential sources of assistance available to small manufacturers, including suppliers and vendors, trade associations, universities, private consulting firms and a host of state and federal programs. Small firms use these entities to help with selection, design, installation, maintenance and training related to manufacturing equipment and processes, often preferring highly specialized consultants either from equipment vendor organizations or from within their specific industries. They are less likely to use consultants in the areas of quality or manufacturing processes, business systems and company assessments, areas of service provided by MEP. Small firms rely heavily on personal contacts and word of mouth for identifying outside resources.

Private Consultants

Since its inception, MEP officials have been aware of the Program's potential impact on private consultants. One of the criticisms of the Program is that it provides services that could be better

[24] *Computer, Internet Use Increases at Small Businesses*. Jupitermedia Corporation http://cyberatlas.internet.com/markets/smallbiz/article/0,10098_897771,00.html
[25] Clusters of Innovation National Report, 2001, page 1.
[26] Ibid, p. xix.
[27] A *Governor's Guide to Cluster-Based Economic Development.* National Governors Association, 2002.

provided by private sector consultants. The consulting industry can be viewed from a number of perspectives, but for the purposes of this study, two groups will be considered: large/medium-sized practices and small practices/individual consultants. The study included interviews with executives from large and medium-sized consulting firms. The perspectives from each of the executives were very similar in regards to the SME market. The following quotes capture the essence of their viewpoints:

- "SMEs do not have the technical expertise to implement system integration and usually cannot afford the private help."
- "The economic model for a large consultancy does not work for SMEs."
- "(We) do not serve this market."
- "SMEs are an underserved market."
- "The MEP is in existence because the cost structure of major consulting firms keeps them out of the SME market. This is not a policy comment, but an economic and cost structure result of SMEs not having the critical mass to afford large-scale projects that are core to the large consulting firms."

There was agreement among the interviewees that the cost structures of larger consulting practices, geared to working with larger manufacturers, make them an unlikely source of assistance for SMEs. However, one Managing Director noted that there are examples of SMEs engaging large consulting forms at rates of $200 or more per hour; while the fees are important, return on investment governs most decision making for large firms. These large consultancies generally view the SME market as highly fragmented, and therefore not able to offer the critical mass needed to amortize marketing and sales costs. Additionally, information technology services drive consulting opportunities within large companies much more then in SMEs, as illustrated by the fact that the categories of information technology management/outsourcing and systems integration amounted to 64% of the worldwide professional services market in 2002.

The Institute of Management Consultants (IMC) is a national professional association representing management consultants and part of the international community of institutes that certifies management consultants in accordance with the standards of the International Council of Management Consulting Institutes**.** At the request of the study team, IMC sent an e-mail request to its 1,750 members providing information about this study and soliciting their views about issues facing small manufacturers and their involvement, if any, with MEP. Only two responses were received as a result of this request. The study team also followed up with phone calls and/or e-mail messages to sixty of the consultants listed on the web site for the Global Network of Certified Management Consultants. The global network provides the names and backgrounds of consultants who have earned the designation Certified Management Consultant from the IMC. When "manufacturing" was used to break out the consultants who worked with manufacturers, only 88 names were referred from a list of 397 consultants. Several of these consultants were not contacted because they dealt primarily with administrative and financial issues (e.g., human resources and accounting services) as opposed to shop floor process and technology improvements or new product development.

The views of the 20 consultants who responded varied significantly. They represented sole proprietor consulting firms to firms with 30 employees. At one end of the spectrum, consultants from California and Ohio believe that the MEP Program is a competitor for their business. The consultant from Ohio said that when MEP began, it was not seen as a threat to his business since

most of his company's consulting work was with large manufacturing firms. However, over time, the market mix of companies served has shifted as a result of the production shift that major manufacturers have made to Asia. Consequently, his firm now considers the MEP service providers as competitors. He added that his company has spoken with other consulting firms that also have lost business to MEP. While he believed there were negative aspects to the Program in terms of the inexperience of the MEP staff in its early years, he acknowledged that small companies probably did gain some benefits. He also stated that although he believed users of the MEP Program wasted a lot of money in the early years, they appeared satisfied with the services they receive.

The consultant based in California stated that there has been no market failure (by the consulting industry) with respect to serving small manufacturers. He said he was aware of the MEP Program and that it represented unfair competition and governmental interference in a profession that was prepared to serve the needs of SMEs. He believed that companies could find at least five legitimate proposals for consulting services by using web sites like www.prosavvy.com, an on-line service for linking clients with consultants.

At the other end of the spectrum, a consultant in Chicago who also was familiar with the Program and made joint presentations with the Chicago Manufacturing Center endorsed the MEP concept and said he did not believe that the Program took business away from private consulting firms. His view was based on the belief, that in general, small manufacturing firm would not unilaterally seek consulting help unless they were introduced to a consultant by the MEP Program.

In the middle were a group of consultants that believed the MEP Program served a market they did not or could not serve because of their fee structures. In one case, a consultant who worked in a MEP Center when the Program began said that when he speaks before groups of companies who desire help but are not able to afford his services he will refer them to the Chicago Manufacturing Center for help. A New England-based consultant stated that the MEP Centers are competing with "single shingles" and have an advantage with the federal and state funding. He stated that the MEP Centers deal with issues and clients that mainstream consultants often will not. He said the real issue is having "real consultants," not Center staff, solve problems and the Centers should contract out for these consulting services. He believed the Centers are a valuable resource to his state's manufacturing industries and solutions at a price a small company can afford.

One of the consultants who specializing in information technology systems for manufacturers said he worked with companies with more than $100 million in annual sales and would not normally pursue business with companies with sales below that level. One of the consultants, who was not aware of the Program, said he would be interested in working with MEP clients but only if their annual sales exceeded $10 million.

Four of the consultants unfamiliar with the MEP Program were interested in learning more about it and the possibility of working with the Centers in areas served. One believed that there are a sufficient number of consultants in the private sector to serve small manufacturers, but that for the most part SMEs "haven't got a clue how to find the right consultant."

Another consultant noted that there are a number of special issues that are involved in working with SMEs. Among the most common are:

- The costs of consulting services often "frighten" senior management.
- Owners often are unable to take a detached view of the problems that need to be fixed.
- Up front marketing costs and time spent attempting to solicit new business prevented his firm from aggressively pursuing this business.
- Middle managers often resisted the recommended changes, even after senior management agreed to them.

He also observed that many consultants do not actively pursue small companies because there usually was little chance of continued or repeat business.

Another respondent saw the issues facing small manufacturers in a very different light. He worked primarily with small firms that were in the supply chains of successful large corporations (IBM, Honda) and believed them to be highly skilled, efficient and effective in their businesses. He agreed that some of the named barriers are significant (capital, regulations, health insurance) while others are not (familiarity with technology, isolation, information technology, skilled workers). Regarding the issue of SMEs being able to find "high quality advice and assistance," he stated, "Many suppliers are being helped by big customers who are not that good at Best Practices themselves!"

While there was no consensus in this group regarding SMEs or the impact of MEP on their business, the general view that the Program was a competitor was not widespread. The relatively small response rate to the information requests, as well as the limited number of listed consultants who deal with SME manufacturing process improvement and product development, also tend to support this conclusion.

A MEP-funded study in 1997[28], which examined the Program's role in the private consulting market, found that:

- MEPs reduce barriers in the SME market for consulting services. MEP customers report that the centers help identify consultants with the required expertise, provide an objective assessment of company needs and reduce the cost of consultants.
- MEPs increase demand for private consulting services. Most consultants involved in the Program feel their market has expanded as a direct result of the MEPs. Over half of manufacturers responding to the survey indicated that they would not have used a private consultant without the assistance provided by the MEP and that these companies are twice as likely as similar manufacturers that have not received MEP assistance to be "very likely" to hire a consultant in the coming year.
- MEP involvement in projects leads to improved customer performance. Among similar firms that changed their operations as a result of a consultant's work, the probability of a typical MEP customer improving its performance is 5.4 times greater than a manufacturer that secured consulting services on its own.

[28] *Competition or Collaboration? The Role of Manufacturing Extension Centers in the Private Consulting Market.* Produced by the Modernization Forum and prepared by Nexus Associates. 1997.

That same study listed the barriers that consultants face (shown below) in working with small manufacturers and the percent that rated them as moderately to extremely significant:

1. inability to pay our standard rates 85%
2. lack of knowledge of how to use consultants 78%
3. inability to recover marketing costs 56%
4. our own difficulty identifying customers 55%
5. inability of SMEs to benefit from our expertise 28%
6. our own difficulty working with SMEs 20%

The responses from SMEs listed the following as being barriers to their use of consultants:

1. identifying consultant with right expertise 83%
2. lack of information concerning qualifications 81%
3. lack of consultant objectivity 79%
4. difficult paying for consultants 70%
5. difficulty defining our own needs 70%
6. difficulty negotiating agreements 65%
7. ability to manage consultant effectively 64%

During interviews with the study team, MEP Center Directors identified what they described as the key issues that face small firms when they are seeking help, specifically that they cannot afford the services of the large consulting firms; large consulting firms do not market their services to small manufacturers; and small manufacturers do not know where to get the type of help they need. Several directors also cited a lack of trust based on previous experiences with private consultants as a reason for not seeking outside help.

A good summary of the views expressed by the MEP Center Directors on this barrier was found in the following characterization of the difficulties faced by small manufacturers: "…small firms lack resources and cannot afford the large staffs of Fortune 500 firms. Many are insular family businesses. Others are run by engineers or inventors, who while experts in their own areas, remain unaware of new technologies and management techniques. Still others are situated in rural areas. Most could use help with some aspects of their enterprise but are reluctant to seek assistance. Small firms lack the internal management resources to use consulting services that could help them, and consulting firms cannot absorb or charge for the high costs necessary to engage consultant averse or geographically dispersed small firms."[29]

Employer Association Group

The National Association of Manufacturers' Employer Association Group (EAG) supports a network of not-for-profit employer associations whose primary purpose is to enhance member organizations' human resource activities by providing hotlines, training services and compensation surveys. It represents an estimated 70,000 employers across the United States.

[29] *Small Manufacturers – the Foundation of our Economy.* PA Manufacturer Edith Ritter, Executive Director of the Manufacturers Resource Center.

EAG has criticized the MEP Program on the grounds that MEP is in direct, federally-subsidized competition with the services it offers, particularly human resource training. Approximately 90% of the 62 local employer associations offer training directly to clients by contracting out to other providers or in partnership with other organizations, some of which are MEP centers. Other criticisms included the assertion that although MEP is supposed to help small firms, it also provides help to large firms, and that although much of the work MEP performs is effective, it costs a lot more than it would if the private sector were delivering it.

An EAG official strongly urged that MEP headquarters, as well as state Centers, make more concerted efforts to ensure that they are not offering programs that the private sector could provide. The official also stated that he believed that there were opportunities for MEP and EAG to work more closely together in providing services to SMEs.

Small Business Development Centers

SBA administers the Small Business Development Center (SBDC) Program to provide management assistance to current and prospective small business owners. This $100 million per year program counseled 22,612 small manufacturers during FY 2002 out of a total of 651,421 clients served. An average of 4.7 hours was spent with each client.

SBA provides 50% or less of the operating funds for each state SBDC; one or more sponsors provide the rest. These matching fund contributions are provided by state legislatures, private sector foundations and grants, state and local chambers of commerce, state-chartered economic development corporations, public and private universities, vocational and technical schools, and community colleges.

The SBDC Program is designed to provide counseling, training and technical assistance in all aspects of small business management. SBDC services include, but are not limited to, assisting small businesses with financial, marketing, production, organization, engineering and technical problems and feasibility studies. Special SBDC programs and economic development activities include international trade assistance, technical assistance, procurement assistance, venture capital formation and rural development.

SBDC assistance is available to anyone interested in beginning a small business for the first time or improving or expanding an existing small business that cannot afford the services of a private consultant.

There are 63 lead SBDCs with one in every state (Texas has four, California has six), the District of Columbia, Guam, Puerto Rico, Samoa, the U.S. Virgin Islands and a network of more than 1,100 service locations. [30]

While there clearly are similarities between the efforts of SBDCs and MEP Centers—including the basic mission, clients served and budget size—and an approach to business that provides grants to local/state partners for delivering services, there also are some fundamental differences. MEPs focus specifically on small manufacturers while SBDCs have a much broader mandate. The amount of time spent with individual clients and, consequently the fundamental nature of the

[30] Source: SBDC web site: http://www.sba.gov/SBDC/

services provided, is very different. While SBDCs averaged 4.7 hours per client, MEP Center projects last about 60-70 hours on average. MEPs and SBDCs also work together on projects to help small manufacturers.[31]

Brokering Work by MEP

In FY 2002, MEP Centers used third party providers for 45% of the total services provided to small firms. This broadens and extends the services the MEP Program can provide and because MEP is providing entrée to the small manufacturers and absorbs some of the sales and marketing costs, consulting firms can offer services that are more affordable to the SMEs. MEP officials also stress that MEP services are more vertically integrated than other service providers and that a small firm can receive a holistic view and help with its entire operations including issues of technology utilization, human resources and lean manufacturing principles. While there are a number of potential sources of assistance to small firms, a study of manufacturing extension noted that, "private consultants, equipment vendors, universities, and other assistance sources often overlook or cannot economically serve the needs of smaller firms."[32]

The extent to which individual MEP Centers utilize third-party sources varies significantly among Centers (from 0% to 96% in FY 2002).[33] There also are indications that some MEP Centers compete with other providers of services. Both issues will be more closely examined in the next phase of this study.

In summary, the study team could find little evidence that MEP significantly supplants the private sector consulting market or other third party service providers. It would be more accurate to describe the Program's activities as complementary, rather than competitive, to these other entities. However, there may well be additional opportunities to broker some work currently performed by MEP staff to other service providers. In evaluating alternative business models in the next phase of this study, the Panel will look at MEP Centers' use of private sector consultants and other third-party providers in lieu of providing direct services.

The Panel finds that this barrier to improving the performance of small manufacturers still is important and that the MEP Program makes significant efforts to avoid impacting negatively other service providers.

BARRIER 5: OPERATING CAPITAL AND INVESTMENT FUNDS FOR MODERNIZATION ARE DIFFICULT FOR SMALL AND MEDIUM-SIZED MANUFACTURING FIRMS TO OBTAIN.

The evidence that the study team gathered indicates that this barrier is not as significant as it was when NRC issued its report. The barrier exists to a greater or lesser extent based on current economic conditions and on regional differences in the availability of capital.

[31] OMB's PART Assessment of the SBDC Program is shown in Appendix A.
[32] *Evaluating Manufacturing Extension Services in the United States: Experiences and Insights.* P. Shapira, p. 263.
[33] Provided by NIST/MEP.

A recent study[34] conducted by Joel Popkin and Company for the SBA included the following chart from the National Federation of Independent Business' Small Business Economic Survey, which shows that financing and interest rates are not as important as they were in the late 1980s and early 1990s.

Chart A-7: Net Percent Saying Loans Harder to Get Now

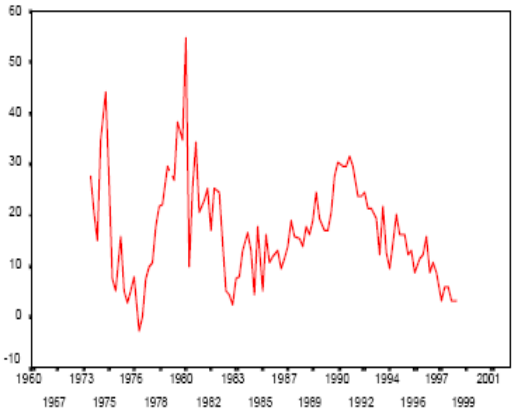
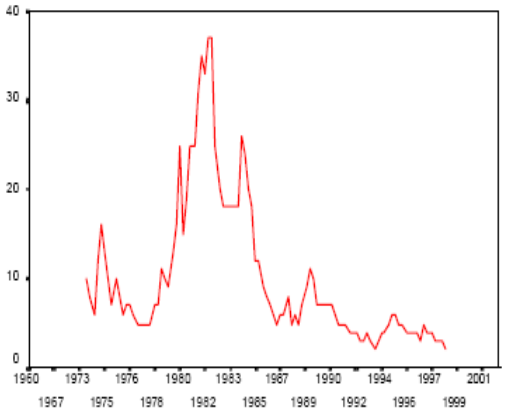


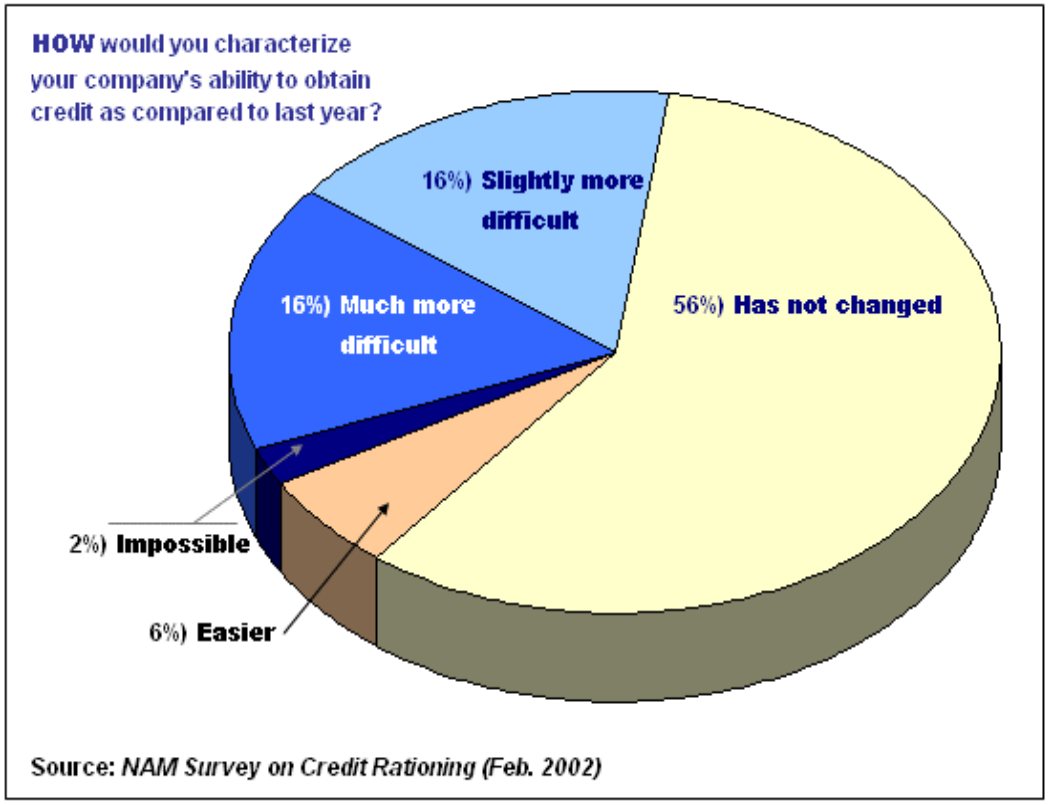
Chart A-8: Percent Saying Financing and Interest Rates are Most Important Problem for Business



The Small Business Administration report suggests that this change in importance is due to a decline in small business borrowing.

Nevertheless, the availability of credit is a problem for some regions and companies, especially when there is a downturn in the economy and bank credit standards are tightened. A 2002 survey by the National Association of Manufacturers reported that 34% of the respondents said credit was more difficult to obtain compared to the prior year.[35] In similar survey released in February 2003, 70% reported that their ability to obtain credit compared to last year was easier (5%) or had not changed (65%); 9% reported it was much more difficult. [36]

[34] *Small Business During the Business Cycle.* Joel Popkin and Company for the SBA's Office of Advocacy, July 2003, Appendix A.
[35] *Productivity on Hold, Economic Recovery Jeopardized by Bank Credit Rationing*. National Association of Manufacturer Online, February 26, 2002.
[36] *Small and Medium Manufacturers Issue Summary Results.* National Association of Manufacturers, 2/20/2003.



Interviews with MEP Center Directors indicated that the availability of credit depends on the region where the business is located, and frequently on how well an SME can prepare a business plan to support its application for a loan. The small profit margins with which companies are working also preclude some of them from putting profits back into their operations for modernization improvements.

"Inaccessible capital" was listed among the factors working against U.S. manufacturing by the Congressional Manufacturing Caucus. It specifically cited the fees charged by the Small Business Administration Loan guarantee programs and the low limits on these loans that do not meet the capital-intensive needs of most small manufacturers. The presentation of the issues also seems to support the view that the problem varies by region and specifically in the Midwest where, according to the Caucus, banks are reluctant to lend to small manufacturers.[37]

OTHER CRITICAL ISSUES OR MARKET FORCES FACING SMEs

What emerged from the study team's interviews with the manufacturing trade organizations, MEP Center Directors, surveys of SMEs and literature review were several other barriers, or market forces that have a significant impact on SMEs.

[37] Congressional Manufacturing Caucus Power Point Presentation, p. 8.

Competition from Low Cost Countries

The most frequently mentioned issue is the competition from what are called "low cost countries." This has been exacerbated by the trend of original equipment manufacturers to obtain more of their components and parts from offshore companies that compete with extremely low wages and operating costs. The extent to which this outsourcing occurs is found in a recent study conducted for the National Association of Manufacturers, which provides a U.S. Department of Commerce estimate that $526 billion, or 47% of all U.S. merchandise imports in 2001, fell under the category of related party trade. The study defines "related party trade" as imports to the United States from U.S.-owned foreign factories or from foreign companies to their U.S. affiliates.[38]

Several sources refer to this as the "China Problem," although it involves numerous other countries, including Mexico, South Korea, Malaysia, Brazil, Eastern Europe and India among others. Testimony given to the House Committee on Science this year stated that, "In the last 25 years, 1.5 billion workers, not just people, but workers, have entered the global market from Brazil, Eastern Europe, India and China alone…and that it will be a long time indeed for that labor market to see broadly rising labor costs." It noted, "Just buying capital equipment is not enough. We need new ways to make things, new technologies for manufacturing. And our manufacturing enterprises must have dependable guidance in changing how they make things—not just advice on the technologies, but help in understanding the implications of those technologies on the business practices that organize production."[39]

A recent white paper issued by the National Coalition for Advanced Manufacturing provided United Nations estimates of the wage differences between China and several other countries: China's average wages were one-third of Mexico's, one-fifth of Malaysia's and Taiwan's, one-tenth of Singapore's and one-twentieth of U.S.'. The paper corroborated the testimony cited above that the labor surplus is of such a magnitude that although China has seen astounding growth in recent years for an economy its size, real wages have fallen because the Chinese economy simply is not creating enough jobs for the masses that want them.[40]

Several sources, including a study for the National Association of Manufacturers, Congressional Manufacturing Caucus and National Coalition for Advanced Manufacturing, pointed out that the competitive position of many low cost countries, especially China, has been enhanced by monetary policies that do not index their currencies to world currencies and are kept artificially low to keep exports flowing.

The National Association of Manufacturers study noted that while value of the dollar is weakening (it has fallen 8% from its peak in February 2002) in many countries with major currencies, it is increasing in countries like China because of their monetary policies. China bought 3% of U.S. exports in 2002, but was the source of 11% of U.S. imports; therefore, China accounted for 21.9% of the 2002 U.S. merchandise trade deficit. The study went on to find that

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[38] *Securing America's Future, The Case for a Strong Manufacturing Base*. Joel Popkin and Company, Prepared for the National Association of Manufacturers Council of manufacturing Associations, June 2003, p. 32.

[39] *Building a U.S. Manufacturing Technology Infrastructure.* Testimony by Lawrence Rhoades before the House Committee on Science. June 5, 2003. Mr. Rhoades is a member of this Panel.

[40] *Industrial Transformation: Key to Sustaining the Productivity Boom*. White Paper prepared by the National Coalition for Advanced Manufacturing, May 30, 2003, p.6.

in the absence of the Chinese government's intervention in the value of its currency against the dollar, U.S. exports to China presumably would be higher and imports from China lower.[41]
The Congressional Manufacturing Caucus stated, "Other nations routinely manipulate currency markets to prevent their currencies from appreciating against the U.S. dollar, and thus keep the dollar overvalued," and specifically mentioned China.[42]

The Society for Manufacturing Engineers noted a position paper prepared by The Right Place, Inc., a regional, non-profit economic development organization in the Grand Rapids, Michigan area that listed the greatest challenges facing small and medium size manufacturers. At the top of the list was "global competition" and "in particular job losses in the manufacturing sector as multinationals continue to shift production and their supply bases offshore in search of cheap labor (especially in China) among the greatest challenges facing SMEs in North America." The position paper also discussed the adverse impact of the dollar valuation on the trade deficit.[43]

In its white paper cited above NACFAM stated, "Competitive regional devaluations, or simply fixed currency regimes pegged at artificially low rates in the case in China, keep the exports flowing."[44]

Some MEP Center Directors stated that they work with SMEs faced with this competition by helping them diversify their product lines through developing new products and markets; facilitating companies' participation in OEM's supply chains; and applying lean manufacturing techniques to drive down their production costs.

Information Technology

The potential for information technology to reshape the world of SMEs is enormous, not only in terms of the potential offered by the Internet but also through the productivity improvements achievable through the intelligent use of information technology. This is a given for larger business enterprises and is supported by the fact that information technology services (systems integration and information technology management/outsourcing) account for 64% of all consulting services provided to large companies.[45]

A report prepared for The Brookings Institution stated, "The Internet has the potential to increase productivity growth in a variety of distinct, but mutually reinforcing ways, including:

- Significantly reducing the cost of many transactions necessary to produce and distribute goods and services.
- Increasing management efficiency, especially by enabling firms to manage their supply chains more effectively and communicate more easily both within the firm and with customers and partners.

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[41] *Securing America's Future, The Case for a Strong Manufacturing Base*. A Study by Joel Popkin and Company, Prepared for the National Association of Manufacturers Council of Manufacturing Associations, June 2003, p. 30-32.
[42] *U.S. in Crisis.* Power Point Presentation. Congressional Manufacturing Caucus. Summer 2003.
[43] *A Growth and Innovative Agenda for Manufacturing.* A Manufacturers Council Position Paper, December 2002, p.34-49.
[44] *Industrial Transformation: Key to Sustaining the Productivity Boom*. White Paper. P. 6.
[45] *Consulting Today.* A Power Point presentation by Bearing Point prepared for this study. 2003.

- Increasing competition, making prices more transparent and broadening markets for buyers and sellers.
- Increasing the effectiveness of marketing and pricing.
- Increasing consumer choice, convenience and satisfaction in a variety of ways."[46]

Access to Skilled Knowledge Workers

At a hearing before the Subcommittee on 21st Century Competitiveness for the Committee on Education and Workforce, Dr. Beth Buehlmann, Executive Director of the Center for Workforce Preparation, a nonprofit affiliate of the U.S. Chamber of Commerce, reported on the results of three employer surveys. In an April 2001 survey of 1,800 employers, 68% said they had a significant problem recruiting qualified employees, and 78% said it was because applicants had the wrong skills, poor skills or no skills at all. By January 2002, 73% of 1,500 employers surveyed said they experienced very or somewhat severe conditions when trying to hire qualified workers. In January 2203, despite the slow economy, over 50% of the 3,700 employers surveyed found it very hard or hard to find workers with the skills they need. [47]

Although the Center for Workforce Preparation's survey was not limited to the manufacturing sector, a 2001 National Association of Manufacturers study focusing only on the manufacturing sector found similar results. It reported that over 80% of the manufacturers reported a "moderate to serious" shortage of qualified job applicants—even as manufacturers were reducing workforces. The study noted that manufacturers faced not a lack of employees, but a shortfall of highly qualified employees with specific educational backgrounds and skills.[48]

The issue of employee skills is not limited to the manufacturing shop floor. The technical skills to implement technology and manage information technology systems often are in short supply in small manufacturing firms. SMEs often are faced with the dilemma of bringing in outside help, which they may not be able to afford, or forgoing the use of technologies that could transform their businesses.

In the 2002 annual survey of small manufacturers conducted by the California Manufacturing Technology Program, upgrading employee skills was rated as the second most important barrier facing the respondents. In another study conducted by the MEP affiliate in York, Pennsylvania (MANTEC, Inc.), "hiring and retaining qualified employees" was ranked as the third most frequently identified "most critical" or "very critical" issue facing the small manufacturers that responded to their survey. [49]

Several MEP Center Directors noted that it is not necessarily the lack of available knowledge skilled employees in the areas of management, information technology, marketing, sales, product

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[46] *The Economy and the Internet: What Lies Ahead*? Robert E. Litan and Alice M. Rivlin. The Brookings Institution. Conference Report #4. December 2000.

[47] Testimony before the Subcommittee on 21st Century Competitiveness, Committee on Education and the Workforce, U.S. House of Representatives, March 4, 2002.

[48] *The Skills Gap 2001: Manufacturers Confront Persistent Skills Shortages in an Uncertain Economy*. National Association of Manufacturers, 2001, p 3.

[49] *Defining the Marketplace for Delivery of High Impact Services*: MANTEC mail market Survey and Focus Groups, 2002.

development or engineering skills, but rather the inability to afford the full time salary and overhead costs associated with hiring employees with these knowledge skills.

One Panel member noted that the discussion of manufacturing employment is an important political and economic issue, but it does not truly capture the issue of manufacturing sustainability. He stated that the United States cannot compete with China in a number of product areas because of low costs, state set labor rates and lack of regulations in the Chinese system. To maintain a manufacturing base, he maintained, the United States must focus on manufactured products that can only be made here which meet security and military needs, or are individually tailored, culturally unique and/or time critical.

Health Care Costs

Although health care costs do not directly affect productivity, they do affect a company's bottom line and competitive position. The study team noted these costs because they were raised as an issue by so many sources. Some MEP Centers have mitigated the impact by sponsoring alliances with health insurance providers and groups of SMEs, resulting in reduced marketing and administrative costs for the health insurers that have been passed on to SMEs.

Data from the Center for Disease Control and Prevention show that the health care premium costs per SME employee increased over 46% between 1993 and 2000. In 1993, the average premium per enrolled employee in a manufacturing establishment with 50 employees or less was $4,690. By calendar year 2000, these same costs had grown to $6,886.[50] While the years 1994 through 1999 saw single digit health insurance premium increases, these premiums have risen from 10 to 13% a year since 2000.

Rising insurance premiums are fueled by demand for hospital services and prescription drugs. A survey conducted by Towers Perrin showed an even higher increase in premiums (14% in 2002). According to this survey, this was the highest year-over- year percentage increase since it began conducting the survey over a decade ago.[51] "Surging health care costs" also was listed as one of the seven factors working against U.S. Manufacturers by the Congressional Manufacturing Caucus, which noted that the number of small businesses offering health care benefits has declined from 67% in 2000 to 61% in 2002.[52]

Rising health care costs was listed as one of the top three human resource issues facing 96% of the 809 respondents to a recent survey conducted by the National Association of Manufacturers. In the same survey, 44.7% of the respondents said their health care costs had increased from 11 to 20% over the past year. Another 29% reported that their costs had risen from 21 to 30%.[53]

According to Jerry Shankel of the Fabricators and Manufacturing Association, with the cost of health care rising dramatically, the higher premiums weigh heavily on a company's decision to continue to operate in the United States or to move production overseas.

[50] Center for Disease Control and Prevention, National Center for Health Statistics, National Employer Health Insurance Survey 1993 and Agency for Health Care Research and Quality 2000.
[51] *Towers Health Care Cost Survey*. Released November 6, 2001.
[52] Congressional Manufacturing Caucus Power Point Presentation, p 7.
[53] *Small and Medium Manufacturers Issue Summary Results*. National Association of Manufacturers. Feb. 20, 2003.

Some MEP Centers operating as non-profit (501c(3)) corporations have helped companies address this issue by working with health insurers to establish larger pools of insured members from several companies or by referring companies to health insurers that are part of a business alliance network. The latter provide discounts based on their savings in marketing and sales costs achieved through MEP Center referrals. Centers that are part of a state or university-based organization said they were precluded from providing this type of service given state or university regulations that restrict providing an advantage to specific bidders from private organizations.

The premiums for health care insurance represent a rapidly increasing cost of doing business. Companies have the option of dropping insurance coverage for their employees, which will adversely impact their ability to retain experienced employees and recruit new employees. Another option is to offset the costs through increased productivity.

Other MEP Center Directors' Perspectives on Issues Facing SMEs

A somewhat unique point of view was expressed by one MEP Center executive who said, "The problem with small companies is that there are too many small companies." His view was that while being small gave companies a competitive advantage at one time because they could react to the market faster than large companies, it is a handicap today because the business of manufacturing has become so complex. Small companies cannot afford to buy the expertise they need to manage the complexity, which includes compliance requirements and technology. They do not have the time and energy to learn what they need to know to be more competitive. Consequently, he believed that MEP must play a larger role in facilitating mergers and partnerships with other companies to leverage their resources and competitive strengths in the market place.[54]

Along a similar line of thinking, a director reported that in addition to providing help with lean manufacturing and continuous quality improvements, they are working with companies on "strategic repositioning" by providing assistance in integrating more products and services and taking advantage of technology.

Other impediments to growth in some companies were attributed to what was referred to as quality of life decisions as owners were comfortable with what they were earning and had no desire to take on new challenges and the potential headaches associated with growing a business. Others cited a sense of entrepreneurial pride that some owners have in the fact they built the business and nobody knows it better than they do.

SUMMARY OF FINDINGS ON BARRIERS AND CHALLENGES FACING SMALL MANUFACTURERS

Examining whether the barriers identified in the 1993 NRC study were still prevalent, the Panel found that all of them were, though their relative importance changed. The Panel also found that

[54] One Panel member specifically noted that he believes this is an incomplete and inaccurate perspective on small companies and that MEP staff are not qualified to perform merger and acquisition work. To become qualified will require a very large investment in high dollar talent.

several new market forces have emerged over the past 10 years, presenting new challenges to the competitive position of small manufacturers.

Small manufacturing firms still need help with technology issues, new production techniques and improving their business practices. In the 2001 survey of 1,750 small and medium-sized manufacturers conducted by the National Manufacturing Association, "sales and marketing," followed by "manufacturing processes and production," were ranked as the top two challenges that require significant improvements. Similar results were found in surveys conducted by the California Technology Program in 2002, and by the MANTEC Organization in 2002. In the California survey, "increasing production cost efficiencies" and "developing effective marketing and sales strategies" were ranked as the first and third most frequently reported barriers facing companies in the area served. In the MANTEC survey, "production improvements" was the fifth most frequent response to a question on critical issues facing the companies they surveyed.

It also is difficult for SME owners and managers to find high quality, unbiased advice and assistance. One Panel member observed that over the past 10 years, many large OEMs have abandoned the vertically integrated model of production and now are outsourcing the production of parts and components previously produced in house. Some of this work has moved offshore and some has shifted to small U.S. manufacturers. The small companies that have acquired some of this production work do not have access to the research and development staff or to extensive management staff that large companies retained on a full time basis. The challenge to programs like MEP is to help replace some of the manufacturing infrastructure that has been lost with the fragmentation of the OEM organizations, as they outsource more of their production processes.

As noted earlier, the evidence drawn from large and medium size consulting firms and national consulting associations, as well as from small manufacturers themselves, supports the MEP Program's view that MEP Centers do not significantly compete with private sector consulting firms for SME consulting business. While individual consultants and firms view MEP as a competitor, the study team found that most Centers typically serve as network integrators that can draw from a wide array of public and private resources to meet specific needs of their client businesses. Forty-five percent of the work accomplished by Centers in FY 2002 was done through third-party providers, including private consultants. The Employee Association Group that sees the MEP Centers as competitive with their member organizations focuses primarily on human resource training, not the broad range of services provided by Centers. In the next phase of the study, the Panel will examine the services provided by the Centers to see if more of the work done by them could or should be brokered out to third parties, or if companies could be referred to other private sector sources to obtain some of the services needed.

The recent National Association of Manufacturers, California Manufacturing Technology Program and MANTEC Organization surveys of small manufacturers indicate that regulatory compliance is no longer one of the most pressing issues facing SMEs. This is attributed to SMEs becoming more familiar with the requirements and the availability of resources like the MEP Centers and SBDCs to help identify and implement practices necessary to ensure compliance.

The lack of available capital is no longer a significant barrier as it was 10 years ago. While it still is mentioned as a problem for some companies and for regions of the country, data from the Small Business Economic Survey show that it has clearly diminished as a significant issue for the companies surveyed.

The isolation barrier, although still mentioned by some as a barrier, also has been diminished by the availability of the Internet. While isolation will continue to be an issue for many SMEs given geography and cultural issues, the growth of an electronically interconnected world can only serve to reduce the significance of this barrier.

The Panel found that new market forces have emerged during the last 10 years, making it difficult for many SMEs to remain competitive. A particularly difficult issue is the challenge of competing with LCCs that have extremely low labor and other operating costs.

Despite a depressed economy, SMEs also find it difficult to recruit the type of skill workers needed to work not only on the shop floor but also in the front office. The 2001 National Association of Manufacturers survey found that more than 80% of the manufacturers reported a "moderate to serious" shortage of qualified job applicants, even as manufacturers were reducing workforces. In many cases, it is not a lack of available employees, but the ability to afford the costs associated with hiring highly skilled-knowledge workers.

The recent double-digit annual increases in health insurance premiums also adversely affect SME's abilities to remain competitive.

As SMEs still face barriers to their performance improvement efforts, the next section of this report will discuss the reported performance of the MEP Program in helping these small firms. This topic will be considered from the perspectives of third-party studies, reports and analyses; MEP's internal performance assessments; and Panel conclusions about performance.

PROGRAM PERFORMANCE AND OUTCOMES

MEP AND THE PRODUCTIVITY GAP

Because the productivity gap between small and large manufacturing firms has continued to grow since the Program's inception, it could be argued that MEP has not had a significant positive impact on small manufacturing firms.

Productivity is dependent upon a number of factors, including scale-related advantages of size, with larger firms tending to have lower average cost-per-unit of production resulting from capital and resource investment. A study comparing U.S. and Canadian manufacturing found that, "Evidence from surveys on the use of these new technologies shows that larger producers are more likely to be adopting these technologies than smaller firms…Differences in labor productivity are closely related to differences in technology usage. Plants using advanced technologies are more productive…(and) pay higher average wages. The fall in small producer labor productivity that has accompanied the transformation in industrial structure is probably closely related to differences in technology use."[55]

Even if larger firms did not have productivity improvement advantages, the MEP Program's 6,000 annual significant interactions with its base of 350,000 small manufacturers is unlikely to have a significant impact on this measure. Given the scale of the Program, the use of this macroeconomic indicator may be a motivating rationale for the Program but is not a good metric for determining its effectiveness. Indeed, to conclude that the growing productivity gap is an indicator of the ineffectiveness of the MEP Program would be a mistake.

EVALUATIONS AND ASSESSMENTS OF MEP PERFORMANCE AND OUTCOMES FROM OTHER ENTITIES

The MEP Program has been the subject of numerous evaluations since its inception. One such study of the impact of MEP on the bottom line of small manufacturing businesses was conducted by an economist at the Center for Economic Studies at the U.S. Bureau of the Census. Using what was described as a rigorous econometric methodology to determine the impact of the MEP Program on client plants compared to non-client plants, the study concluded that the former on average experienced 4.67% more employment growth and 5.23% more labor productivity between 1995 and 1996 than non-client plants and that, "This report finds evidence of beneficial impacts of manufacturing extension services on client manufacturing plants."[56]

The recently published work, *Evaluating Manufacturing Extension Services in the United States: Experiences and Insights* cited 30 evaluations that have been conducted by a variety of authors

[55] *The Trend to Smaller Producers in Manufacturing: A Canada/U.S. Comparison*. Micro-Economic Analysis Division, Statistics Canada. John R. Baldwin, Ron S. Jarmin, Jianmin Tang. May 2002.

[56] *The Impact of the Manufacturing Extension Partnership on Plant Performance: 1996*. Ronald Jarmin and Dean Prestegaard. A report prepared at the Center for Economic Studies of the U.S. Bureau of the Census for the National Institute of Standards and Technology.

from 1994 to 1998.[57] Various data collection methods were used in these evaluations, including telephone and written surveys of small manufacturers, manufacturing trade organizations and MEP Centers; case studies and meta-analyses of case studies; longitudinal research studies; performance benchmarking; and simulation models. The summary findings indicated that the majority reported favorable program impacts, describing the approach taken by the MEP Centers as "pragmatic, with an emphasis on best practices, known, and commercially tested techniques and methods." It also found that, "Smaller firms frequently lack information, expertise, time, money, and confidence to upgrade their manufacturing operations, resulting in under investment in more productive technologies and missed opportunities to improve product performance, workforce training, quality, and waste reduction." The conclusion was reached that, "Private consultants, equipment vendors, universities, and other assistance sources often overlook or cannot economically serve the needs of smaller firms."[58]

The Office of Management and Budget's (OMB) Program Assessment Rating Tool for the FY 2004 budget fall review also evaluated the MEP Program.[59] The evaluation proceeded through four areas of assessment: purpose and design, strategic planning, management, and results and accountability. The first set of questions gauged whether the Program's design and purpose were clear and defensible. The second section involved strategic planning and weighed whether the agency set valid annual and long-term goals for programs. The third section rated agency management of programs, including financial oversight and program improvement efforts. The fourth set of questions focused on results that programs could report with accuracy and consistency.

While the MEP Program was rated as moderately effective, the second-highest possible evaluation, an important conclusion drawn by OMB was that, "It is not evident that similar services could not be provided by private entities." The assessment also stated that taxpayer support for MEP services that benefit firms (through increased sales, capital investment, and inventory savings) is unnecessary. A fuller discussion of OMB's assessment is contained in the next section of this report.

Similar criticisms concerning the fundamental question whether a program such as MEP is needed have come from other sources. The MEP Program, along with NIST's Advance Technology Program (ATP),[60] were referred to as programs that "hand out money to private companies in the name of advancing technology" in a Cato Institute Handbook for Congress. The handbook stated that Program expenditures are examples of unneeded corporate welfare, wasted in a market that already produces world-class technology. Cato lumped the two programs together, but the examples cited represent grants given by the ATP program to companies like General Electric, Motorola, Dow Chemical, 3M, Xerox, Lucent Technologies and Cargill. (The MEP Program does not give grants to small manufacturers, but in fact charges for its services. Grants are given to state centers as part of the one-third, one-third, one-third matching formula.)

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[57] *Experiences and Insights,* in, *Learning from Science and Technology Policy Evaluation: Experiences form the United States and Europe, Cheltenham, UK and Northampton, MA.* P. Shapira and, S. Kuhlmann (editors) Edward Elgar Publishing. 2003, pp. 261-293.

[58] Ibid. p. 263.

[59] For a fuller discussion of this assessment system see: http://www.whitehouse.gov/omb. Also see Appendix B for OMB's complete *Summary Evaluation of MEP.*

[60] A major element of NIST, the Advanced Technology Program is designed to bridge the gap between the research lab and the market place. ATP's early stage investment is designed to accelerate the development of innovative technologies that promise significant commercial payoffs and widespread benefits for the nation.

Similar language appeared in a Heritage Foundation analysis of the appropriations bill for the Department of Commerce's Technology Administration, which recommended eliminating NIST's ATP and MEP Programs. The analysis stated, "These programs were designed to supplement American industry research and development in the late 1980s so that American industry could innovate and compete with foreign corporations." As with the Cato Institute example, the examples provided by the Heritage Foundation referred to ATP grants and did not speak directly to the MEP mission.

A 1995 U.S. General Accounting Office report found that 73% of the manufacturers that responded to its questionnaire reported that MEP assistance positively affected their overall business performance. The respondents stated that such assistance improved their use of technology in the workplace, the quality of the product and the productivity of their workers. The survey covered manufacturers served by 57 Centers and was based on responses from 551 small manufacturers.

The Organization for Economic Co-operation and Development's (OECD) report on Small and Medium Enterprise Outlook for 2002 stated that the U.S. research and innovation community has evolved from one traditionally dominated by research universities and large companies to a continuum of research universities, federal laboratories, small and large businesses and states supporting technology based economic development. It described the MEP Program as one that "…supports smaller manufacturing firms in becoming globally competitive, with services that are defined by industry, and delivered using both private and public sector enterprise."[61]

In another OECD report on diffusing technology to industry, the author of a section devoted to the MEP Program stated that the creation of MEP is recognition of the importance of manufacturing to the U.S. economy. She quoted Alexander Hamilton who wrote in 1791 that, "Not only the wealth; but the independence and security of a Country, appear to be materially connected with the prosperity of manufacturers."[62]

An article on the MEP Program that appeared in *INC Magazine* in January 2002 presented three case studies where MEP Centers had positive impacts on three businesses. The article stated, "Today (as compared to 1988) MEP's mission is critical for a more sobering reason: in the aftermath of September 11, the U.S. domestic capabilities are in the spotlight. Manufacturing, once the sector that the country looked to for innovation, now occupies center stage again. And MEP is helping manufactures use the best of the technological advances to revitalize existing plants and create new ones in industries that can only be imagined."[63]

MEP INTERNAL EVALUATIONS AND ASSESSMENTS OF PERFORMANCE AND OUTCOMES

The MEP Program has an extensive array of internal performance measures. Center cooperative agreements are renewable annually, and the Program manages performance through a series of interactions and deliverables described here:

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[61] *Small and Medium Enterprise Outlook*. OECD, p. 219.
[62] *Diffusing Technology to Industry: Government Policies and Programs.* OECD Publications, Paris, 1997.
[63] *Made in the USA*. Inc Magazine, January 1, 2002, p. 78.

Operating Plan. A Center must prepare an operating plan annually (linked to its strategic plan) that outlines the proposed nature and level of activities and results for the coming year. The operating plan, reviewed and approved by NIST-MEP, forms the basis for monitoring progress throughout the year.

Quarterly Data Reporting. Each Center reports data on a variety of areas quarterly. Major elements of quarterly reporting include progress data, progress narrative, activity data log (which forms the basis for the client impact survey), partner and affiliate information and client success stories.

Annual Review. Prior to being renewed, each Center must be reviewed by NIST-MEP with funding addressed as part of that review. The annual review was modeled as a subset of the external panel review and the Criteria for Center Performance Excellence review criteria modeled after the Baldridge assessment. More recently, the reviews have become more strategy oriented, focusing on linked strategic-operational plans and performance-based results. The review typically is conducted by the NIST-MEP program officer assigned to monitor that Center, and conducted there. Each review is documented in the form of a written report, provided to the Center for implementation of recommendations, and is part of the Center renewal package.

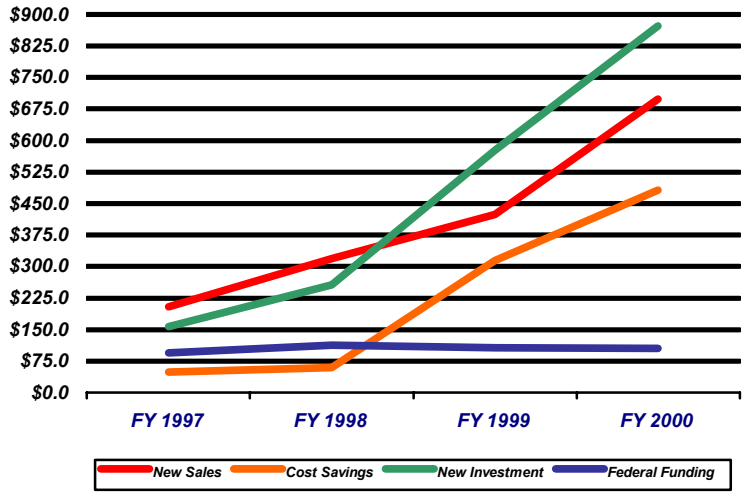
External Panel Review. The MEP statute (15 USCS 278k) requires each Center to be reviewed by an external panel during years three and six and every two years thereafter. The panel reviews are managed and chaired by NIST-MEP using the Center Progress Report (CPR). The Center prepares the CPR, which includes the center profile, strategic and operational plans and quantitative performance-based results. The Center and panel then meet to discuss and clarify the written report, recommendations (and funding for the center), and a written report that documents results of the process. These are developed and delivered to the Center for implementation.

Third Party Client Survey. Since 1996, NIST-MEP has sponsored a national survey of Center clients by an independent third party. The survey asks clients to comment on the business impact of the services provided by their local Center. These surveys are done for two primary purposes:

- Collect aggregate information on program performance to report to various stakeholders as indicators of performance. The survey provides information about the quantifiable impact on client firms of the services provided by MEP Centers. NIST-MEP also conducts other studies to evaluate the systems impact that corroborate and complement the survey results.
- Provide Center-specific program performance and impact information for Center use. Centers use the information to communicate results to their own stakeholders at the state and federal level. Center management and NIST-MEP use it to evaluate Center performance and effectiveness. The MEP Center Review Criteria and review process place strong emphasis on a centers ability to demonstrate impacts and uses the survey results in its program reviews. The results also provide MEP centers with a tool to measure their individual performance and effectiveness and benchmark their performance against other Centers and performance standards. In addition, the data allow NIST-MEP to gauge the impact of the national MEP network on small manufacturers and on the national and regional economies.

The following graph details Center performance on some key measures tracked by the MEP Program, compared with the size of the federal investment in the Program[64]:

MEP Center Performance



Based on the third-party client surveys and a 2001 study, MEP reported the following program outcome performance:

MEP clients reported that the MEP services resulted in:

- new and retained sales of over $2.2 billion
- cost savings of nearly $482 million
- new investment of $873 million
- retaining and creating over 25,000 manufacturing jobs
- productivity improvement as a result of the services provided[65] (64% reported this impact)

The broader economic effects were reported as:[66]

- Gross Domestic Product in 2000 was $7.6 billion higher with the Program.
- Personal income was $4.8 billion higher with the Program.
- The Program generated 114,000 more jobs.
- This same study showed that MEP services increase corporate and personal

[64] *Manufacturing Extension Partnership*: *An Analysis of Center Performance & Review*. Report to Deputy Secretary of Commerce Sam Bodman. May 28, 2002.

[65] Independent survey conducted by Market Facts, Inc. for NIST-MEP of over 7,000 clients served in FY 2000. Over 11,400 clients were interviewed via telephone in FY 1999 and FY 2000 and the overall response rate was 68.3%.

[66] *NIST MEP Program: Impact on the U.S. Economy in 2000.* Nexus Associates, November 2, 2001.

tax revenues by significantly growing before-tax profits of small manufacturers and stabilizing or growing the manufacturing workforce.

The Program also estimates that it generates a 4:1 return on investment to the federal treasury.

The metrics used by MEP to evaluate its own performance and the Program's outcomes are extensive. This is best characterized in a report which noted that "Methods used in MEP-supported evaluations…(cover) virtually the entire range of evaluation methods available…the significance of these efforts is not in the methods used or the results generated, but in the integration of evaluation into a longer-term, strategic framework."[67] However, some measures used by the Program may not be optimal and will be considered in more detail in the next phase of the study.

PANEL ASSESSMENT OF MEP PERFORMANCE

The performance of the MEP Program has received generally positive reviews while its fundamental mission has come under some criticism, the most comprehensive of which is contained in the OMB's PART analysis. The Panel felt it was important to carefully address the points raised since they involve so many aspects of the Program. The following section will discuss the OMB concerns (shown in ***italicized boldface***) of Program structure, performance and outcomes:

"***… MEP only serves a small percentage of small manufacturers each year, and it is not clear that there is a significant impact on the productivity and competitiveness of small manufacturers as a whole.***"

Given the scale of the Program, the use of this macroeconomic indicator is a motivating rationale for the Program, but is not a good metric for determining its effectiveness. With significant interventions taking place annually with less than 2% of the SME population (6,000 out of 350,000), it is unlikely that the MEP Program could significantly move the performance of the entire group.

"While MEP's performance measures and outside studies show improvements in productivity and competitiveness of clients…it is difficult to isolate the impact of MEP from other factors, such as changes in the economy."

It *is* difficult to isolate MEP impact on small firms from other factors, a quality shared with a number of other federal assistance programs. However, the best available information, including the Program's internal statistics as well as outside sources (see Jarmin), indicates that the positive impact on SMEs is significant. This is reinforced by a number of studies,[68] including one by the General Accounting Office which noted, "73% of respondents viewed MEP assistance as having a positive effect on their overall business performance. In addition, most

[67] *Outcome Measurement in the United States. State of the Art 1.* David Roessner. SRI International.

[68] *Summary of Manufacturing Extension Impact Studies, 1994-1998.* Jan Youtie. (Georgia Tech Economic Development Institute) and Philip Shapira (Georgia Tech School of Public Policy). Atlanta, GA: April 07, 2003. http://www.cherry.gatech.edu/mod/pubs/impact.htm.

respondents found that MEP assistance had had a positive effect on their use of technology in the workplace, the quality of their products and customer satisfaction." [69]

"A long-term study of MEP clients vs. non-MEP clients is not available."

The Jarmin study was a long-term study using the U.S. Census Longitudinal Research Database. The original study covered 1987 to 1992 and was repeated for 1995 and 1996 with similar results. Absent a more current long-term study, the best available evidence is that the Program is effective in helping small firms improve their productivity. MEP Program officials may want to consider commissioning such a study to respond to OMB's concern.

"Some performance gains may also be the result of displacing business from nonclient firms, resulting in little or no net effect on the economy..."

Data to support or refute this assertion were not found by the study team in its research. As with the previous statement, this may be an area that MEP Program officials may wish to study further.

"Because firms self-select into the MEP program, it is possible that the firms could have sought assistance through other means and achieved similar results."

Similar to the previous answer, data concerning this were not found by the study team. This, too, could be a topic for further research.

"While the big consulting firms may not provide services to small manufacturing firms, there are a number of nonfederal entities across the country that are available to small firms for various consulting services."

There are a number of nonfederal entities that provide such services to small manufacturers; in fact, small firms often avail themselves of those services. Some studies have shown that the primary suppliers of assistance to small firms are suppliers/vendors, followed by trade associations.[70] MEP officials assert that the Program does not attempt to compete with those and other forms of assistance, but rather attempts to target assistance to help small manufacturers overcome three of the barriers to productivity improvement:

- Smaller manufacturers often are unfamiliar with changing technology, production techniques and business management practices.
- It is difficult for owners and managers of smaller companies to find high quality, unbiased advice and assistance.
- Smaller manufacturers are generally isolated and have too few opportunities for interaction with other companies in similar situations.

MEP officials emphasize the issue of trust ("high quality, unbiased advice and assistance") that seems to keep many small firms from utilizing private sector consulting services. They also

[69] Manufacturing Extension Programs: Manufacturers' Views of Services, General Accounting Office, Report Number GGD-95-216BR, 1995.
[70] *Summary of Results of Recent MEP Center Surveys*. Stone & Associates. 2001.

stress that MEP services are more vertically integrated than other service providers and that a small firm can receive a holistic view and help with its entire operation.

To the extent that the Program keeps its focus on overcoming these barriers, it does not necessarily conflict with services provided by other nonfederal entities. However, there is an indication that some MEP Centers do, in fact, provide services that are readily available through other sources, in some cases possibly driven by the need to generate income from service recipients to meet their matching requirements. This issue will be more closely studied in the next phase of this study.

In addition to providing services directly, the MEP Program helps to link-up small manufacturers with a wide variety of third party service providers, including private consultants. As of 2002, third parties were responsible for the delivery of 45% of all services reported by MEP Centers, although the percentage varied greatly from Center to Center. As discussed earlier, the MEP Program is more of an enabler for consulting entities to gain access to small firms than a competitor. The extent to which individual Centers use outside consultants and its impact on outcome measures will be reviewed in the next phase of this study.

"MEP has developed a nation-wide network of centers through state-federal partnerships, but what the program's next steps will be is unclear. The original design of the program intended for centers to become self-sufficient, yet there are currently no plans for achieving this goal…Centers do not have long-term plans for becoming self-sufficient and there is no policy in place to encourage them to do so."

The Program's original design included a six-year sunset provision for federal funding of state Centers. Congress eliminated that provision in subsequent legislation but recent administration budget submissions for MEP provided funding based on the earlier (sunsetted) law. Although the last few presidential budget submissions only requested funds sufficient to pay for Centers that were not sunsetted under the old law (less than six years of operation), Congress restored full funding in the final appropriation. It should be noted that the continued uncertainty of funding for the Program has the potential to seriously undermine its operations, even if full funding is restored. A complex alliance of organizations such as this one cannot help but be weakened by doubts about the federal commitment. This is exacerbated by the current financial strains in which many states find themselves.

"The program should focus on creating a private sector market for these services rather than continually providing federal subsidies."

As mentioned above, the Program has been successful at matching third party private sector providers with SMEs and there is potential for this to grow beyond the current level. The issue of continuing to provide federal resources is best addressed in the legislative and appropriations processes. It would be helpful for MEP and OMB officials to discuss what additional steps could be taken to create a more effective private sector market for providing services to small firms.

"…Improvements to the design of the program should be made."

The Program could be improved as indicated by interview subjects, studies and MEP Program officials themselves. The initial results from this study indicate that the MEP organization and performance are not optimal. This will be the main focus of the second phase of this study.

"MEP's survey-based evaluation system obtains results data from clients that, when aggregated, demonstrate system-wide progress toward the Program's goals; however, results vary widely by Center."

The difference in performance among Centers is an area of concern for program officials and is an issue that will be more closely examined in the second phase of this study, which looks at business models.

"MEP should be able to leverage the established infrastructure and serve clients more cost-effectively over time."

Improving MEP's productivity and effectiveness is an important concern of MEP officials and provides the fundamental basis for the second phase of this study.

While there are observations about the Program's reported outcomes, OMB's statements focus mainly on the structure of the Program and the necessity for continued federal funding for mature Centers. It should be noted that the OMB assessment of the MEP Program describes program weaknesses that could apply to most federal assistance programs. Do these criticisms justify the low PART score in Program "focus"? (40 of a possible 100 points.) Consider the PART assessment of SBA's SBDC Program. This Program provides consulting services to small businesses, small manufacturers included, through a nationwide network that uses state and private funding sources in addition to the federal contribution.

The PART assessment of the SBDC Program found that "the program's purpose is clear" and assigned a score of 80 for this area. On the question, "*Is the program optimally designed to address the interest, problem or need?,"* OMB found that, "There is no conclusive evidence that another approach would be more efficient or effective." While MEP Centers work exclusively with manufacturers and tend to spend more time with each client, the underlying premise of the Program does not substantially differ from SBDC's: providing business advice and assistance to small businesses. The reasons why the MEP Program's purpose is assessed at less than half the score of an analogous program are not apparent from the narrative in the PART assessments.

As mentioned, the PART assessment gives MEP generally high marks in terms of planning, management, strategic planning and performance measurements. Setting aside issues of structure and funding for the purposes of this discussion, this study considered the actual performance of MEP regarding its stated mission: helping small manufacturers improve their performance. As detailed earlier, there is a substantial body of information in the form of MEP internal data sources, studies and reports that point to the degree to which MEP is efficient and effective in its core business.

The numerous studies of the MEP Program conducted over the last decade (see Appendix B for a list of studies conducted from 1994-1998) have used a variety of methodologies to answer this

question, including telephone and written surveys of small manufacturers; manufacturing trade organizations and MEP Centers; case studies and meta-analyses of case studies; longitudinal research studies; performance benchmarking; and simulation models. Although not all results were favorable to the Program, the reported findings on balance were positive and supported the Program's approach and effectiveness.

When coupled with the extensive performance data metrics compiled by the Program, the Academy Panel concludes that MEP is effective in its core mission of helping small manufacturers reduce the barriers to productivity improvement.

An additional issue that needs to be addressed is whether the metrics currently used by the Program to assess Center performance and small manufacturer outcomes are optimal. Indications from this initial phase of the study are that program metrics provide opportunities for improvement that can help performance and outcomes. The next phase of this study will address this issue in the context of considering alternative business models for the Program.

CONCLUSIONS AND FINDINGS

The MEP Program is distinctive in several respects. First, it is the only federal program designed specifically to help small manufacturers, and positioned to help create an infrastructure for providing support to these firms as the U.S. economy moves through enormous economic transition. Second, MEP Centers are encouraged to operate as businesses—that is, with balance sheets, cash flows and receivables and other characteristically private sector features. This approach is highly unusual among federal programs. Third, the MEP Program, operating as a partnership with states, universities, not-for-profit and for-profit organizations, is positioned to effectively link federal goals for the Program with state and local economic developments. Each stakeholder provides resources and gains in the process. These network services and convening roles performed by MEP constitute an important, if non-reimbursable, part of what the Program does and helps contribute to its overall effectiveness.

The OMB PART assessment makes an important statement in this regard: *"Through its state and local affiliates, MEP is designed to reach small manufacturing establishments that are less likely to be served by large private consulting firms. MEP leverages state and local resources to provide tailored manufacturing technical assistance to its customers. MEP is unique in that it is the only nationwide network of specialized manufacturing extension centers."*

The MEP Program provides critical assistance to the small manufacturers that perform the bulk of the U.S. manufacturing tasks so they can identify, understand and successfully implement modern manufacturing methods and practices that are appropriate, and can exploit U.S. manufacturing capability advantages. The federal contribution to the Program is not used to subsidize small manufacturing firms, which are expected to pay the incremental costs of the direct services received.

Dr. Phillip Shapira articulates some of the Program's most positive aspects.

> …The MEP program incorporates most of the principles articulated in recent government reform proposals in the United States. First the program seeks a co-operative relationship between the public and private sectors. The private sector is involved not just as a recipient, but also as a service partner and an advisor. Second, the program is decentralized and flexible, with individual centers able to develop strategies and program services which are appropriate to state and local conditions. Third, the MEP seeks not to duplicate existing resources. Rather than provide services directly from the federal level, MEP awards are designed to get existing service providers, whether they be consulting firms, non-profit organizations, academic institutions, public agencies or trade associations, to cooperate and coordinate in their efforts to assist local manufacturers.

While economic circumstances have changed significantly since the Program's inception in 1988 and the NRC report in 1993, there still is the need for a program that provides assistance to small manufacturers. And while there are opportunities for improvement in the way services are provided, the Program does perform in a capable and effective manner.

The goal of this phase of the study was to answer two questions. First, what are the current barriers to productivity improvement faced by small manufacturers? Second, to what extent is the MEP Program positioned to help with reducing these barriers?

For the reasons stated in the earlier sections of this report, the Panel concludes that significant barriers to small manufacturers' productivity improvement efforts still remain. Additionally, the MEP Program is uniquely situated to deal with these barriers and it does not supplant other service providers by offering these services.

The following represent the principal findings for this phase of the study:

FINDING 1

Barriers to productivity and performance improvement continue to challenge small manufacturers.

- The barriers identified in earlier studies still exist but the relative importance of each to small manufacturers has changed since the inception of the MEP Program.
- Additional factors affecting small manufacturer performance have grown in importance since the inception of the MEP Program, including rapidly increasing competition from low cost countries in terms of the number of competitors and the quality of that competitive output; the explosion in the availability of information and information technology; insufficient access to knowledge workers by small manufacturers; and the high cost of providing health insurance to employees.
- Over the last decade, the importance of leveraging technology has become even more critical to improving the performance of small manufacturers. The MEP Program needs to better focus its corporate strategy on facilitating technology implementation, technology integration and technology transfer for small manufacturers.

FINDING 2

The small manufacturing market is underserved in terms of assistance with productivity and performance improvement efforts.

- While there are individual consultants and firms and other private and public organizations that can and do provide services to small manufacturers, for the most part, this remains a largely underserved market.
- The MEP Program does not significantly displace these other entities in the marketplace but more typically serves as an enabler to link small manufacturers to their services.
- The MEP Program is uniquely situated to create the nationwide network and infrastructure that can provide systematic and comprehensive productivity improvement assistance to small manufacturers.

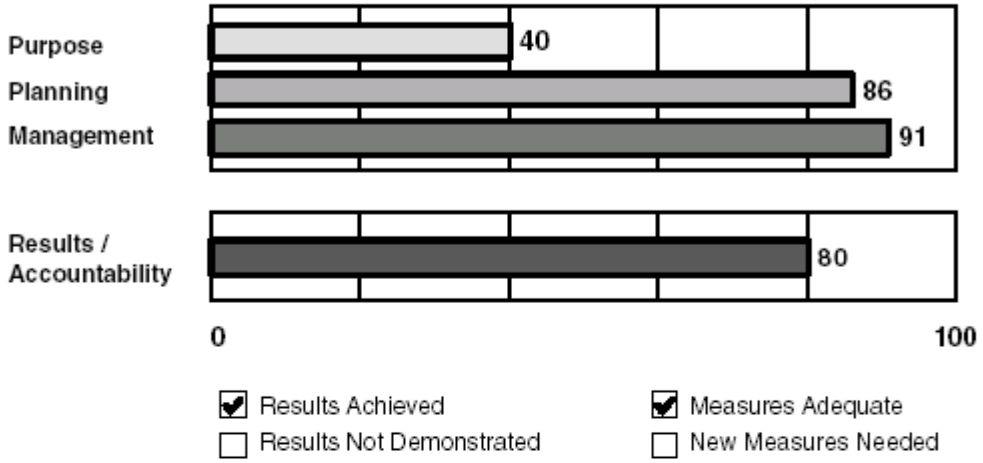
The Panel also notes that given the wide range of performance among MEP Centers, there are opportunities to improve the Program's service delivery, organizational structure and outcome

and performance measures. These will be the focus of the next phase of this study, which will consider alternative business models for the Program.

APPENDIX A

Program: *Manufacturing Extension Partnership*

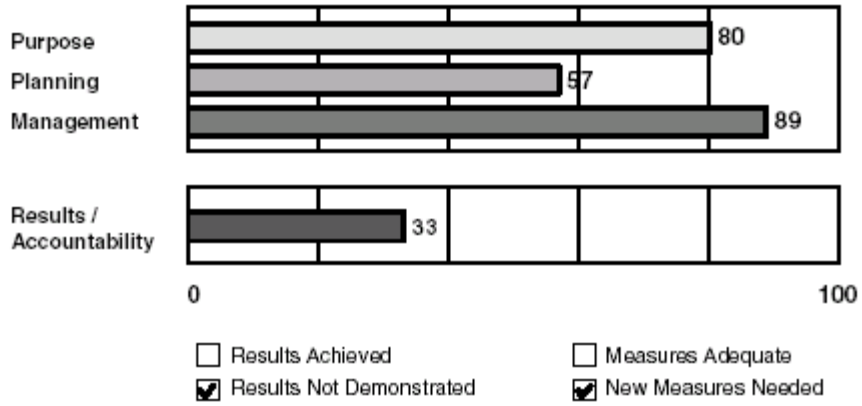
Agency: *Department of Commerce*
Bureau: *National Institute of Standards and Technology*



Key Performance Measures	*Year*	*Target*	*Actual*
Annual Measure: Increased sales attributed to MEP assistance ($ in millions)	1999	443	425
	2000	670	698
	2001	708	
	2002	726	
Annual Measure: Capital investment attributed to MEP assistance ($ in millions)	1999	359	576
	2000	864	873
	2001	913	
	2002	910	
Annual Measure: Cost savings attributed to MEP assistance ($ in millions)	1999	New	364
	2000	545	482
	2001	576	
	2002	497	

Program: *Small Business Development Centers*

Agency: *Small Business Administration*
Bureau:



Key Performance Measures	*Year*	*Target*	*Actual*
Long-term Measure: Measure under development			
Annual Measure: Cost of providing services to clients (Targets under development)	2001		$164.57
	2002		$154.43
Annual Measure: The number of small businesses counseled or trained (Revised targets under development)	2001	631,349	609,646
	2002	627,935	651,421
	2003	634,214	
	2004	653,240	

Rating: *Results Not Demonstrated*

Program Type: *Block/Formula Grants*

Program Summary:

Small Business Development Centers (SBDCs) provide basic business counseling to current and prospective business owners. These centers are partially funded by the federal government. State and private sources also provide funding. SBDCs counsel over 600,000 clients annually.

While the assessment found that the program's purpose is clear, SBA lacks meaningful annual and long-term goals necessary to measure the program's performance. Additional findings include:
1. An independent evaluation of the program indicated that each $1 spent on counseling resulted in $2.78 in tax revenue.
2. There are no evaluations from which to assess the agency's management of the program. Based on preliminary cost allocation data, the agency spent approximately $13 million to manage and support $88 million in SBDC grants.
3. Funds are allocated to SBDCs based on formulas rather than performance. In addition, the hourly cost of counseling services varied significantly among SBDCs without any evidence that the quality of services or outcomes differed.

In response to these findings, the Administration will:
1. Develop outcome-oriented annual and long-term goals and measures to assess program performance.
2. Undertake an evaluation of the program's effectiveness and measure whether it duplicates other federal and non-federal mentoring programs.
3. Revisit SBA's cost allocation methodology to determine whether current estimates accurately represent true program related expenditures.

(For more information on this program, please see the Small Business Administration chapter in the Budget volume.)

Program Funding Level (in millions of dollars)

2002 Actual	2003 Estimate	2004 Estimate
88	88	88

APPENDIX B

SUMMARY OF MANUFACTURING EXTENSION IMPACT STUDIES, 1994-1998

Source: Jan Youtie (Georgia Tech Economic Development Institute) and Philip Shapira (Georgia Tech School of Public Policy). Atlanta, GA: April 07, 2003.

Author/Year	Method	Focus	Main Findings	Comments
MEP (1994)	Center surveys of customer impacts	MEP customers	Benefits per company anticipated by 610 firms responding to MEP center surveys in 1994 included 5.5 jobs added or saved, $43,000 savings in labor and material costs, and an increase of almost $370,000 in sales. Benefits exceeded federal costs by 8:1 ratio.	
Swamidass (1994)	Member survey	National Association of Manufacturers members	Only 1% of manufacturers say government is an important source of assistance in technology investment decisions.	Suggests that market penetration of modernization services is low.
GAO (1995)	Survey of MEP manufacturing customers	Nationwide	73% of 389 respondents indicated that their overall business performance had been improved	
Shapira and Youtie, (1995)	Benefit-cost study	Georgia, MEP customers	Combined net public and private economic benefits exceed costs by a ratio of 1.2:1 to 2.7:1	
Luria and Wiarda (1996)	Benchmarking survey, comparison group	Michigan MTC customers; nationwide manufacturers	MEP customers improve faster than comparable firms in a comparison group. However, assisted firms had smaller increases in computer-based technologies.	17 key technology and business performance metrics used; ITI Performance Benchmarking Service dataset
Michigan Manufacturing Technology Center (1996)	Benefit-cost study	Michigan, MTC customers	Combined net public and private economic benefits exceed costs by a ratio of 1.45:1	
Nexus Associates (1996)	Survey of NYMEP customers, comparison group, benefit-cost study	NYMEP customers	NYMEP generated $30 million to $110 million of value-added income; 510 to 1920 jobs. Benefit cost ratio of 0.14:1.0 to 0.51:1.0.	Cobb-Douglas Production Function; A priori prediction of high impact oversampling; ITI Performance Benchmarking Service dataset is control group
Oldsman (1996)	Customer Survey, comparison group	New York Industrial Technology Extension Service customers	Total annual cost savings for the 1,300 companies participating in the program between July 1990 and March 1993 is $30 million. Majority companies said their ability to compete was improved as a result of the program.	The average customer added 5.7% fewer workers than similar, non-participating companies.
Shapira and Rephann (1996)	Survey with comparison group, multivariate regression	West Virginia, manufacturing extension customers and non-customers.	Participation in a manufacturing technology assistance program is not yet associated with higher levels of aggregate new technology use, but it is found to associate with adoption of specific technologies and receptivity to new technology investment.	The study's results also confirm the value of training and suggest that a strategy of targeting smaller and medium-sized plants with services focused on multiple clustered locations may be effective in stimulating new technology use among these manufacturers.
Cosmos Corporation, NIST MEP, 1997	Case studies	25 MEP engagements in 13 states	Structured case studies of MEP projects show that program services help smaller manufacturers to modernize their operations, improve quality, and increase profitability through such means as reducing waste, redesigning plant layouts, and improved inventory control and employee training.	
Jarmin (1997)	Longitudinal study, comparison group	Longitudinal Research Databases, 1987-1992, MEP customer data from 8 centers	Manufacturing extension clients had 4-16% higher growth in value-added per worker than non-clients	Standard value-added production function; Controls for self-selection
Kelly (1997)	Case studies of 3 centers	Northern Pennsylvania, Michigan, Minnesota	MEP's focus on one-on-one assistance fails to address problems that limit the diffusion of knowledge and skills in using more advanced technologies.	

Luria (1997)	Performance Benchmarking Service dataset, comparison group	Michigan MTC customers	Customers improved to a greater extent than non-customers in sales growth, employment growth, and adoption of certain process improvements and technologies. However, center customer growth in wage rates, profitability, and labor productivity were not significantly different from that of non-customers.	The author attributes the results to the center's service mix, which attracts companies that are not on a rising productivity path, combined with intense customer price pressures.
MEP (1997)	Telephone survey of MEP customers by U.S. Census Bureau	Nationwide, MEP customers	MEP customers' report $110 million increased sales, $16 million from reduced inventory levels, $14 million in labor and material savings, 1,576 net jobs created, 1,639 total jobs retained as a direct result of MEP services.	Information provided 9-10 months after project close
Modernization Forum and Nexus Associates (1997)	Survey, comparison group	Manufacturers that used consultants	94% of MEP customers reported improvement in services vs. 77 percent of non customers who worked with consultants	
Shapira and Youtie (1997)	Case studies and analysis of reporting data	6 MEP centers and their partnerships	MEP sponsorship has led to increased service coordination not readily obtained through individual center efforts alone or through demands of state governmental funders. Increased service coordination, in turn, has mostly improved the assistance delivered to firms, though significant expenditure of resources were required to achieve these benefits.	
Welch, Oldsman, Shapira, Youtie, and Lee (1997)	Survey of manufacturing network customers	99 members of 13 separate business networks	The median net benefit of network participation to the firm is $10,000 (the average was $224,000)	
Youtie and Shapira, (1997)	Customer survey - longitudinal tracking study	Georgia, MEP customers	68% assisted firms took action, with more than 40% percent reporting reduced costs, 32% improved quality, 28% capital investment	Customers overestimate benefits and underestimate costs close to point of survey, except for small number of high impact projects
Ehlen and Weber (1998)	REMI input-output model	Based on data from 1559 customers of 8 centers, reported in Jarmin (1997)	Impact of program services, 1987-92, is $1.3 billion in total economic output (based on multipliers) and $213 million in additional federal tax revenues.	
Ellis (1998)	Surveys of MEP customers	Massachusetts MEP customers	29% MMP customers may not have undertaken changes without MMP assistance. 71% of MMP customers reported some improvement in competitiveness.	
Jarmin (1998)	Panel, longitudinal study	Longitudinal Research Database, Annual Survey of Manufacturers 1987-1993, MEP customer data from 9 centers	The timing of observed productivity improvements at client plants is consistent with a positive impact of manufacturing extension.	
Kingsley and Klein (1998)	Meta-analysis of 123 case studies	Cases of industrial networks in Europe, North America, and Asia	Network membership can be built with the sponsorship of parent organizations and with public funding, but the networks that generate new business are associated with private sector leadership and at least some private sector funding.	
MEP (1998)	Telephone survey of MEP customers by U.S. Census Bureau	Nationwide, MEP customers	MEP customers report increased sales of nearly $214 million, $31 million in inventory savings, $27 million in labor and material savings, and a $156 million increase in capital investment as a direct result of MEP services.	Information provided 9-10 months after project close
MEP (1998) (with Nexus Associates)	Simulation model	MEP centers nationally	2/3 of states would end state funding if federal funding were ended; 60-70% of centers would not be able to maintain a focus on affordable, balanced service.	
Oldsman and Heye (1998)	Simulation	Hypothetical metal fabrication firm	Reducing scrap by 2% raises profit margins by 1.2%, but increasing piece price by 2% adds $200,000 a year.	Authors conclude that manufacturing extension centers should help companies become more distinctive as well as more efficient.
Shapira and Youtie (1998)	Customer survey; project-impact analysis	Georgia, MEP customers	Product development, marketing projects are 60% more likely to lead to sales increases; energy projects are most likely to lead to cost savings; plant layout, environmental projects help companies avoid capital spending. Quality projects do not rate highly anywhere, although they require the largest MEP customer time commitment.	

Shapira and Youtie (1998)	Survey of manufacturers, comparison group	Georgia manufacturers with 10+ employees	The average client plant had a value-added increase of $366k-$440k over non-clients	Cobb-Douglas Production function; Controls include use of other public and private sector service providers
Thompson (1998)	Benefit-cost study, simulation	Wisconsin taxpayers	Taxpayer payback ratios of 0.9:1.0 to 3.5:1 from the point of view of the state taxpayer who receives a federal subsidy. However, there is considerable variation in payback ratios by industry and by service type. Increasing *sales* shows the greatest taxpayer-payback.	
Wilkins (1998)	Center management benchmarking	14 MEP centers	No single measure designates a high or low performing center. Costing rate of $200-$400 per hour resulted. Field staff tends to develop more projects than they close. 75% of centers have moved from subsidizing services to generating positive cash flow	
Yin, Merchlinsky, Adams-Kennedy (1998)	Survey and case studies, comparison group	7 pilot centers (receiving $750,000 over 3 years to establish a manufacturing SBDC) and 7 comparison centers with SBDC relationships but no special funding	Pilot and comparison centers did not differ markedly either in the nature of their partner relationships with SBDC or in the seamlessness of their service delivery.	

REFERENCES

Ehlen, M. and Weber, S.F. (1998), Estimating Economic Impacts of Government Technology Programs: Manufacturing Studies Using the REMI Model, National Institute of Standards and Technology, Gaithersburg, MD, Report No. NISTIR 6107.

Ellis, S. (1998) "Evaluation of Massachusetts Manufacturing Partnership: Selected Findings" in Philip Shapira and Jan Youtie, editors. Manufacturing Modernization: Implications of Evaluation Results for Program Improvement and Policy Development: Proceedings of Fourth Workshop on the Evaluation of Industrial Modernization Programs, Atlanta, Georgia: Georgia Institute of Technology.

General Accounting Office (1991) Technology Transfer: Federal Efforts to Enhance the Competitiveness of Small Manufacturers, GAO/RCED-92039. Washington, D.C.

General Accounting Office (1995) Manufacturing Extension Programs: Manufacturers' Views of Services, GAO/GGD-950210216BR. Washington, D.C.

Jarmin, R. (1997) "Measuring the Impact of Manufacturing Extension" in Philip Shapira and Jan Youtie, editors. Manufacturing Modernization: Learning from Evaluation Practices and Results: Proceedings of Third Workshop on the Evaluation of Industrial Modernization Programs, Atlanta, Georgia: Georgia Institute of Technology.

Jarmin, R. (1998) "Manufacturing Extension and Productivity Dynamics: Preliminary Evidence" in Philip Shapira and Jan Youtie, editors. Manufacturing Modernization: Implications of Evaluation Results for Program Improvement and Policy Development: Proceedings of Fourth Workshop on the Evaluation of Industrial Modernization Programs, Atlanta, Georgia: Georgia Institute of Technology.

Kelly, M. (1997) "From Mission to Commercial Orientation: Perils and Possibilities for Federal Industrial Technology Policy," Economic Development Quarterly, November, Vol. 11, No. 4, pp. 313-328.

Kingsley, G. and H. Klein (1998) Interfirm Collaboration as a Modernization Strategy: A Survey of Case Studies, The Journal of Technology Transfer, Vol. 23, No. 1, Spring, pp.65-74.

Luria, D. (1997) Toward Lean or Rich? What Performance Benchmarking Tells Us About SME Performance, and Some Implications for Extension Center Services and Mission? in Philip Shapira and Jan Youtie, editors. Manufacturing Modernization: Learning from Evaluation Practices and Results: Proceedings of Third Workshop

on the Evaluation of Industrial Modernization Programs, Atlanta, Georgia: Georgia Institute of Technology.

Luria, D. and E. Wiarda (1996) Performance benchmarking and measuring program impacts on customers: lessons from the Midwest Manufacturing Technology Center, Research Policy, Vol. 25, No. 2, pp. 233-246.

Manufacturing Extension Partnership (1994). Making a Difference for America's Manufacturers. Gaithersburg, MD: National Institute of Standards and Technology.

Manufacturing Extension Partnership (1997) MEP National Data Highlights. Gaithersburg, MD: National Institute of Standards and Technology, December.

Manufacturing Extension Partnership (1998). Review of Mission and Operations of Regional Centers of the Manufacturing Extension Partnership, Gaithersburg, MD: National Institute of Standards and Technology, February.

Michigan Manufacturing Technology Center (1996) Fifth Year Review. Ann Arbor, MI: Michigan Manufacturing Technology Center.

Modernization Forum and Nexus Associates (1997) Competition or Collaboration: The Role of Manufacturing Extension Centers in the Private Consulting Market. Working with Consultants: A Tool Kit for Manufacturing Extension Centers, Volume 3. Washington, D.C.: NIST MEP.

Nexus Associates, Inc. (1996), *Evaluation of the New York Manufacturing Extension Program: Final Report*, prepared for the New York Science and Technology Foundation/ Empire State Development. Belmont, MA, March 18.

Oldsman, Eric (1996) Does manufacturing extension matter? An evaluation of the Industrial Technology Extension Service in New York. Research Policy, Vol. 25, No. 2, pp. 215-232.

Shapira, P. and J. Youtie (1995) Assessing GMEA's Economic Impacts: Towards a Benefit-Cost Methodology. Atlanta, Georgia: Georgia Institute of Technology, March (Revised October, 1996).

Shapira, P. and J. Youtie (1997) Coordinating Manufacturing Extension Services, The Journal of Technology Transfer, Vol. 22, No. 1, Spring, pp. 5-10.

Shapira, P. and J. Youtie (1998) Evaluation Industrial Modernization: Methods, Results, and Insights from the Georgia Manufacturing Extension Alliance" The Journal of Technology Transfer, Vol. 23, No. 1, Spring, pp. 17-28.

Shapira, P. and T. Rephann (1996) "The adoption of new technology in West Virginia: Implications for manufacturing modernization policies," *Environment and Planning C: Government and Policy*, 1996, 14, pp. 431-450.

Swamidass, P. (1994) Technology on the Factory Floor II: Benchmarking Manufacturing Technology Use in the United States, Washington D.C.: The Manufacturing Institute.

Thompson, C. (1998) Local Politics, National Policy, and the Taxpayer-Payback of Manufacturing Extension, The Journal of Technology Transfer, Vol. 23, No. 1, Spring, pp.37-42.

Welch, D., E. Oldsman, P. Shapira, J. Youtie, J. Lee (1997) Net benefits: An assessment of manufacturing business networks and their impacts on member companies. Chapel Hill, NC: USNet and Regional Technology Strategies.

Wilkins, T. (1998) "Benchmarking Manufacturing Extension Centers" in Philip Shapira and Jan Youtie, editors. Manufacturing Modernization: Implications of Evaluation Results for Program Improvement and Policy Development: Proceedings of Fourth Workshop on the Evaluation of Industrial Modernization Programs, Atlanta, Georgia: Georgia Institute of Technology.

Yin, R., S. Merchlinsky, and K. Adams-Kennedy (1998) Evaluation of MEP-SBDC Partnerships. Bethesda, MD: COSMOS Corporation.

Youtie J. and P. Shapira (1997) Tracking Customer Progress: A Follow-up Study of Customers of the Georgia Manufacturing Extension Alliance, Journal of Technology Transfer, Vol. 22, No. 2, Summer, pp. 43-52.

GLOSSARY

Academy: National Academy of Public Administration – an independent, nonpartisan organization chartered by Congress to assist federal, state, and local governments in improving their effectiveness, efficiency, and accountability.

Agricultural Extension Services: The Cooperative State Research, Education, and Extension Service is part of the United States Department of Agriculture. Its Cooperative Extension System (CES) is an educational network centered in the nation's land-grant universities that applies research-based practical education to the complex problems of America's rural and urban families, communities, agriculture, natural resources, and business and industry. Established by Congress in 1914, the nationwide system operates as a unique partnership of the federal government and 74 land-grant colleges and universities. Working in more than 3,000 counties, the system receives funding from federal, state, and local governments.

Annual Review: If a MEP Center is not scheduled for an External Panel Review, they are subject to an annual review by the NIST-MEP staff prior to approval for continued funding.

APICS, Educational Society for Resource Management: Formerly, the American Production and Inventory Control Society is a not-for-profit international organization with educational professional certification programs. They have 60,000 individual and corporate members in 20,000 companies worldwide, their objective is to use education to improve the business bottom line.

Association of Manufacturing Technology: Represents and promotes the interests of American providers of manufacturing machinery and equipment, with the goal to promote technological advancements and improvements in the design, manufacture and sale of members' products in those markets and act as an industry advocate on trade matters to governments and trade organizations throughout the world.

ATP: Advanced Technology Program. This is another program that is part of the National Institute of Technology. The goal of the ATP is to benefit the U.S. economy by cost-sharing research with industry to foster new, innovative technologies.

Center Advisory Boards: These are less formal bodies that can be affiliated with any type of organization. The roles and responsibilities of advisory boards may be similar to fiduciary boards (see below) or may be more focused on areas such as client needs.

Clusters: A geographically limited critical mass (i.e. sufficient to attract specialized services, resources, and suppliers of companies that have some type of relationship to one another –generally complementariness or similarity in product, process, or resource (excerpt taken from the glossary of terms in "A Governor's Guide to Cluster-Based Economic Development")

External Panel Review: By law (15 USCS) 278k) every Manufacturing Extension Partnership Center is subject to an external panel review at the end of year three and year six and every two years after they begin operations. The review is managed and chaired by the

NIST–MEP Staff in Gaithersburg, MD. The panel typically consists of 3-5 members chosen from center directors, small manufacturers from another center's board of directors, a state or other key stakeholder from the center's state or an outside economic development expert.

Fabricators & Manufacturers Association: Provides members, their companies, and industry with current and evolving metal forming and fabricating technology. The association delivers this information through education programs, expositions, publications, and related communication. The goal of this association is to improve quality and productivity through the optimization of employee and management performance in manufacturing.

Center Fiduciary Board: A fiduciary board exists for all freestanding non-profit organizations, and is typically involved in making policy decisions, hiring and firing the Director/President/CEO, and in the center's planning and operations.

GDP: Gross Domestic Product **-** Gross Domestic Product (GDP), the total value of goods and services produced in a country over a period of time. GDP may be calculated in three ways: (1) by adding up the value of all goods and services produced, (2) by adding up the expenditure on goods and services at the time of sale, or (3) by adding up producers' incomes from the sale of goods or services.

House Science Committee: The Committee in the United States House of Representatives that has jurisdiction over the National Institute of Standards and Technology.

Institute of Management Consultants USA: A national professional association representing management consultants and awarding the CMC (Certified Management Consultant) certification mark.

ISO 9001/ 2000: Management system to insure continuous quality improvement.

LCC: Low Cost Countries - Countries whose labor and other operational costs are significantly lower than similar costs in the United States. The competitive position of many of the LCCs have been enhanced by monetary policies that do not index their currencies to world currencies. Their currencies are kept artificially low to encourage exports and maintain a favorable balance of trade.

Lean Manufacturing: Producing more with existing resources by eliminating non-value added activities. A systematic approach to eliminating waste and creating flow throughout the whole company.

MEP: Manufacturing Extension Partnership Program – a Department of Commerce program that is part of the National Institute of Technology. The program involves a partnership between federal, state and local organizations and institutions, including the private sector that works together to improve the performance of small manufacturers.

MEP Centers: The Manufacturing Extension Partnership Program consists of 60 manufacturing extension centers and 400 satellite facilities, which are located in every state and Puerto

Rico. Each Center works directly with local firms to provide expertise and services tailored to their most critical needs, ranging from process improvements and employee training to new business practices and the application of information technology. Services are delivered through direct assistance from Center staff, outside consultants, or a combination of both.

MTC: Manufacturing Technology Centers – the orginal name of the Centers that were established by Public Law 100-418 to make advanced technology developed in the National Institute of Technology labs available to small manufactuers as a way to improve productivity.

NAM: The National Association of Manufactuers' stated mission is to enhance the competitiveness of manufacturers and to improve American living standards by shaping a legislative and regulatory environment conducive to U.S. economic growth, and to increase understanding among policymakers, the media and the general public about the importance of manufacturing to America's economic strength. The NAM represents 14,000 members (including 10,000 small and mid-sized companies) and 350 member associations serving manufacturers and employees in every industrial sector and all 50 states.

MEPNAP: Manufacturing Extension Partnership National Advisory Board - A nine member board, established by the Secretary of Commerce to provide guidance and advice on the MEP program from the perspective of industrial extension customers, and providers who have a vision of industrial extension with a national scope.

NTMA: National Tooling and Machining Association is the national representative of the custom precision manufacturing industry in the United States. Many NTMA members are small businesses, privately owned and operated. It has over 2500 members who design and manufacture special tools, dies, jigs, fixtures, gages, special machines, and precision machined parts..

NRC: National Research Council – organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purpose of furthering knowledge and advising the federal government.

OEM: Original Equipment Manufacturer

PART: Program Assessment Rating Tool. A process used by the Office of Management and Budget (OMB) to evaluate the effectiveness of government programs.

Public Law 100-418: The Omnibus Trade and Competitiveness Act of 1988, which directed the Secretary of Commerce to establish the manufacturing Technology Centers program whose name was later changed to the Manufacturing Extension Partnership

SBDC: Small Business Development Center Program is administered by the Small Business Administration. The program provides counseling, training and technical assistance in all aspects of small business management. SBA provides 50% of the SBDC's funding. Matching funds are provided by the states, private sector foundations and grants, state and local chambers of commerce, state-chartered economic development corporations,

public and private universities, vocational and technical schools and community colleges.

SME: Small Manufacturing Enterprise – Small manufacturers employ less than 500 people. They are defined as establishments engaged in mechanical or chemical transportation of materials or substances into new products and are often described as plants, factories or mills. Small manufacturers assemble component parts of manufactured products, blend materials, such as lubricating oils, plastics, resins, or liquids into new products, and make products of agriculture, forestry, fishing, mining and quarrying.

Technology Transfer: As used in this report, it refers to the process of federal labs sharing the benefits of the national investment in scientific progress, spinning off and commercializing this technology to enhance nation's ability to compete in the global market.

Third Party Client Survey: A nationwide survey of clients of the manufacturing centers conducted by a survey research firm under a contract with NIST-MEP. The survey asks clients to comment on the impact that engagements with an MEP Center had on their business results.