Renewing the U.S. Commitment to a Strong Manufacturing Base

Expanding the Reach of the Manufacturing Extension Partnership

July 2010

STONE & ASSOCIATES

CREC CENTER FOR REGIONAL ECONOMIC COMPETITIVENESS

National Institute of Standards and Technology Manufacturing Extension Partnership

The National Institute of Standards and Technology's Manufacturing Extension Partnership (MEP) is America's #1 resource for helping U.S. manufacturers use innovation to grow their profitability as they compete for customers in the global marketplace. MEP's nationwide network of field staff serve as trusted business advisors focused on solving manufacturers' challenges and identifying opportunities for growth. As a program of the U.S. Department of Commerce's National Institute of Standards and Technology, MEP offers manufacturers a wealth of unique and effective resources. As a result, MEP clients achieve higher profits, save time and money, invest in physical and human capital, and create and retain thousands of jobs.

As the catalyst for strengthening American manufacturing, MEP recognizes that innovation driven economic development requires a multi-faceted approach. In addition to providing services to manufacturers focused on everything from process improvements to strategies for growth to green manufacturing, MEP works with state and federal partners to accelerate manufacturing's ongoing transformation into a more efficient and powerful engine of innovation that drives economic growth and job creation. Through a framework focused on five critical areas – technology acceleration, supplier development, sustainability, workforce as well as continuous improvement – MEP is positioning manufacturers to develop new customers, expand into new markets and create new products with the end goal of increasing profitability and competitiveness.

Renewing the U.S. Commitment to a Strong Manufacturing Base

Expanding the Reach of the Manufacturing Extension Partnership

Table of Contents

Prepared for the NIST Manufacturing Extension Partnership by Stone & Associates and the Center for Regional Economic Competitiveness (CREC)

July 2010

The views expressed in the paper are those of the authors and do not necessarily represent the views or recommendations of the National Institute of Standards and Technology.

Letter from the NIST MEP Director

Since 1989, the Hollings Manufacturing Extension Partnership (MEP) program has been working to improve the competitiveness of U.S. manufacturers. The MEP centers serve as trusted advisors to their small and medium sized manufacturing clients, helping them to strategically implement business growth opportunities and to improve their competitive position in the market. Our program has helped clients obtain significant and measurable economic impacts, and these results have been recognized at all levels of government. Recent legislation proposing MEP support for issues facing many industries ranging from the nuclear industry to construction suggests that the MEP system is highly regarded and valued.

However, today with manufacturing industry markets both contracting and expanding and business success factors changing, manufacturers must establish competitive niches to capture new business opportunities. MEP must refocus on addressing these new challenges and opportunities facing U.S. manufacturers. Through the MEP next generation strategy, we are working with manufacturers to harness technology and innovation that results in new business opportunities. We have outlined a framework of five critical areas – supplier development, technology acceleration, sustainability, workforce and continuous improvement – in which MEP is working not only to help manufacturers' problem-solve to survive, but also to grow by developing new sales, new markets and new products.

In order for MEP to remain on our own continuous improvement path and continue facilitating the long-term economic prosperity of the U.S. manufacturing industry, we must consider changes to the way we operate in order to reach more firms, quickly respond to the changing needs of manufacturers and foster the partnerships that allow us to provide the tools and services needed by our clients. Now more than ever, we need to assess our current operating model and consider changes to ensure that the MEP system remains flexible to not only address today's challenges but also ensure that the MEP program is positioned to address emerging opportunities which support manufacturers' continuous growth and competitive position.

Sincerely,

Roger D. Kilmer
Director
Hollings Manufacturing Extension Partnership (MEP)
National Institute of Standards and Technology

Executive Summary

Introduction

Over the last two decades, the economic landscape has changed dramatically, featuring the most significant downturn since the Great Depression, the rapid decline of manufacturing employment, the emergence of the internet and advanced information technology and the beginning of the sustainability revolution. As a result of these trends, the challenges faced by manufacturers have also changed. Innovation has become an imperative for survival and growth. The demand for environmental stewardship and energy efficiency has dramatically increased, and even the smallest firms must navigate global markets and supply chains.

At the same time, the Manufacturing Extension Partnership (MEP) has now been in existence for over 20 years, and has accumulated a solid base of experience with thousands of manufacturing clients. During this time, MEP has established 60 regional centers throughout the country, employing over 1,500 nonfederal staff in 370 locations. In FY 2009, these centers and their 2,300 third party service partners provided in-depth assistance to over 7,100 manufacturers and served 33,000 when all training, workshops and other less intensive interactions are included.[1]

The system that has emerged is highly effective in generating significant and measurable impact for clients. In the most recent published client survey data, 7,648 companies that received in-depth assistance – mainly during FY 2008 – reported the following results from MEP center services: $3.6 billion in new sales (despite the recession), $5.5 billion in retained sales, and $1.4 billion in cost and investment savings.[2] Those clients also reported that they made $1.7 billion in new investments in their companies, and created or retained 53,000 jobs. Most of these results were generated by assisting companies with manufacturing process and quality improvements.

MEP Next Generation Strategy

While this model has generated significant impact, NIST MEP leadership perceived that the scope and scale of today's challenges faced by the manufacturing sector demanded a change in approach. Several issues in particular sparked a change in program strategy to have a more dramatic impact on the manufacturing sector's performance and its contribution to economic prosperity:

1. **The Innovation Imperative** – Innovation has become critical to the long-term success and growth of manufacturing companies. U.S. firms cannot survive against intensified global competition without continually developing new products, processes and technologies, entering new markets, and adopting new strategies and practices. The MEP network's traditional focus had been on assisting firms to adopt improvements in manufacturing processes, but the system has placed less emphasis on other forms of innovation related to new products, markets and technologies.

2. **Companies Need to Utilize Capacity that Becomes Available from Process Improvements** – MEP's current process improvement services, particularly assistance with lean manufacturing, often free up production capacity. However without new product and market opportunities, firms cannot leverage this capacity to generate sales and income for owners, employees and the broader economy. A wider range of services are required to assist firms to sell and utilize the capacity generated from process improvements.

3. **Many Manufacturing Firms Remain Un-served** – Currently MEP serves 10% of U.S. manufacturers, and provides only 2% with in-depth assistance. For

many small firms, MEP is the best or only option for substantive outside assistance. Without an expanded reach, MEP cannot have a significant impact on overall manufacturing performance.

In response to these challenges, NIST MEP released a new strategy (in December 2008) that re-defined its vision for the program.[3] The vision positions MEP as a catalyst for accelerating manufacturing's transformation into a "more efficient and powerful engine of innovation driving economic growth and job creation." MEP's mission is defined as "to act as a strategic advisor to promote business growth and connect manufacturers to public and private resources essential for increased competitiveness and profitability."

This new vision and mission shifts the program from focusing only on efforts to enhance productivity through process improvement, to include those that generate growth and innovation. This new vision also shifts the focus of MEP to being a strategic advisor and connector to resources and skills, as well as a deliverer of technical assistance. This shift attempts to engage clients at a more strategic level to understand their critical needs and provide assistance in those areas, rather than delivering services in which MEP has capabilities, but which may not match the future direction and strategic priorities of the companies. It also recognizes the importance of more actively engaging in partnerships with other organizations that can provide additional capabilities needed by manufacturers.

The plan expands MEP's scope to cover a broader range of services, focused around five service categories, all under the overarching objective of helping companies achieve profitable growth (see Figure 1). The five service categories include Continuous Improvement, Technology Acceleration, Supplier Development, Sustainability, and Workforce.

Figure 1: MEP Next Generation Strategy Framework

Re-Examining the Business and Service Model

This report is the next step in defining MEP's Next Generation strategy. The objective of this effort is to make recommendations about how the MEP program business and service model should change to reach more firms, offer the wider range of services required, and have a more significant impact on manufacturing sector performance – particularly smaller firms.

Manufacturing Performance

The first step in re-examining MEP's model is to recognize the special role that manufacturing plays in the economy, and identify how MEP can favorably impact its performance.

Manufacturing is Critical to U.S. Productivity and Innovation – The manufacturing sector plays a special role in the economy because it is critical to U.S. productivity and innovation. Manufacturing sector productivity has grown nearly twice as fast as the rest of the economy[4] – raising the overall average – and is responsible for 70% of U.S. business research and development.[5] Further, manufacturing generates innovations, such as machinery and equipment, which drive productivity growth in many other sectors.

Growing Sectors are Losing Ground – While manufacturing employment has declined over the last decade, underneath the aggregate data is a more dynamic sector. Over the past decade, real manufacturing value added grew by 18%,[6] and some companies and segments are growing and adding employment. The growing component of manufacturing created 300-900 K jobs per quarter over the last decade.[7] But since 2000, the *growing segment is losing its ability to keep up with job losses* in the declining segment. Since 2000 job losses have intensified, due to the recessions, the heightened intensity of competition from China and low cost countries, and the migration of manufacturing overseas.[8]

MEP's Objective Should be Growth as well as Productivity Improvement in Manufacturing – The need to nurture the growing sector of manufacturing reinforces the idea that MEP's goal should be growth in manufacturing value added and output, as well as productivity improvement. This two-pronged objective will ensure that MEP is contributing to a manufacturing sector that produces the greatest income per person, and expands the growing portion so that it *exceeds the pace of declining sectors*. This must be the "yardstick" by which MEP measures its success.

Challenges for Small and Mid-Size Manufacturers

Given that MEP's primary focus is small and mid-size manufacturers, an understanding of the key challenges they need to overcome is critical for re-examining the MEP system. At a high level, this project identified three broad challenges faced by SMEs:

1. **Lagging Productivity and Business Practices** – Small and mid-size manufacturers (SMEs) are lagging behind large firms in terms of productivity and adopting best practices.[9] For example labor productivity for large establishments (with over 500 employees) is nearly double that of establishments with less than 100 employees.

2. **Unrealized Growth Potential and Missed Opportunities in Emerging Technologies** – Many small firms are missing opportunities for growth – which creates U.S. value added and jobs – partly due to a lack of innovation, i.e., an inability or unwillingness to exploit new product and market opportunities.[10] As an example, a number of observers are concerned that U.S. firms have not been able to seize emerging opportunities in the production of clean/renewable energy products.[11]

3. **Leadership Challenges** – The leaders of small and mid-size manufacturing firms face extraordinary competitive and management challenges. Unlike large companies which can afford larger teams of managers, leadership in small firms "wears many hats" and is often challenged to extract itself from day-to-day operations and "fire-fighting." This results in insufficient time spent planning for and investing in the future. Most small manufacturing companies are family businesses,[12] and succession from one family generation to the next, or one leadership team to the next, can put the company's existence at risk. Intense global competition, particularly from low cost countries, magnifies the importance of leadership being innovative and adaptive to market changes. Finally, firm leadership has limited access to outside expertise, as it is generally not economic for private consultants to serve small manufacturers at reasonable rates.[13]

Section 5 identifies the specific services required by small and mid-sized manufacturers as they work to improve productivity and grow their businesses. However at a high level, a revised MEP model must overcome these three sets of challenges.

The challenges discussed above represent a market failure since the extraordinary capabilities and potential of small U.S. firms, that have been able to survive intense global competition in recent years, are not fully realized. These challenges also represent an opportunity for government to invest in existing manufacturing companies to maximize their potential for growth and productivity improvement.

MEP Uniquely Positioned to Respond

MEP is uniquely positioned to respond to the gaps (and market failures) identified above. **First, MEP's focus on established manufacturing firms is critical, as they are an under-valued source of innovation.** There are thousands of established manufacturing firms that represent opportunities for growth, with much less risk than start-ups.[14] The leadership of these firms, often in mature industries, needs help to transform their companies, re-ignite innovation, enter new markets, and accelerate growth. The market by itself is unable to fully exploit the growth potential of these small and mid-size manufacturers. Yet, limited public investment has been made to foster innovation for these established manufacturing companies. Federal and state government efforts to assist companies with technology commercialization and innovation often focus on start-up and early stage companies.[15]

Second, MEP is positioning itself to assist manufacturing companies holistically, i.e., help them to grow, change and transform themselves. Other organizations either offer more narrowly focused assistance in specific areas, such as export (U.S. Foreign & Commercial Service) or energy efficiency (the Department of Energy's Industrial Assessment Centers), or tend to focus on start-ups, early stage or very small companies (e.g., SBDCs/SBTDCs and technology commercialization programs). MEP is the only organization offering to assist established manufacturing firms with overall improvement and growth.

Third, MEP is the only organization with a focus on manufacturing businesses, combined with the technical and executive experience that can build credibility with manufacturers.[16] Manufacturers deal with a complex set of management issues that are much different than other types of companies. Other organizations generally do not have the technical skills or manufacturing background that is required to assist established manufacturers – particularly those over 20 employees.

Fourth, MEP and its partners provide in-depth, intensive implementation assistance. This "hands on" assistance is critical for MEP to be an effective catalyst of change for companies and their leadership. The government's investment in MEP reduces the cost of sales (reaching smaller manufacturers) and reduces the cost of change for these manufacturers.

Fifth, MEP's field network is well positioned to be a connection point between manufacturing firm *demand* for technologies that can differentiate their products and improve manufacturing processes, and sources of *supply* of those technologies.

Assessment of the Current Model

MEP's current model has been highly effective in generating results for clients, but the model also has disadvantages that constrain the program's ability to have greater impact on the manufacturing sector. The two most important issues related to the current model are:

1. **MEP Must Reach Additional Clients** – As indicated above, it was already recognized that MEP can only reach a limited percentage of the manufacturing base. However realistically, only a portion of the manufacturing base is willing and able to invest in improvement and growth, and to seek outside assistance. This project explored the definition of the available market in more depth, and estimates that currently the MEP national network only provides in-depth assistance to 9% of the available market of companies with 20-499 employees that are willing to seek out and invest in outside support. Thus, much of the relevant market remains un-served.

2. **Manufacturers Require a Broader Range of Services** – Manufacturers require assistance beyond MEP's core services in process improvement, quality, and cost reduction. Firms also need services that foster growth, innovation and sustainability. Without assistance in these areas, the U.S. economy will miss opportunities for growth in manufacturing value added and jobs.

In addition, other constraints have emerged which further limit reach and performance:

>> The current cost-share requirement for MEP centers is positive in that it produces market-driven services and generates additional resources for centers, however the resulting emphasis on client fee revenue has also produced counterproductive behavior that constrains the centers ability to reach more clients and expand their service offerings.

>> Centers have a unique business model relative to other economic development organizations, and as a result have had difficulty building or sustaining partnerships; these partnerships would allow centers to provide additional capabilities and resources to clients, and to be more efficient in outreach.

>> The measurement and evaluation system for the MEP program does not measure or provide incentives for strong center performance, but focuses on whether centers meet minimum performance thresholds. Combined with cost-share and revenue requirements, the evaluation system also contributes to centers' reluctance to invest in new service offerings. Finally, the system also fails to capture important measures – such as those related to productivity and innovation – that are required to evaluate the success of the program.

>> The system's structure of 60 autonomous centers does not fully realize national economies of scale and results in some duplication of effort.

Changing the MEP Model

To significantly impact manufacturing performance, and respond to the issues described above, the MEP program must change in four ways, as summarized in Figure 2. These changes taken as a whole define a future state model for MEP in 3-5 years.

1. **Expand the scale of the program, in order to reach a much larger percentage of the available market** – If MEP could expand its reach, from its current level of providing in-depth assistance to 7,000-8,500 firms annually, to about 30,000, it could increase its impact on total SME manufacturing sales/output from 0.3% to as much as 2.0% annually. Based on our "future state" model this would require a federal investment of $406M, leveraging state and private funds to build a national system of $875M. MEP could then have a meaningful and measurable impact – i.e. cause the "needle to move" – on the manufacturing sector and the broader national economy.

2. **Leverage and maximize the federal investment** – Several measures are required to better leverage the federal investment:

   >> Reduce the cost-share requirement: to retain market focus, but discourage counterproductive behaviors that result from the emphasis on fee revenue; to encourage investment in new services; and to allow for expansion of the program;

   >> Measure and provide rewards for high performing centers;

   >> Require an in-depth *strategic review* of each center cooperative agreement every five years (so that 20% of centers would be reviewed each year), while at the same time simplifying interim review processes;

   >> In the context of strategic review, MEP should *target*[17] a state cash cost-share of at least 1/2 of the federal contribution, implemented once state budgetary situations improve; this target could be achieved through state funds that support training or offset the costs of assistance projects, as well as a direct contribution to a center's operating budget;

   >> Create an "SME Fund" to make services more affordable to smaller firms with less than 20 employees;

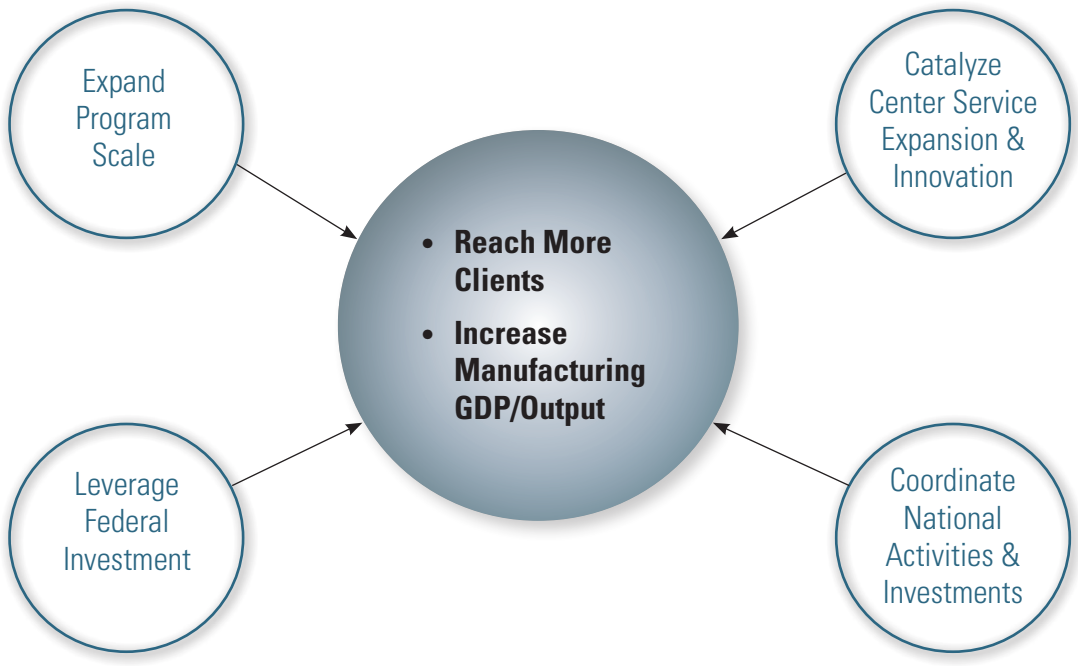
   >> Re-examine and revise the measurement system to gauge center performance beyond minimum thresholds, and capture client impacts related to growth in value added, productivity, and innovation.

3. **Catalyze service expansion and innovation at centers** – NIST MEP must work in several areas to drive innovation at centers:

   >> Encourage centers to expand the range of services to include new offerings in growth, innovation and green/sustainability:

   - A significant percentage of new funding increments should be specifically designated for investment in new growth, innovation and

Figure 2: Changes to the MEP Model



sustainability service offerings; the goal over the long-term is to have these offerings become a significant portion of MEP network activity.

>> Systematically employ all the resources and incentives at its disposal to catalyze change and innovation in center service and business models:

- Encourage innovation in service models that generate impact in an efficient manner, such as hybrid models that combine group education and one-on-one implementation/coaching, peer-to-peer learning models that assist SME management to improve their leadership skills, and investment in web-based tools to supplement hands on in-person assistance services;
- Offer a series of incentives to enhance center collaborations and partnerships with other public sector and non-profit entities;
- Create national service delivery and rapid response teams to assist centers with start-up of new services or respond quickly to immediate opportunities;
- Organize national teams to coordinate product development and deployment, composed of representatives from centers, NIST MEP, and outside experts.
- Encourage centers to consider expanded use of outside service delivery partners, to gain flexibility in service capabilities and capacity, and to reach more companies.

4. **Coordinate specific national activities and investments to achieve economies of scale and reduce duplication of effort at centers** – The specific functions or activities that should be led, and in some cases expanded, at the national level include the following:

>> Expand national level coordination and investment in product development, market research, program impact analysis, and identification of best practices;

>> Increase national investment in skills training and development for center and partner staff, eventually leading to certification efforts in key areas;

- Training related to outreach and client relationship development is of particular importance, as improvement in these areas leads directly to better utilized and thus more efficient centers.

>> Spearhead the development of national partnerships that benefit the entire network. National partnership development should include efforts to position the MEP national network as the field implementation force that helps other programs achieve their objectives in manufacturing[18] (e.g., energy efficiency for DOE, hazardous waste reduction for EPA); NIST MEP should also expand its regional presence to facilitate state and regional level partnerships.

These recommendations taken together define a future state model for MEP in 3-5 years. **The recommendations are integrated and reinforce each other, and should not be taken individually**. The impact of each recommendation is either magnified, or made more efficient, by the others. The result will be an MEP network that assists more than 4 times as many firms as it does today, and delivers services in a highly efficient manner that provides a high return to the federal investment.

Nothing short of the future of manufacturing is at stake. With a modest federal investment that leverages state and private sector funds, we can renew our commitment to a strong manufacturing base – where growing sectors are outpacing declining ones, where thousands of firms are not only improving their manufacturing processes, but are developing innovative new products, entering global markets and capturing a greater share of green market opportunities, and where MEP is providing indispensable assistance to the thousands of small and mid-size manufacturing firms that make a major contribution to U.S. economic prosperity.

Introduction: Report Background and Objectives

Over the last two decades the economic landscape has changed dramatically, featuring the most significant downturn since the Great Depression, the rapid decline of manufacturing employment, the emergence of the internet and advanced information technology and the beginning of the sustainability revolution. As a result of these trends, the challenges faced by manufacturers have also changed. Innovation has become an imperative for survival and growth. The demand for environmental stewardship and energy efficiency has dramatically increased, and even the smallest firms must navigate global markets and supply chains.

At the same time, the Manufacturing Extension Partnership (MEP) has now been in existence for over 20 years, and has accumulated a solid base of experience with thousands of manufacturing clients. During this time, MEP has established 60 regional centers throughout the country, employing over 1,500 nonfederal staff in 370 locations. In FY 2009, these centers and their 2,300 third party service partners provided substantive assistance to over 7,100 manufacturers and served 33,000 when all training, workshops and other less intensive interactions are included.[19]

While this model has generated significant and measurable economic impact, NIST MEP leadership perceived that the scope and scale of today's challenges faced by the manufacturing sector demanded a change in approach. Several issues in particular sparked a change in program strategy to have a more dramatic impact on the manufacturing sector's performance and its contribution to economic prosperity:

1. **The Innovation Imperative** – Innovation has become critical to the long-term success and growth of manufacturing companies. U.S. firms cannot survive against intensified global competition without continually developing new products, processes and technologies, entering new markets, and adopting new strategies and practices. The MEP network's traditional focus has been on assisting firms to adopt improvements in manufacturing processes, but the system has placed less emphasis on other forms of innovation related to new products, markets and technologies.

2. **Companies Need to Utilize Capacity that Becomes Available from Process Improvements** – MEP's current process improvement services, particularly assistance with lean manufacturing, often free up production capacity. However without new product and market opportunities, firms cannot leverage this capacity to generate sales and income for owners, employees and the broader economy. A wider range of services are required to assist firms to sell and utilize the capacity generated from process improvements.

3. **Many Manufacturing Firms Remain Un-served** – Currently MEP serves 10% of U.S. manufacturers, and provides only 2% with in-depth assistance. For many small firms, MEP is the best or only option for substantive outside assistance. Without an expanded reach, MEP cannot have a significant impact on overall manufacturing performance.

In response to these challenges, NIST MEP released a new strategy (in December 2008) that re-defined its vision for the program.[20] The vision positions MEP as a catalyst for accelerating manufacturing's transformation into a "more efficient and powerful engine of innovation driving economic growth and job creation." MEP's mission is defined as "to act as a strategic advisor to promote business growth and connect manufacturers to public and private resources essential for increased competitiveness and profitability."

>> Innovation has become an imperative for survival and growth.

This new vision and mission shifts the program from focusing only on efforts to enhance productivity through process improvement, to include those that generate growth and innovation. This new vision also shifts the focus of MEP to being a strategic advisor and connector to resources and skills, as well as a deliverer of technical assistance. This shift attempts to engage clients at a more strategic level to understand their critical needs and provide assistance in those areas, rather than delivering services in which MEP has capabilities, but which may not match the future direction and strategic priorities of the companies. It also recognizes the importance of more actively engaging in partnerships with other organizations.

The plan expands MEP's scope to cover a broader range of services, focused around five categories: Continuous Improvement, Technology Acceleration, Supplier Development, Sustainability, and Workforce.

This report is the next step in defining MEP's Next Generation strategy. The objective of this effort is to make recommendations about how the MEP program business and service model should change to reach more firms, offer the wider range of services required, and have a more significant impact on manufacturing sector performance – particularly smaller firms.

To help define this model, NIST MEP asked our team to re-examine the network's approach to meeting the needs of U.S. manufacturers, based on internal and external research, analysis and stakeholder interviews. Key questions include:

>> What is the array of challenges facing U.S. manufacturers?

>> What are the services that MEP should provide – beyond what is offered today – to overcome these challenges?

>> How should MEP change its business, funding and service delivery model to effectively and efficiently expand its reach and impact?

>> How can MEP leverage partnerships – with public, non-profit and private sector organizations – to more effectively achieve its goals?

>> What resource level is required to support this expanded MEP model, and have a meaningful impact on U.S. manufacturing?

As part of the research and analysis effort, the project team:

>> Conducted internal focus groups and one-on-one interviews with directors and managers of MEP centers, as well as NIST MEP managers; (Nearly 50 people were engaged in focus groups or one-on-one interviews.)

>> Conducted over 50 external interviews with partner organizations, including state government, economic development organizations, other federal agencies, industry and professional associations, and other manufacturing and policy experts;

>> Reviewed and summarized recent market data on the needs of manufacturers;

>> Analyzed MEP client impact data;

>> Conducted a scan of literature related to economic development in manufacturing;

>> Collected and analyzed data on the manufacturing sector;

>> Conducted research and analysis on other foreign manufacturing assistance programs.

SECTION 1

The Importance of Manufacturing

Employment and Value Added

U.S. manufacturing is often portrayed as in steady decline. However, while employment has decreased, manufacturing value added and output have grown. Further, manufacturing remains one of the largest sectors in the economy, accounting for 11% of U.S. GDP. Over the last decade, real manufacturing GDP or value added has grown over 18% (Figure 3).[21]

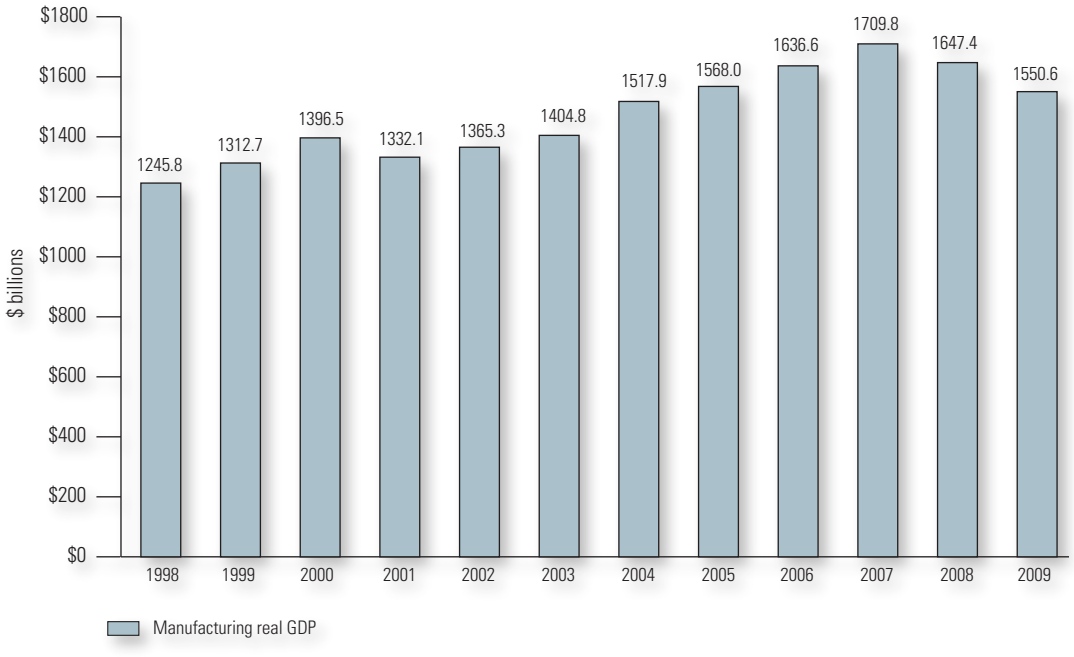
Not only has value added grown overall, but the overall decline in manufacturing employment masks the fact that a significant portion of U.S. manufacturers have grown and added employment (see Figure 4). This growing segment has been able to create 300,000-900,000 jobs per quarter over the last decade.

Productivity and Innovation

More important than simple growth and decline, is the critical importance of the manufacturing sector to U.S. innovation and productivity. Productivity growth in manufacturing has far exceeded the rest of the economy over the past two decades. Manufacturing output per labor hour nearly doubled from 1990 to 2009 (see Figure 5). In contrast, productivity of the overall non-farm economy grew at 56%. In other words, manufacturing's advances in productivity are "bringing up the average" for the whole economy, and thus driving higher living standards.

The National Science Foundation reports that in 2007, manufacturers performed 70% of U.S. business R&D,

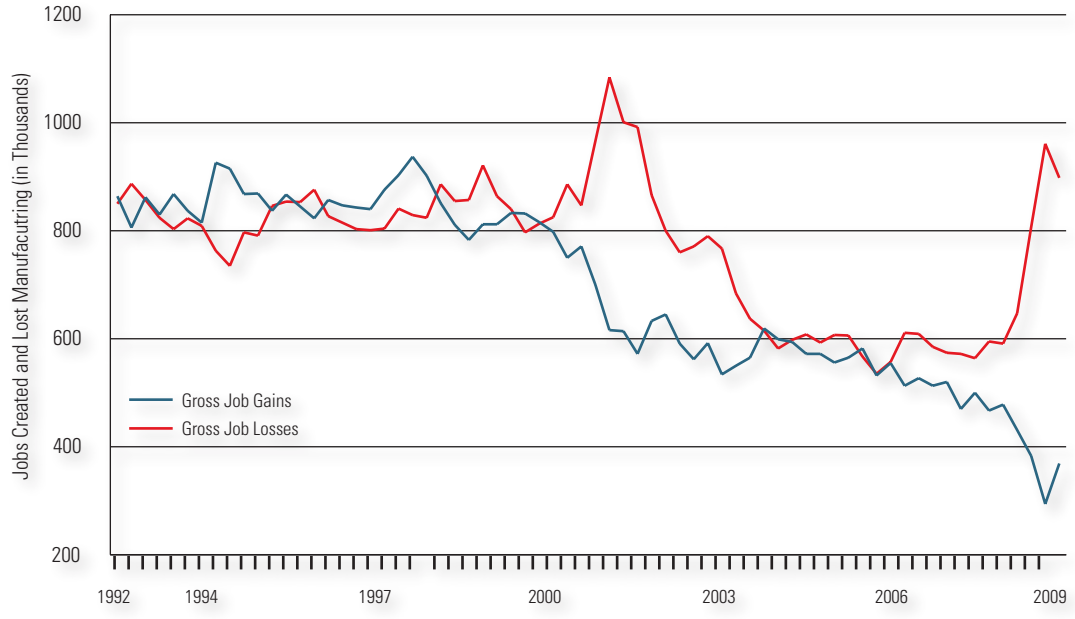
Figure 3: Real Manufacturing GDP (Value Added)



Source: Gross Domestic Product by Industry Accounts, Bureau of Economic Analysis

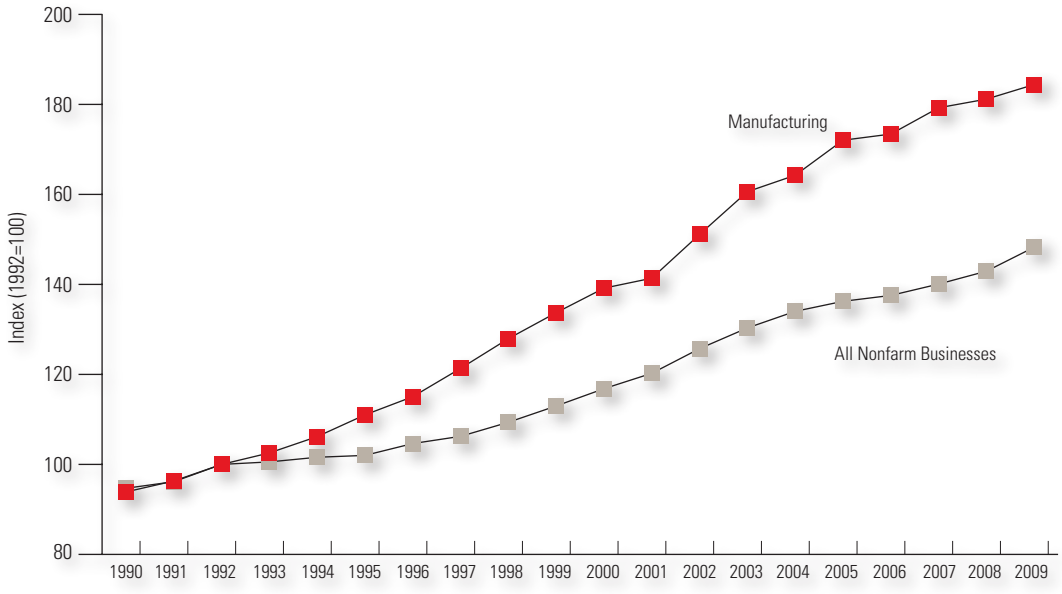
>>Productivity growth in manufacturing has far exceeded the rest of the economy over the past two decades.

Figure 4: Job Gains and Losses in Manufacturing, 1992-2009



Source: US Bureau of Labor Statistics, Business Employment Dynamics

Figure 5: Labor Productivity – Output per Labor Hour (for all employees)



Source: Bureau of Labor Statistics

and over half of total R&D.[22] Three industrial sectors lead the way in private sector R&D investment – chemicals (especially pharmaceuticals), transportation equipment (including automotive and aerospace), and computers and electronics (led by semiconductors, electronic instruments, and communications equipment).These key sectors illustrate how industrial R&D develops innovations that change processes and increase productivity in other sectors well beyond manufacturing. Medical device manufacturers offer innovations that increase productivity in health care. Advances in semiconductors and integrated circuits end up impacting productivity in a wide array of other commercial sectors. Equipment manufacturers increase productivity in a range of other manufacturing and service industries.

Growth and Decline

As shown in Figure 4 on the previous page, while growing firms continue to create jobs, during the past decade they have not kept pace with declining firms – and this has resulted in the accelerated decline in manufacturing employment. Manufacturing employment has declined from 17.4M in 2000 to 13.4M in 2008 and 11.9M in 2009 at the height of the recession.[23] This decline is driven by the two recessions, the heightened intensity of competition from low cost countries, and more broadly due to the migration of manufacturing operations to foreign markets. These trends, and the resulting decline in a *portion* of manufacturing, are inevitable. Consequently the key to improving the health of manufacturing is to nurture the growing companies.

The Role of Small and Mid-Size Manufacturing Enterprises (SMEs)

Small and medium-sized enterprises (SMEs) are an important driver of manufacturing sector performance. About 99% of U.S. manufacturing firms employ fewer than 500 people, and approximately 44% of manufacturing workers are employed in these small companies.[24] SMEs, defined as establishments with less than 500 employees, represent 57% of total manufacturing value added.[25]

Small and mid-sized manufacturing firms are responsible for a significant number of new jobs created each year. The U.S. manufacturing sector created, on average, 1.8 million new jobs annually during the 1990-2005 period, of which 1 million were in firms with fewer than 500 employees.[26] In addition to representing a significant portion of job creation, SMEs have shed fewer jobs than larger firms during recessions. According to one data source, employment in manufacturing establishments with 500 or more workers in 2000 shed 1.17 million jobs by 2007. At the same time, those manufacturing establishments with less than 500 workers shed only 564,000 net jobs during that same time period.[27]

Small manufacturers provide an array of innovative niche finished products in almost every sector, ranging from specialized machinery and equipment to medical devices to furniture. Small and mid-size firms of course also pay a critical role as suppliers to original equipment manufacturers (OEMs), which increasingly look to their supply base as sources of cost reduction, technical expertise and new product ideas. OEM customers often demand annual cost reductions, leaving SME suppliers with the task of determining how to continue supplying the same or better quality product at an ever lower cost.

Measuring Manufacturing Health and Contribution to Prosperity

As noted in the 2009 MEP Advisory Board paper "Innovation and Product Development in the 21st Century,"[28] numerous measures can be used to assess the health of the manufacturing sector. They might include productivity, jobs, firm survival rates, balance of trade and more. For purposes of this paper, and for determining the business model for the MEP network, we propose two key measures of the manufacturing sector's health and contribution to income and prosperity:

>> Productivity - value added per work hour

>> Total manufacturing value added and sales/output[29]

These measures are commonly employed by economists, and they reflect concrete, "real world" changes that MEP and other service providers strive to achieve in manufacturing. When MEP assists clients to implement lean or other process improvements, introduce innovative new products, grow their top line revenues or enter higher margin new markets, it is all reflected in these macro-economic measures – higher productivity and increased value added and output. Firm level improvements translate into macro-economic benefits yielding income and prosperity for workers, firm owners and taxpayers.

Working to increase both of these measures simultaneously should increase the health of manufacturing, lead to strong performance in other measures (such as jobs, wage rates) and reflect success in stimulating innovation.

SECTION 2

Small and Mid-Size Manufacturers – Challenges and Unrealized Potential

At a high level, three broad challenges have emerged for small and mid-size manufacturers: 1) SMEs lag behind in productivity and best practices; 2) small firms are missing out on growth opportunities; and 3) the leadership of small manufacturing firms faces critical challenges and lacks adequate access to outside expertise. In all of these cases, the market by itself has not fully realized the potential of these firms. A new MEP model must be able to respond to these issues.

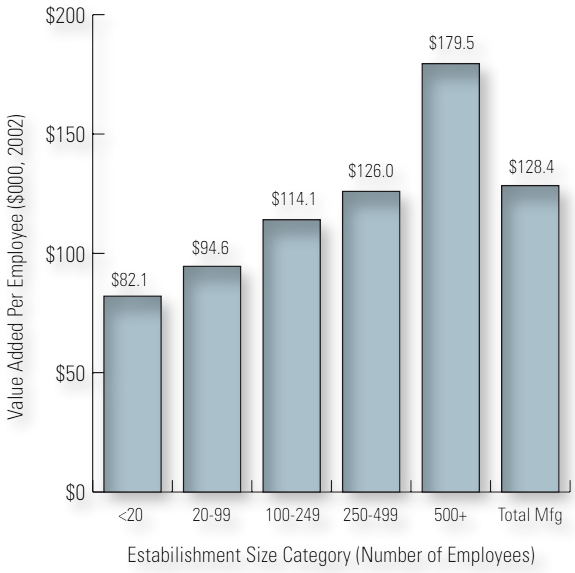
Lagging Productivity and Business Practices

Small establishments lag behind large establishments in productivity (value added per hour) and in the adoption of leading management practices. The most recent data available from the 2002 Economic Census (shown in Figure 6) demonstrates that labor productivity for large establishments (with over 500 employees) is more than twice the level of small establishments employing 20 or fewer people, and nearly 90% higher than establishments with 20-99 employees. Value-added per employee grew among large manufacturers by 42% as compared with 35% among small manufacturers between 1992 and 2002.[30] Until more current federal data become available, it is difficult to know whether the widening gap will continue.

Part of the explanation for lower productivity is a lag in adopting best practices. In a national study completed in 2009, researchers found that small manufacturers lag behind larger firms in implementing world class manufacturing strategies[31] The study of over 2,500 manufacturers assessed their progress in achieving world class status across six dimensions: customer-focused innovation, engaged people/human capital, superior process/improvement focus, supply chain management and collaboration, green/sustainability, and global engagement.

Small (defined for the study as less than $10M in sales) and mid-sized firms (defined as those with $10M to $100M in sales) are much more likely than large firms to *fail* to attain world class in any of the six dimensions. One-third (33%) of small firms and 26% of medium size firms did not attain

Figure 6: Labor Productivity by Establishment Size



Source: U.S. Economic Census, 2002

>> Many small firms have growth potential that lies dormant.

world class status in any of the dimensions. By comparison only 14% of larger firms (with $100M or more in sales) failed to attain world class status in at least one of the dimensions.

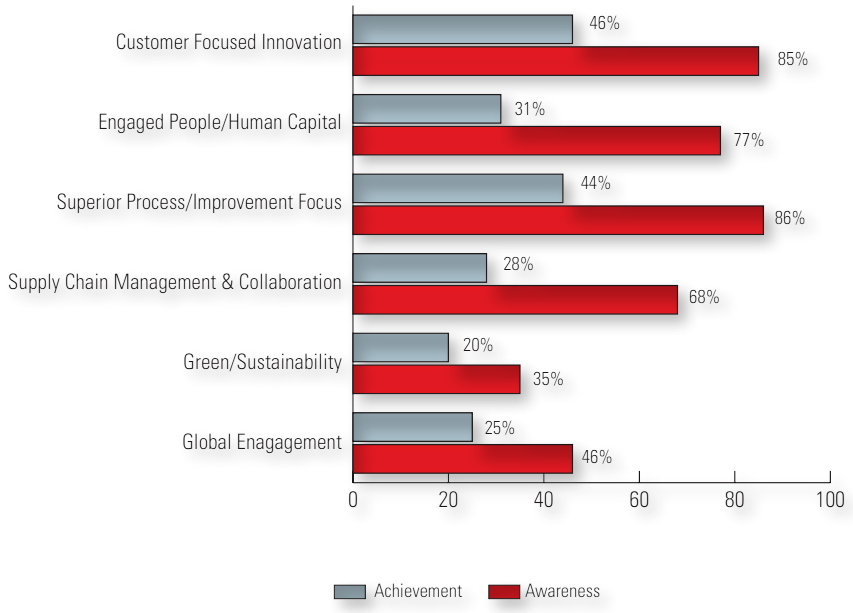
Furthermore the study (which predominantly surveyed small and medium size manufacturers or divisions with less than 500 employees) shows there is a considerable "gap" between achieving world class status and the perceived importance of these strategies. As shown in Figure 7, many firms are aware of the importance of these six strategies, but a much smaller proportion have rated themselves as having achieved world class status. The study suggests that this achievement gap among manufacturers will limit U.S. companies in recovering from the current recession.

Unrealized Growth Potential and Missed Opportunities in Emerging Technologies

Many small firms have growth potential that lies dormant. If this potential could be unlocked, the growing portion of manufacturing sector value added and output could grow faster, and thus replace lost income and jobs resulting from the declining segment.

One specific example of missed opportunities can be found in the clean/renewable energy markets, such as wind and solar photovoltaics. According to one estimate, "70% of America's clean energy systems and components are produced abroad."[32] Another observer indicates that China,

Figure 7: Next Generation Manufacturing Strategies: Gap Between Achievement and Awareness



Awareness: Percent of firms that believe the strategy is 'very' or 'highly important' for success
Achievement: Percent of firms at or near world-class in the strategy

Source: Manufacturing Performance Institute, *Next Generation Manufacturing Study: Overview and Findings*

Japan and South Korea have "already surpassed the US in the production of virtually all clean energy technologies."[33]

There are a number of reasons for the low U.S. market share in renewable energy, and other missed opportunities. Some factors are large macro-trends or structural barriers which are beyond the control of U.S. firms, such as aggressive public investment by foreign competitors to foster the development of renewable energy supply chains[34] and other emerging industries.

However some of the barriers are at the firm level – the inability to develop and launch innovative new products, the difficulty of identifying market opportunities in new industries or in global markets, and as discussed below the inherent challenges faced by leadership in small firms. All of these factors undermine their ability to innovate, grow, and contribute to overall U.S. economic growth and prosperity.

Leadership Challenges

The leaders of small and mid-size manufacturing firms face extraordinary competitive and management challenges. Unlike large companies which can afford large teams of managers, top leadership is often consumed with managing day-to-day internal operations and "fire-fighting." As a result, it can be difficult for management of small firms to carve out time to look for future growth opportunities, develop innovative products, or identify new markets.[35] In other words, leaders are constrained by the scale of the enterprise.

Three additional leadership issues deserve further consideration. These issues relate to how small firms access outside help, their preparedness for leadership change, and how competition from low cost countries has changed the requirements for leaders to be successful.

Limited Access to Private Sector Expertise – SMEs seldom have an adequate network of external contacts that provide technical expertise or management advice.[36] Interviews with MEP center directors, as well as recent surveys of small manufacturers, suggest that SMEs are underserved by consultants and other outside assistance organizations. For instance, the Georgia Manufacturing Survey[37] asks companies about their use of outside assistance providers, including private consultants, MEP centers, universities, Small Business Development Centers (SBDCs), and other organizations. *The survey found that 44% of manufacturing facilities have not worked with any outside assistance organization over the past two years.* For companies employing between 10 and 49 workers, the rate is 51%, and if they work with an outside provider, it is generally one organization, often a public sector (or nonprofit) development organization. In essence, the few small firms that do obtain help tend to turn to economic development organizations as their sole source of outside expertise.

Interviews with MEP center staff confirm that private consulting firms have only a limited presence in serving small manufacturers. Those seeking outside expertise often turn to small and even individual consultants, with a limited range of skills. Consultants, more often than not, spend most of their time working with larger clients with more resources to pay. Other consultants have learned that the only way to economically reach small firms is by working in partnership with MEP centers.

Previous studies also support similar findings about the isolation of firm leaders, the lack of opportunity to interact with and learn from other similar firms, and the difficulty in finding high quality, unbiased advice and assistance.[38] All of these factors contribute to a situation where leadership cannot obtain the outside expertise it needs.

Business Succession in Small Manufacturing Firms – The majority of small manufacturing companies are family businesses.[39] Many of these firms are facing succession issues as the first or second generation business owners are set to retire and either hand over ownership to the next generation or sell the business to new owners. This succession issue is both significant and imminent. Nearly 50% of companies surveyed in the Next Generation Manufacturing (NGM) study indicated they either were planning a leadership succession or may be dealing with one in the next five years.[40] There is substantial risk that many firms will not ultimately survive these transitions.

Across all industries (not just manufacturing), about 30% of family-owned businesses typically survive into the second generation. Only 12% remain viable in the third generation. Only 3% survive to a fourth-generation or beyond.[41] Among small manufacturers, research suggests that family businesses are often not as adaptive as investor-owned businesses. The danger for the U.S. economy is that these enormously valuable business assets will be squandered if they do not survive beyond the current generation.

Competition from Low Cost Countries – Global competition from low-cost countries has radically changed what it takes to survive and prosper,[42] and these changes have critical implications for firm leadership. Firms cannot rely solely on the ability to compete on cost as a strategy – achieved through operational improvements such as lean or automation. Instead, these companies must also seek out niches in which they can offer higher value versus offshore competitors, and find ways to develop innovative products and services that differentiate them from global competition.

The new competitive environment also means that companies can no longer "rest on their laurels." The manufacturing capabilities of China and other low cost countries continue to increase. As a result, a strong competitive position can easily erode over time. Successful firms must be adaptive to changing market conditions, continuously looking to innovate out of commodity businesses.

Firms with adaptive, outward-oriented, forward-looking managers have the best chance to survive and grow. These small business leaders are able to identify and respond quickly to a changing competitive environment. They continuously look ahead to seek out new customers. Adaptive leaders and companies have the greatest chance of continued success because they adjust to continuous change.

A fundamental change in mindset – to become more adaptive – is required for many SME leaders and their companies. The future of many small manufacturers, and the jobs they currently provide, depends in part on just such a change.

Market Failures

The challenges discussed above – lagging productivity and practices, missed growth opportunities, and leadership challenges – represent a market failure since the extraordinary capabilities and potential of small U.S. firms, that have been able to survive intense global competition in recent years, are not fully realized. These challenges also represent an opportunity for government to invest in existing manufacturing companies to maximize their potential for growth and productivity improvement.

SECTION 3

MEP is Positioned to Respond Effectively to the Market Failure for SMEs

Government has an Opportunity to Foster Growth that the Market Can't Achieve by Itself

As discussed in the previous section, the market by itself is unable to fully realize the growth and improvement opportunities for established small and mid-size manufacturers. Many of these firms – particularly those that have survived global competition in the last decade – are run by experienced leadership that needs help to transform their companies, re-ignite innovation, and enter new markets. Many of these companies are in mature industries where the need for ongoing innovation is critical to remain viable and grow.

Outside "hands on" assistance is often required to catalyze a change in mindset of company leadership, to help them transform their companies into lean operations, to face critical challenges from low cost countries, or to plan for management succession. But obtaining outside input is difficult and expensive for small firms. As discussed earlier in this report, the consulting market is still largely focused on larger firms, and the cost of selling to small firms can be prohibitive. As a result, it remains difficult for small firms to receive attention from consultants. In addition, firm management often feels isolated, with limited access to other CEOs or mentors who are or have been "in their shoes."

Established Manufacturers are an Under-valued Source of Innovation

Governments recognize the value and importance of investing in innovation, but established manufacturers are an under-valued source of potential innovation and growth. Most of the focus of government resources has been on start-ups and entrepreneurs.[43] More limited government attention has been paid to "reigniting" entrepreneurial and innovative behavior in established manufacturers. The major gap is on the company side – providing technical assistance to help established companies identify and exploit new growth opportunities. This gap exists despite the fact that established firms are a major source of new jobs created each year in manufacturing.[44]

The MEP Network is Uniquely Positioned to Respond

Within the landscape of service providers, MEP is uniquely positioned to be the government's response to the market failure discussed above, i.e., lagging productivity and practices, unrealized growth potential, and leadership challenges – and a lack of assistance to overcome these challenges from consultants or other government programs.

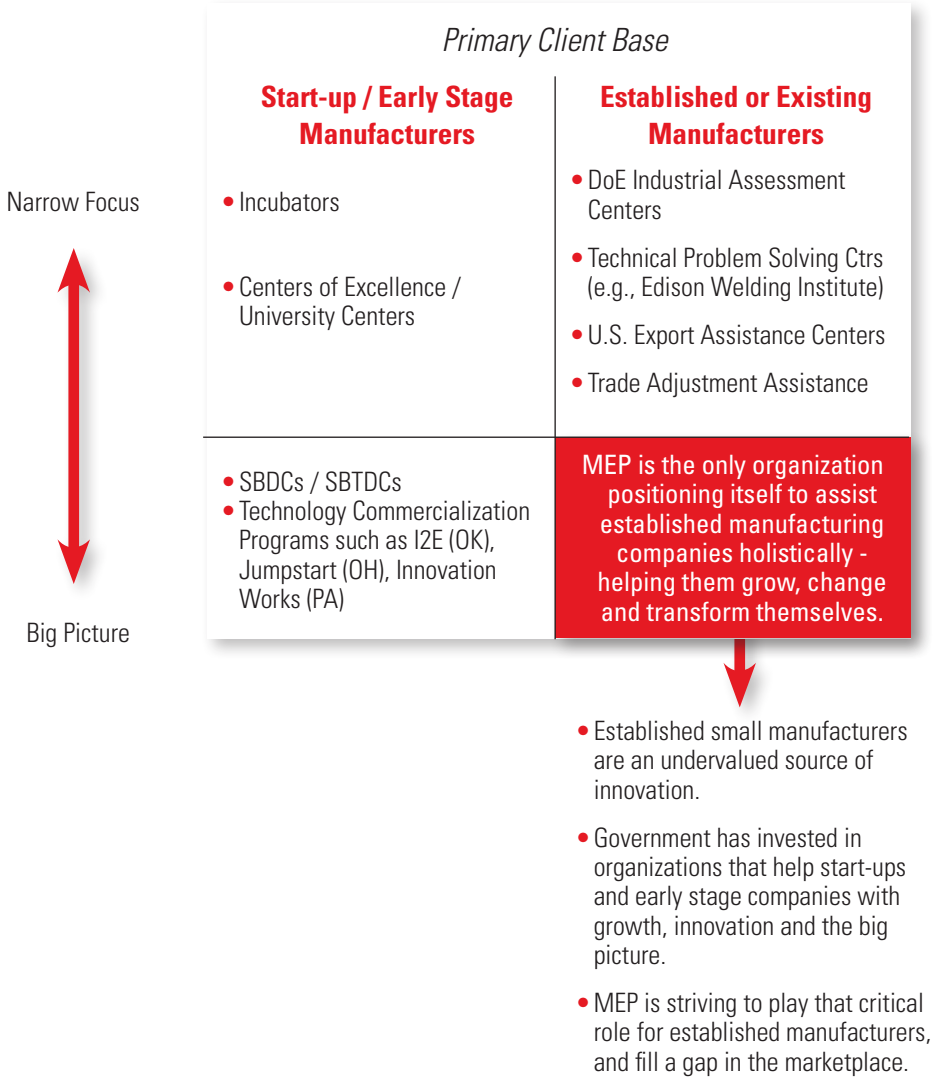
Figure 8 illustrates the gap in government supported technical assistance, which MEP is striving to fill. MEP is positioning itself as the only organization that can help established small manufacturing companies focus on the big picture – the overall strategic direction and priorities of the company. This involves expanding its range of services, including those which help companies grow and innovate, but also assisting companies in a holistic manner.

MEP is also the only organization that exclusively focuses on manufacturing businesses, and has the engineering/ technical skills and executive experience that is required to effectively build credibility with and serve manufacturers. As shown in Figure 9, which compares MEP to other federal programs that offer "hands on" technical assistance to manufacturers, SBDCs offer more general business assistance to a wide range of organizations, but are not specifically geared toward manufacturing or capable of

>> Established manufacturers are an under-valued source of innovation and growth.

handling technical issues. In addition, they have tended to focus on smaller and start-up firms rather than the thousands of manufacturers in the 20-499 range. Other organizations are narrower in scope, either offering very specific services (such as energy efficiency in the case of the Department of Energy's Industrial Assessment Centers or export in the case of the U.S. and Foreign Commercial Service) or are aimed at addressing very targeted market needs (in the case of Trade Adjustment Assistance).

Figure 8: Technical Assistance Programs for Manufacturers



In addition, the MEP network and its service delivery partners provide the *in-depth, intensive implementation* that is required to unlock growth opportunities. A change in leadership, mindset, or culture requires outside change agents or catalysts that can provide hands on assistance to companies. The government's investment in MEP reduces both the cost of sales (reaching manufacturers) and the cost of change (implementation) for those manufacturers.

Finally, MEP's field network and existing client relationships position it well to be the linchpin in an effort to accelerate the development and commercialization of new technology. MEP can be a connection point between *sources* of technology - innovators, developers and licensors - and manufacturing companies that represent demand for technology needed to develop innovative new products, overcome technical barriers or improve manufacturing processes.

Figure 9: Comparison of MEP to Other Federal Programs

Comparison of MEP to Selected Federal Technical Assistance Programs that Serve Manufacturers					
Program	**Manufacturing Extension Partnership (MEP)**	**Small Business Development Centers (SBDCs)**	**U.S. and Foreign Commercial Service (USFCS)**	**DOE Industrial Assessment Centers (IACs)**	**Trade Adjustment Assistance Prog.**
SUMMARY	Focus on manufacturing; technical and executive background, range of services, in-depth implementation	Serve broader audience than manufacturing; focus on smaller firms and start-ups; brief engagements	Focus on export	Focus on energy efficiency	Focus on firms affected by imported competition
Market Focus	Manufacturers, with an emphasis on establishments with < 500 employees	All small firms, including service and retail; focus on companies with <10 emps and start-ups	Exporters, primarily manufacturers with < 500 emps, and increasingly service exporters	Small manu-facturers with energy bills of less than $3.0M	Manufacturers impacted by foreign competition
Services, Capabilities	Range of technical assistance and training, covering process improvement, quality, supplier development, workforce development, top-line revenue growth, technology, innovation, diversification, export, lean and clean	One-on-one counseling and training related to business planning, SBA loan packaging or referrals, financial planning, human resources, start-up and other management guidance	Export assistance and trade promotion – counseling, identifying and qualifying partners, market research, marketing support, trade missions	Assessments and tools to identify energy efficiency, cost reduction opportunities.	Pay for 1/2 of cost for consultant delivered projects in manufacturing, engineering, marketing, financial & general mgmt, IT
Delivery Staff Backgrounds	Manufacturing, engineering and executive experience (3rd party service partners also have mfg & business experience)	Generally business and management experience	Mix of experience – with export assistance organizations and business	University engineering faculty and students	Services delivered by consultants with business experience; TAA center staff also have business experience
Engagement Depth	Focus on in-depth engagements (average ~125 hrs per client) plus seminar/ educational programs of shorter duration	Briefer engagements, averaging several hours per client; extensive use of training & seminars	Ongoing in-depth work with a portion of client base; and briefer interactions with others (through workshops and responses to company questions)	Substantive engagements, each IAC serves only10-12 clients per year	Funds projects of up to $150K (50/50 cost share)

Sources: Interviews with SBA, ITP/IACs USFCS, and websites of all of the above organizations

SECTION 4

Overview of the Manufacturing Extension Partnership (MEP)

This section provides an overview of MEP, intended as background for those unfamiliar with the program. The analysis and assessment of this program, and how it should change, is included in later sections.[45]

The Hollings Manufacturing Extension Partnership (MEP) program was created in 1988 to improve the productivity, economic competitiveness, and technological capabilities of America's manufacturers, particularly small manufacturers. The program grew from an initial pilot project to a national network of 60 state and regional centers operating from approximately 370 locations with over 1,500 nonfederal staff. In addition, the centers work with over 2,300 third-party service contractors throughout the United States and Puerto Rico.

MEP and its partners provide companies with technical assistance to improve their manufacturing processes and productivity, expand capacity, adopt new technologies, utilize best management practices, and accelerate company growth. MEP works with those companies willing to invest in their future – by making short-term improvements, and positioning themselves to be stronger long-term competitors.

MEP centers are non-profit, university or state-based organizations which receive one-third of their operational funding from NIST, with a two-thirds cost-share realized from state funds, other regional partners, and revenue from fees for services paid by manufacturers. The state and federal funding for the centers makes it economically feasible to reach small firms at reasonable rates (offsetting the high cost of outreach to a large number of small companies).

Client Base

MEP employs two definitions to describe how many companies it assists. MEP provided "in-depth" or substantive assistance to 7,123 clients in FY 2009 and 7,412 in FY 2008. These companies generally report measurable impact from MEP services on sales, costs, employment or investment. A broader measure refers to the 33,000 companies MEP "served" in FY 2009. This broader measure includes an additional 26,000 firms that typically participated in some type of event or educational workshop. Based on these numbers, MEP provides in-depth assistance to about 2.2% of all manufacturing establishments, and serves 10% with less intensive interactions.

MEP focuses its assistance on small and medium-sized manufacturers. As shown in Figure 10, companies employing less than 500 employees represent 96% of MEP clients that were substantively assisted.[46]

Services

MEP centers deliver services through a variety of approaches. Most of their work is in-depth technical assistance and education/training, but formal assessments of companies are also a significant portion of activity. Also, many companies receive a combination of services, often starting with an educational program, which leads to more in-depth technical assistance and consulting.

Traditionally, MEP's focus has been on the manufacturing floor, helping companies implement operational improvements and quality systems. Centers estimate this represents 60-70% of their activity. Among the most common service offerings is "lean" manufacturing – also

>> Clients reported $9.1 billion in increased and retained sales, as a result of MEP assistance.

known as the Toyota Production System – a methodology aimed at minimizing waste and non-value added activities. "Lean" and its many variants emphasize reduction of lead times and inventory levels, continuous improvement of operations, quality throughout production, rapid response to actual customer demand, and preventive maintenance. MEP also frequently assists clients with quality improvements, and the adoption of quality systems and certifications (e.g., ISO certifications). Through lean and quality, MEP is helping manufacturers achieve their goals of providing the highest quality product at the lowest possible cost. MEP has also begun to apply these lean principles not just to the production floor, but to the entire manufacturing enterprise, including administrative functions and product development.

More recently, MEP has worked to expand the range of services offered beyond operational improvements and cost reduction, to help companies generate top line growth, innovate, become more green/sustainable, and improve in other areas. The MEP Next Generation Strategy, discussed later in this section, outlines this new direction.

Service Delivery

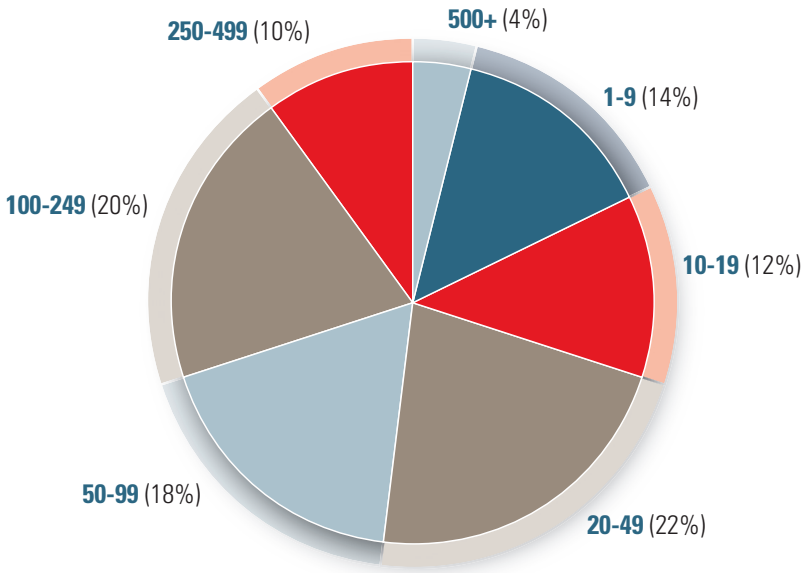
Each center operates differently. Some deliver nearly 100% of their services using in-house staff. Others provide services largely through contracts with outside partners or third-party providers. Across the entire MEP network, 71% of all service delivery hours are performed in-house by center staff. About one-third of clients received services from outside service partners, such as private consultants, or from a collaboration involving in-house center staff and these third-party service providers. The predominance of in-house service delivery has emerged for several reasons:

>> It is perceived as easier for the center to capture fee revenue to cover a portion of its operations;

>> It offers greater control over delivery resources, in terms of quality, consistency, and ability to respond to the customer; and

>> It reduces the risk of a third-party organization taking over the client relationship and "cutting out" the center.

Figure 10: Distribution of MEP Clients by Size (# Employees)



However a number of centers have had success with a model where the vast majority of services are delivered by 3rd party partners. In these cases the center plays an active role in outreach, building client relationships, defining the client's needs, managing the project, identifying and qualifying 3rd parties, and sometimes delivering a portion of the services. They are able to generate sufficient revenue to meet their cost-share requirement by charging fees for the services of their partners, and also capture a portion of the fees for their own staff's value added role. As will be discussed later, this model also has the benefit of being more flexible in responding to the wide range of company needs, and avoids the risk of hiring in-house staff that may not be fully utilized.

Funding & Cost-Share Requirements

One of MEP's unique characteristics is the requirement that each dollar of federal funds be cost-shared with two dollars of funds from state government (or other state/regional partners) and from client fees. This funding model leverages state investments, and ensures that clients receiving assistance demonstrate that they value MEP services, and are willing to invest in their own improvements and growth.

In fiscal year 2009, the total cash budget of the MEP system was roughly $274M. The federal contribution represented $110M or 40%. State government contributed approximately $66M or 24%. And the private sector contributed – predominantly through client fees – $98M or 36%. (Center budgets also included an additional $47M, largely composed of in-kind contributions from partners.)

However, this cost-share model has faced increasing challenges. Some state governments have reduced or eliminated their cash contribution to center budgets, a process which has accelerated during the recession and recent state fiscal stress. In addition, centers are increasingly receiving state funding with more restrictions on how it can be used (since it is either designated for a specific purpose, or is provided as in-kind assistance rather than cash). As state governments struggle to address all the needs for funding from various constituencies, including education, safety, healthcare, and other areas, the limiting funding available to assist existing businesses to survive and grow is sometimes the first to be cut.

Measures

From the outset, MEP has placed considerable emphasis on measuring and monitoring the performance of its centers. The MEP performance measurement system involves a two-part process. The first involves a holistic assessment of center performance through a panel review process, involving NIST MEP staff, peers from other centers, and external experts. These reviews assess a center's entire operation and performance, based on an understanding of each center's unique situation. Panel reviews also provide constructive feedback on opportunities for improvement and adoption of best practices from other centers in the national network. Continued Federal funding depends on NIST MEP's review and approval of each center's performance, and the panel makes a recommendation to NIST MEP on whether to continue funding.

Each center's success is also judged in part based on data generated from an independent third-party national survey of MEP clients. The system documents client firm reports of how MEP centers have helped them increase or retain sales, reduce costs, make new investments, and create or retain jobs. These measures – collectively referred to as "client impact" – measure outcomes and results, rather than simply project activities. The measures also assess the reach that MEP centers achieve within their regional markets – including the total number of clients served as well as those that report measurable impact. NIST MEP monitors these measures to ensure that centers meet minimally acceptable targets. Centers that do not achieve these pre-specified benchmarks may be put on probation, and run the risk of ultimately losing their federal funding.

MEP's key metrics focus on the amount of client impact, and the number of companies assisted or impacted (reach), per dollar of federal investment.

Program Impacts

MEP surveyed 7,648 companies that received in-depth assistance – mainly during FY 2008 – that reported the following results from MEP center services: $3.6 billion in new sales (despite the recession), $5.5 billion in retained sales, and $1.4 billion in cost and investment savings.[47] Those clients also reported that they made $1.7 billion in new investments in their companies' improvements, created nearly 14,000 new manufacturing jobs and retained another 39,000 jobs (for a total of 53,000 jobs).

For the purposes of later sections in this study, the team examined data in greater detail for assistance provided primarily between the 4th quarter 2006 and the 1st quarter 2008 (and surveyed a year later). During that 18 month period – largely prior to the recession - MEP received survey responses, with quantified impacts, from nearly 8,919 companies that employed over 1.3 million U.S. employees.

As compared with other programs, MEP offers more in-depth, intensive technical assistance services. Nearly 70% of MEP clients reporting positive impact received somewhere between 9 and 160 hours of assistance. As a comparison, the SBDC program reported nearly 600,000 clients served annually, allowing for only a few hours of time per company.

Finally, based on national client survey data, MEP was able to help create or retain a job for a modest federal investment of roughly $2,000. By comparison, state business attraction packages can invest hundreds of thousands of dollars per job. MEP's performance in terms of investment per job is also in line with the Economic Development Administration's widely acclaimed programs.[48]

Partnerships

MEP was designed as a partnership program, engaging the states and the private sector as co-investors in the national network.

In addition to the role of co-investors in the system, centers also develop partnerships for three primary reasons: (1) to obtain additional skills required to meet client needs, (2) to extend outreach/marketing to a wider range of potential clients, and (3) to expand the resources available to support MEP's mission.[49]

First, partnerships may offer skills that centers do not have in-house. Collaborating partners help the centers deliver services to clients in about one-third of their significant projects. These service delivery partners are typically private third party consultants, community colleges, universities, or other economic development and business assistance organizations.

Second, joint marketing and outreach with partners allows centers (and partners) to expand their reach by cross-marketing and cross-referring to each others' organizations. MEP centers have developed relationships with other economic development organizations and private consultants, in order to understand each other's offerings, make appropriate referrals, and jointly promote events, seminars and workshops to manufacturers. These partners can also provide visibility and credibility for centers, within the broader economic development community as well as with potential clients.

Finally, partnerships provide an opportunity for manufacturers to gain access to other resources that support the centers' mission. For example, many centers have identified partners that can access state training funds to help reduce the cost to clients of projects or seminars.

National System Organization

The MEP network is composed of 60 autonomous state and regional centers – separate non-profit organizations, as well as university-based and state-based organizations that work directly with manufacturers – along with NIST MEP. As the federal program manager, NIST MEP is responsible for: overall program stewardship; strategic direction and research; evaluation and measurement; intergovernmental and partnership relationships; and investment in specific areas to gain economies of scale and reduce duplication of effort, such as the development and roll-out of new service offerings, and training programs for field specialists.

Next Generation MEP

In December 2008, NIST MEP defined a new strategic plan that re-defined its vision for the national program.[50] The plan defined a vision for the program as a catalyst for accelerating manufacturing's transformation into a "more efficient and powerful engine of innovation driving economic growth and job creation." In that same document, MEP's mission was defined as "to act as a strategic advisor to promote business growth and connect manufacturers to public and private resources essential for increased competitiveness and profitability."

This new vision and mission shifts the program from focusing on efforts to enhance productivity through process improvement, to include those that generate growth and innovation.[51] Over time, MEP has learned that it is no longer sufficient to assist client companies to become more efficient and increase production capacity. To survive and compete, companies must consider new business strategies that both take full advantage of the company's unique capabilities and distinguish the firm from competitors.

This new vision also shifts the focus of MEP to being a strategic advisor and connector to resources and skills, as well as a deliverer of technical assistance. This shift attempts to engage clients at a more strategic and holistic level to understand their critical needs and provide assistance in those areas, rather than delivering services in which MEP has capabilities, but which may not match the future direction and strategic priorities of the companies.

The plan expands MEP's scope to cover a broader range of services, focused around five service categories, all under the overarching objective of helping companies grow top line revenue as well as bottom line profit through cost reduction (see Figure 11). The five service categories include Continuous Improvement, Technology Acceleration, Supplier Development, Sustainability, and Workforce.

This new emphasis on growth, innovation and sustainability is designed to build on MEP's traditional strength by identifying ways to use capacity freed up from continuous improvement efforts.

Most of MEP's existing services fall under the categories of continuous improvement (lean manufacturing and quality), supplier development (application of lean and quality systems to suppliers of OEMs), and workforce (training on lean, quality and other operational practices). The new service areas tend to fall under the categories of business growth, as well as technology acceleration and sustainability.

Among its initial priorities, NIST MEP has spearheaded the development of several new "growth and innovation" services to help companies identify new product opportunities, enter international markets, and access new technologies. These include Eureka! Winning Ways, ExporTech, the National Innovation Marketplace, and Technology Scouting. The Eureka! Winning Ways (E!WW) program assists small manufacturers to generate, evaluate and prioritize new ideas that can increase sales. The program helps companies to develop and deploy innovative new products, enter new markets and develop more effective market messages. Over 300 E!WW projects have been delivered since its inception. MEP, along with its partner Eureka! Ranch, continues to improve this service offering based on feedback from manufacturing firms, MEP centers, and other partners. Currently MEP is offering the 5th version of the program.

NIST MEP has developed the ExporTech program in partnership with the U.S. Department of Commerce U.S. Foreign & Commercial Service. This initiative aims to assist groups of companies to enter or expand into international markets. To date, 25 ExporTech programs have been completed nationwide with approximately 200 client companies.

Additionally, NIST MEP has partnered to develop the National Innovation Marketplace (NIM) pilot, which makes connections for manufacturers to generate business growth and profitability. The NIM pilot combines a web-accessible database with the MEP field network to connect U.S. manufacturers to sources of technology, new product ideas, inventors, researchers, as well as investors and large corporate partners and customers. The NIM is unique because the technologies are translated into straightforward, non-scientific terms with a clear customer benefit, and it provides an independent sales forecast. In this way the NIM provides critical information in a format that allows innovators or sources of technology to connect with companies that can use or commercialize them. To date, 1,178 business translations have been posted, along with 771 requests for products or technologies.

MEP has achieved initial success matching ideas and innovations from technology sources to needs of manufacturers by using the electronic clearinghouse in conjunction with the human network of field agents that have deep knowledge of U.S. manufacturing firm needs and capabilities. This combination is allowing the MEP system to tap into the unrealized growth potential of existing businesses and the promise of new technology.

All of these examples of emerging growth services demonstrate how MEP is leveraging partnerships – with other federal programs, state agencies, and private partners – to expand its range of services and improve the competitiveness of U.S. manufacturers.

Figure 11: MEP Next Generation Strategy Framework

5 SECTION

Assessment of the Current MEP Model

The current model has been highly successful in generating measurable impact for clients, measured in terms of sales growth and retention, cost reduction, investment and jobs created or retained. For the average client prior to the recession, sales growth and retention – the sales that the client indicated would have been missed without MEP center assistance – was $1.8M per company. The cost reduction obtained was $200K per company. The total bottom line impact per company (roughly speaking an attempt to quantify the annual improvement in profit for client companies) was just under $500K.

Moreover, the federal investment required to generate this impact is very modest. Over $23 in client impact was generated for every federal dollar invested in FY 2008. Prior to the recession, the number was $26. In addition, MEP centers were able to create or retain one job for every $2,000 federal dollars invested – a level of investment per job which compares very favorably to other programs. Part of this performance is due to the programs structure which secures state funds and client fees, through the nonfederal cost-share requirement, to amplify the impact of federal investment.

In addition, clients are highly satisfied with the services. In FY 2008, over 90% of clients were likely to recommend the center to other companies (i.e., on a scale of 1-10, they scored a 7 or higher, meaning they were "likely" to recommend).[52] MEP has developed a reputation for generating real, measurable impact for its clients. In contrast, consultants (that do not work through the MEP network) are unlikely to have their client impact documented by a third party survey. The result is that MEP reduces the risk for clients of working with outside consultants, as they provide a measurement discipline that helps ensure results.

However there are four elements of the current approach that limit the MEP network's ability to reach and impact a larger portion of the manufacturing sector – particularly small firms. These issues form the basis of proposed changes to the model in the next section:

1. The scale of the program is insufficient to reach enough companies.
2. SMEs require a wider range of services.
3. The current center business and service model limits reach and investment in new offerings.
4. The national system's organization of 60 autonomous centers misses opportunities for economies of scale and improved efficiencies.

The Scale of the Program is Insufficient to Reach Enough Companies

By far the greatest barrier to reaching more companies, and to having greater impact on the manufacturing sector, is that the scale of the program is too limited. Figure 12 shows the percentage of total U.S. manufacturing firms that are assisted by the program. Clients receiving "in-depth" assistance are likely to have measurable impact, and generally have defined projects with centers. The total number of clients "served" includes those companies that participated in an educational event or workshop, an initial company visit, or other less intensive interactions.

As shown, on an annual basis, the national system provides in-depth assistance to only 2% of the total 331K U.S. manufacturers, and only 5% of establishments with 20-499 employees. Even using the broader "clients served" number, indicates that MEP served only 10% of total market.

>> The scale of the program is insufficient to reach enough companies.

Figure 12: Market Reach / Penetration

Measure	Number of Companies	As % of Total U.S. Manufacturers (331K)	As % of U.S. Manufacturers with 20-499 Employees	As % of Available Market (Manufacturers with 20-499 Employees, Who are Likely to Seek Out and Invest in Outside Assistance)
Number Clients Provided In-depth Assistance Annually	7,412 (FY08) 7,123 (FY09)	2%	5%	9%
Total Number Clients Served Annually, Including Less Intensive Interactions	31,961 (FY08) 32,926 (FY09)	10%	NA	NA

A more relevant market penetration number should use a narrower definition of the available market, to include those firms that have the greatest likelihood of working with MEP. Based on MEP experience and research, the sweet spot of the market are those firms that *are able to invest in themselves and willing to work with outside assistance providers.* Figure 13 below shows that roughly 60% of establishments with 20 or more employees – about 60K – tend to work with outside service providers (e.g., private consultant, MEP center, consultant, university, SBDC, etc.). The most likely recipients of MEP services are among this portion of companies that are sophisticated or progressive enough to welcome outside help to improve and grow their businesses, but are small enough that they cannot afford to access private consulting assistance.

Based on this definition, each year the MEP national network provides in-depth assistance to 9% of the available market (firms with over 20 employees that are willing to seek outside assistance; again see Figure 12). While most firms will not engage MEP every year, and some firms will obtain assistance from other organizations without MEP involvement, it is clear that *the bulk of the relevant market is currently not served by MEP.*

The program's limited scale means that no matter how successful the program is with its client base, it is impossible to have a significant and measurable impact on overall manufacturing performance – measured in terms of growth in sales, output and value added. Today, the MEP program helps its clients to increase or retain sales of $9.1 billion, which represents roughly a 0.3% increase in total SME manufacturing output.[53]

In order to "make a dent" in these measures of manufacturing sector health, it will require the funding and scale to reach a much larger number of firms, as well as other changes to the business and service model discussed below.

Figure 13: Use of Outside Service Providers

Size Category (# of Emps.)	U.S. Manufacturing Establishments with < 500 Emps	Establishments that Use Outside Business Assistance	
		% of size category	# Establishments
20-499	100 K	60%	~60 K
<20	228 K	n/a	n/a
Total SMEs	328 K	n/a	n/a
Source	County Business Patterns 2007	Estimated based on Georgia Manufacturing Survey[54]; analysis of data presented in *State of Manufacturing 2009*[55] Enterprise Minnesota; and Stone & Associates unpublished data	

SMEs Need a Wider Range of Services

Based on market surveys, MEP client experience, interviews with manufacturing experts, and assessments of trends impacting the manufacturing sector, small and medium-sized manufacturers face a wide range of challenges that threaten their competitiveness, future viability, and growth.

Companies continue to need MEP's core services in cost reduction, operational improvements and quality (which includes assisting suppliers to become more effective at meeting OEM requirements, and enhancing worker skills in these areas). However, companies also need assistance related to top-line growth, innovation and green/sustainability, including technology commercialization, pursuit of growth opportunities in green products and markets, export/international growth, and enhancing the skills of SME leadership and management (see Figure 14).

MEP's current focus on process improvement and lean services primarily impacts labor productivity (valued added per work hour), but *is less effective at increasing total manufacturing value added and output.* An emphasis on fostering revenue growth will help increase total manufacturing value added and its contribution to the economy, and help offset declining manufacturing sectors and firms.

The next section describes the wide range of services that SMEs need to enhance productivity, grow and innovate, and serves as the explanation for why the MEP network must expand its offerings.

Core Services

Cost Reduction / Process Improvement / Lean – Cost reduction, quality and efficiency improvement continue to be top priorities for manufacturers. Figure 15 identifies the top 5 responses from two recent manufacturing surveys,[56] indicating that "lean manufacturing" and "cost reduction / process improvement" are at or near the top of both lists.

According to the 2008 MPI/IW Census,[57] 77% of U.S. plants are engaged in continuous improvement programs, while at the same time only 26% have self-assessed their facilities as having "fully achieved" or "made significant progress" in becoming world class manufacturers. In other words, many firms are pro-actively involved in continuous improvement efforts, and while they have made significant progress they still have a long way to go. This should continue to drive the need to invest in improvements – and for outside assistance to support these efforts. Interviews with centers validate that demand continues for lean, continuous improvement, and quality services.

Figure 14: Expansion of Service Offerings

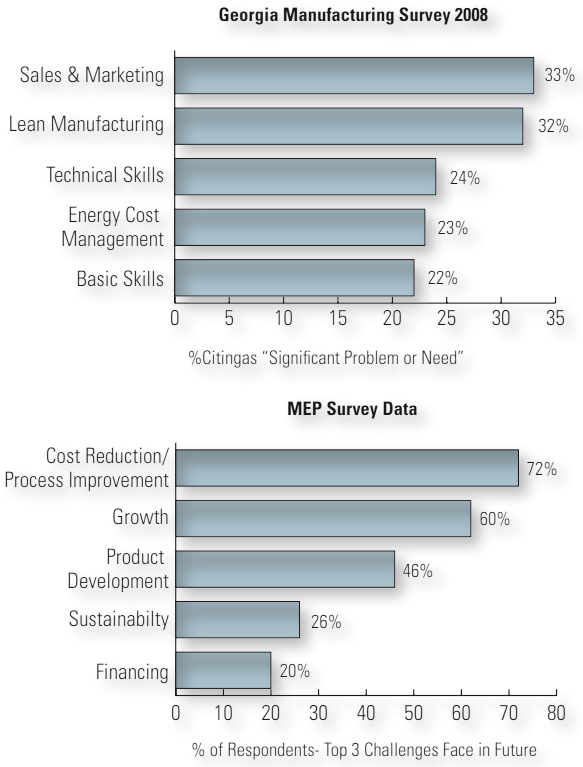
In addition, centers are seeing the need to move into more advanced types of lean enterprise services, including application of lean to all functions within the enterprise, such as office and product development, as well as more comprehensive lean enterprise or transformation services that work with top management to permanently install lean in the culture and processes of client organizations.

Supplier Development – Small lower tier suppliers need to become better partners with their customers. Part of being a good partner is adopting the lean and quality systems demanded by their OEM and upper tier customers. It is also about providing other value added such as design support, technical expertise, and inventory management (e.g., kan ban, consigned inventory, etc). As stated in an article in Enterprise Minnesota's State of Manufacturing[58] survey, the most sophisticated firms learn to establish their value to their customers, and "become part of the OEM team… Lexus automobiles are known for innovative, cutting edge design and technology. It is what makes it a Lexus. But the company does not hide the fact that virtually all of its innovation comes from its team of suppliers…That means they put a premium on their suppliers engineering and design expertise." Small firms must build capabilities that add new value to their OEM and upper tier customers.

Workforce – A skilled workforce is required to implement lean manufacturing, cost reduction, and quality systems. And it is in these areas where MEP makes its greatest contribution to workforce skills. In addition, more general skill shortages exist:[59]

>> "Basic workforce skills" including such capabilities as working in teams, reading and math, or appropriate conduct in the workplace;

Figure 15: Top Priority Needs from Manufacturing Surveys



>> "Technical skills," encompassing a range of skills related to the trades as they apply on the factory floor to engineering and science skills as they might be used in the research and development lab.

MEP is involved in some programs aimed at these skill shortages – mainly training efforts. Many of these issues, however, are best addressed by other organizations, such as community colleges, that do not have cost-share requirements.

Growth, Innovation and Sustainability

Growth and Innovation – Most manufacturers indicate they are looking for ways to increase revenue, particularly during the current downturn. Some are aggressively trying to grow their companies. Others are simply trying to replace lost sales.

However manufacturers often do not have the skills or mindset to be successful at growth and innovation. Part of the problem is that U.S. manufacturing's focus on cost and efficiency is undermining its future viability. This focus on operational efficiency has engendered a culture of risk aversion, greater psychological distance from the customer, and erosion of innovation skills.

Many small and mid-sized manufacturers are two to three generations from their entrepreneurial roots. They have focused on building sales and reducing costs of the product platform they inherited from previous generations of business owners, but not on introducing the next generation of products.

MEP centers have seen this lack of market focus and innovation in clients, who often do not have a thorough understanding of their customers' needs or why they buy the company's products. Incapable or unwilling to look to new markets and products, firms chose to compete on price, focusing their attention on areas of the business that have little to do with improving customer benefit or making their product offerings unique relative to their competitors. This has led many firms into the "commoditization trap" from which they do not believe they have the resources or skills to escape. Rather than looking forward and investing in innovation and new product development, these firms engage primarily in the here-and-now crises of running a business, maximizing efficiency, and often times simply "putting out fires."

Small manufacturers' deficiencies in basic marketing and selling compound the growth challenge. They may be well established in their current markets/supply chains, but they have only a limited ability to enter and develop new markets – including export markets. They often do not collect adequate market data, nor do they have a good understanding of how to conduct marketing activities that generate leads with new potential customers. Strategic marketing questions are not adequately answered, such as "what are the most attractive target markets?" or "what is the most effective marketing message that provides a clear benefit statement to the customer and differentiation from our competitors?"

In the face of intense global competition, particularly from low cost countries, companies must seek out niches in which they can offer higher value versus offshore competitors, and find ways to develop innovative products and services that differentiate them from global competition. However, executives believe the U.S. is losing its distinction as an innovation leader and may be under-investing in its future.[60]

Analyses of the U.S. at a macro-level also come to troubling conclusions about U.S. innovation. According to the Boston Consulting Group, the U.S. remains a "top tier" innovator, but it has fallen behind several competing countries (including South Korea Switzerland, and Singapore) in comparisons. The Information Technology and Innovation Foundation (ITIF) also concluded that the U.S. is falling behind. According to ITIF, the U.S. ranks sixth overall and *all of the other 39 comparator countries have made faster progress toward creating a knowledge-based innovation economy.*[61]

Small firms are typically viewed as being more entrepreneurial, risk taking, nimble and responsive to new markets and needs. Yet, they exhibit lower levels of innovative activity than do larger firms. For example, in the Georgia Manufacturing Survey, firms with over 250 employees spend roughly double on R&D related expenditures per employee as smaller firms.[62] In the same survey, focused primarily on small firms, those manufacturers that are pursuing innovation as their top strategy to compete for customers are reporting the highest profitability (return on sales) and the highest wages, yet less than 10% of companies are pursuing innovation as their top competitive strategy.[63]

Most firms do not have an innovation and product development process that will mitigate risk of market failure for new products and technologies. Those that have a process are often slaves to outdated "gate" processes, where development slowly progresses according to a sequential series of milestones, rather than more dynamic simultaneous engineering or rapid test and learn cycles. Their products still tend to come to market late, miss profitability targets, and suffer from excessive development costs.

Part of the way the U.S. can compete and innovate is through the development and *commercialization of technologies* that give U.S. firms a competitive edge. However there is a wealth of basic research and scientific discovery that has yet to be converted into new technology and ultimately into commercially viable products. A pressing need exists in this area. One recent study, for example, highlights the difficulties in connecting federal research at the U.S. Department of Energy (DOE) to the commercial marketplace:

> "Competing priorities, insufficient numbers of technology transfer staff, or gaps in staff expertise have sometimes constrained laboratories' ability to recognize and promote technologies with commercial promise. DOE has acknowledged that although laboratory staff, particularly scientists, excel at innovation and invention, not all of them look beyond their research to possible applications in the marketplace."[64]

Small manufacturers often lack the means to take research-based intellectual property and "translate" and commercialize it into unique market-ready products and services. Their need for outside assistance may fall into a variety of areas, but could include: the need for innovation and idea generation methodologies; market research techniques for ferreting out needs that are not yet articulated by potential customers; idea-to-launch processes and work plans that help them quickly prove out new ideas at minimal investment and risk; access to affordable product design and development services; and the ability to affordably protect the intellectual property vital to move innovation securely to the market place.

Leadership & Management – One of the central lessons from MEP client experience is that company leadership – both their skills and mindset – is critical to firm success. MEP centers have learned through experience that firms are much more likely to be successful if their CEOs are committed to continuous improvement, have a vision of the future, and are driven to innovate and grow. The Next Generation Manufacturing study, which is focused on smaller firms, states that "Change is driven and sustained from the top, and the most important driver of strategy in any company is the CEO. A talented, passionate, skilled CEO will lead the firm to a next level of performance."[65] A series of studies by Stone & Associates[66] for NIST MEP indicated that the small firms most successful in competing globally had proactive and adaptive leadership. These progressive and highly adaptive executives have a game plan, with a sense of priorities, and are willing to work with outside experts. They are also outward-oriented, forward thinking and embrace change. Adaptive companies have the greatest chance of continued success, because they can prepare for and adjust to changes in the competitive and market environment.

As a result, helping company executives to become better leaders is one of the most critical needs of small manufacturers. And the role of leadership must be incorporated into effective service offerings. Many of the service needs related to top-line growth and innovation discussed above revolve around the CEO and leadership team. It's also increasingly recognized by centers that top management commitment and involvement is critical to long-term success of lean and continuous improvement initiatives.

Finally, leadership transitions and family succession may be the most critical strategic issue facing America's manufacturing base. Leadership loss represents a significant threat – or opportunity. Transitions can inject new ideas, energy and skill sets into firms, but also represents a significant risk where a succession plan is not in place.

Green/Sustainability – Manufacturing is transforming itself to become more environmentally friendly and energy efficient. The impact on companies is wide-ranging, resulting in the need to reduce waste streams, eliminate the use of hazardous materials, redesign products to be more energy efficient, recyclable, and reusable, and minimize carbon footprints. It also presents tremendous opportunities for growth, as companies develop new green products and enter new markets that have emerged in response to the green trend.

There are many ways in which firms may need assistance to respond to the trend toward green and sustainability. However, two specific types of services are particularly relevant for MEP, given their current capabilities. First, waste minimization and energy efficiency are natural extensions of lean services. Lean manufacturing is already being expanded to include a more explicit emphasis on waste reduction and energy efficiency, in such areas as the jointly sponsored MEP-EPA Green Suppliers Network (GSN), the E3 (Energy, Environment, Economy) programs which are focused particularly on lean and energy efficiency, and finally the "lean and clean" manufacturing workshops which are being offered by several centers.

The second sustainability service offering that is particularly relevant to MEP is the use of Growth Services tools to assist companies to identify and pursue new market opportunities in renewable energy and other green products and markets. These current offerings – lean and market diversification – are already being extended and repositioned to incorporate green/sustainability components.

Export – Growth opportunities for manufacturers are increasingly international, driven by economic growth in China, India, Russia, Brazil and other emerging economies, the continued weakness of the U.S. dollar, and fierce domestic competition. However, it has become clear from interviews and recent studies that small manufacturers too often fail to see the market as global, and myopically limit their vision to the domestic market. A large percentage of small manufacturers do not export at all, and maybe more importantly, the companies that do are often reactive. These reactive exporters primarily respond to international inquiries, sell to customers in only one or a handful of countries, and do not proactively or aggressively pursue export growth opportunities.[67]

Beyond a proactive mindset, the specific service needs are similar to other market diversification services, but geared to international markets. More specifically they include market research, strategy and planning, information on potential distributors, reps or partners, marketing support (e.g., trade missions and shows), and information related to the specific operations of international business, including logistics, regulations/compliance, payment and financing, language and culture. By demystifying international business, MEP and its partners can help small firms see global opportunities.

MEP is partnering with numerous U.S. Export Assistance Centers of the U.S. & Foreign Commercial Service/ Department of Commerce to collaboratively offer ExporTech as one tool to "jump start" international business for small and mid-size firms.

Summary – Expanding the Range of Services

In summary, SMEs require a broader range of services – particularly if they are to grow and innovate. As a result, MEP is already beginning to drive the national system to expand its range of offerings beyond its core process improvement efforts to emphasize growth, innovation and sustainability.[68]

The service categories defined in MEP's strategic plan map very closely to the needs of the market as described in this section. This report groups them differently to highlight current core service capabilities versus new and expanding service offerings, since these new offerings require whole new skills sets and capabilities.

The Current Center Business and Service Model Limits Reach and Effectiveness

Several aspects of the current center business model constrain the program's reach and effectiveness. This section discusses these issues, which need to be addressed as MEP considers changing its approach.

Cost-share and Revenue Requirements

The requirement that MEP centers generate two dollars of non-federal cost-share for every one dollar of federal funding, has forced centers to place an emphasis on client fee revenue – especially as state budgets have become severely constrained. This emphasis on fee revenue has also been heightened as a response to periodic uncertainty regarding federal funding levels, as well as the inherent uncertainty of annual public funding and budgetary decisions.

While this emphasis on fee revenue ensures that manufacturing clients invest in their own improvements (and thus have "skin in the game"), expands the funding of the network, and ensures that services are market-driven, it also produces behaviors that undermine program reach and impact.

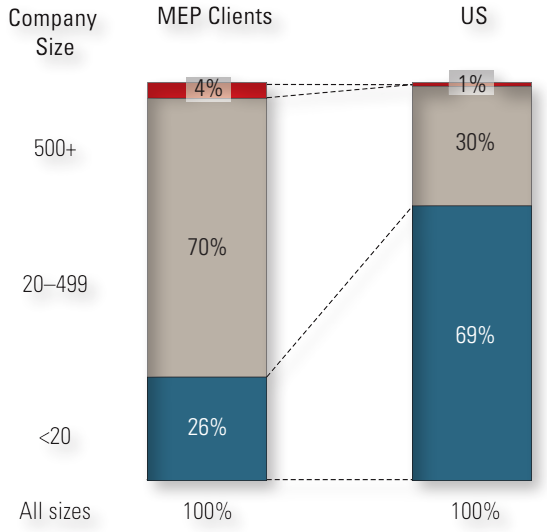
Cost-share/Fee Requirements Limit Reach – To generate sufficient fee revenue, centers have shifted their focus "up market" to firms over 20 employees, and especially to mid-size firms over 50 employees; and more importantly they have emphasized longer engagements with repeat clients. Larger firms are more likely to be able to afford to invest in themselves and pay fees for services. In addition, they are more apt to employ outside expertise than their smaller counterparts. As shown in Figure 16, 70% of MEP center clients are in the 20-499 size category, whereas only 30% of the U.S. manufacturing base is in that size category – most U.S. manufacturers (69%) are below 20 employees.

The smallest firms in particular may have difficulty obtaining assistance in this model, in some cases finding that MEP services are not affordable at all.[69]

In addition, 84% of MEP clients reporting positive impact have worked with the centers for at least a year, meaning that they are likely to be repeat clients. Further, MEP provided roughly 125 hours of service delivery time on average per client – over 3 person weeks. These are much more intensive engagements than other technical assistance programs. This very high level of repeat client work reflects favorably on the centers ability to satisfy their clients, and the in-depth nature of the assistance generates measurable results. Fee revenue requirements also partly drive this shift to larger engagements, which make it easier to maintain high staff utilization and billability.

Embedded in these averages are a subset of clients that receive a large number of delivery hours. In our analysis of 8919 clients with quantified impacts, 438 clients accounted for 40% of total delivery hours. The average hours devoted to each of these clients *was over 1,000 hours*. These clients tie up service delivery capacity working on in-depth

Figure 16: Distribution of MEP Clients by Size of Company



engagements. The result is very positive for those clients, but it *reduces the MEP network's ability to reach more companies.* It is a classic tradeoff between reach and depth, as MEP wants to generate meaningful and lasting change with its clients, and reach as much of the manufacturing sector as possible.

In sum, the shift up-market to longer engagements with repeat clients, often limits reach to additional clients. However MEP must also ask how this shift impacts its ability to generate client impact. Based on analysis of client data, a couple of conclusions become apparent. First, the focus on SMEs with over 20 employees *is efficient* at generating impact. As shown in Figure 17, MEP generates higher bottom line impact and jobs created/retained with larger companies, whether measured per client or more importantly per hour of service delivery time. So for each hour spent with clients, working with larger SMEs does generate higher impact.

However, the data indicates there is a point of diminishing returns, after working with a client for a large number of hours, or for many years. This is illustrated in Figure 18, which shows a clear decline in impact per delivery hour for those clients where MEP works with them for a large number of hours. Figure 19 also shows a clear decline in impact per hour for repeat clients over many years. This suggests it may be more efficient to generate impact by reaching new clients rather than continuing to work in depth with a smaller number of clients.

In summary, while cost-share and fee requirements cause centers to be market-driven, they also cause them to focus on mid-size and larger companies, and to work on longer engagements with repeat clients. However this reduces reach and may in some cases be less efficient in generating impact. A shift in emphasis away from large projects for long-standing clients might actually increase total impact generated by the program, by capturing "low-hanging fruit" with additional companies.

Cost-share/Fee Requirements Constrain the Network's Ability to Expand – The second disadvantage of the current 2:1 cost-share requirement is that it constrains the program's potential to expand, since (as indicated by center interviews) it would be difficult if not impossible for some centers to expand in this current economic climate, given the challenge of generating client fee revenue, as well as declining state contributions. In 2009, many states reduced their contributions to centers, and some have eliminated

Figure 17: Impact by Size of Company

Measurable Impact by Size of Company				
Company Size	**Impact Per Client**		**Impact Per Delivery Hour**	
	Bottom Line ($M)	Jobs Created/ Retained	Bottom Line ($)	Jobs Created/ Retained
50-499	$0.7	14	$3,568	0.07
20-49	$0.2	7	$1,789	0.06
<20	$0.1	4	$1,244	0.05

funding altogether. If the program wanted to expand, the federal contribution would be constrained in many regions because those centers could not leverage sufficient state government and client fee revenue to meet cost-share requirements.

Due Partly to Cost-share/Fee Requirements, Centers are Reluctant to Invest in New Services – The third issue is that the emphasis on fees – as well as meeting minimum impact performance metrics discussed below – can make centers conservative about investing in new service offerings, particularly growth and innovation. It can take time for new offerings like these, often requiring new skills sets and partnerships, to generate the same level of fees and impact as compared to more familiar process improvement services. New services require investment of training time, development time, and underutilized staff delivery time, and are initially less reliable generators of client impact. Not surprisingly, center interviews indicate they are particularly reluctant to invest in new services as a result of the economic downturn.

Partnerships

Barriers exist that limit MEP centers' ability to leverage partnerships that can expand reach, increase efficiency, broaden service capabilities and expand delivery capacity. As discussed below, MEP has a very different model than other technical assistance programs – particularly with regard to its emphasis on fee revenue. There are several particularly relevant barriers which inhibit partnerships. Some of the barriers identified below are based on perceptions summarized from interviews with 50 different organizations – including state government, economic development organizations, trade and professional associations, and other federal programs.

Client Fee Revenue – MEP's emphasis on fee revenue can inhibit the development of partnerships. Most other economic development organizations offer free or very low cost services. MEP's revenue focus can impede collaboration with partners, who may be reluctant to make referrals to MEP. Partners sometimes perceive centers as acting more like private consultants than economic development service providers.

Figure 18: Impact by Hours Spent per Client

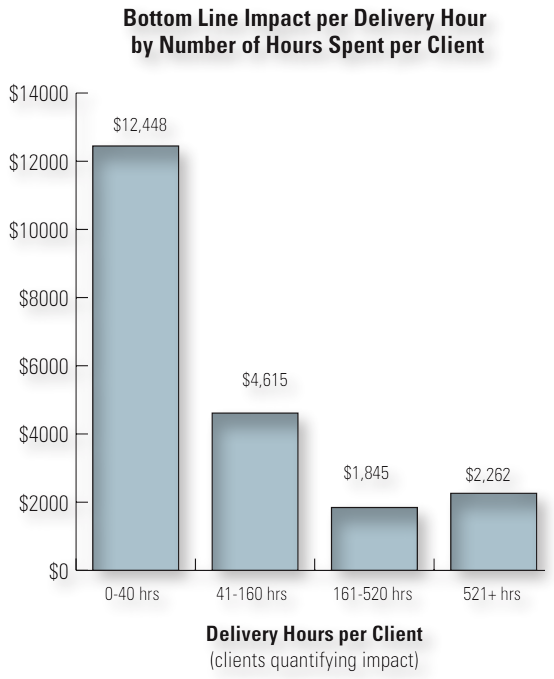


Figure 19: Impact by Years of Being Client

Lack of Familiarity with MEP's Capabilities – Other organizations do not adequately understand the capabilities of the MEP network. Many organizations view MEP narrowly as an engineering resource, with an emphasis on manufacturing process improvement. As discussed above, while these perceptions are true at a high level, they lag behind the reality as centers are beginning (albeit slowly) to expand their capabilities into growth, innovation, green/sustainability and other new areas. Partners must be educated to see MEP's full range of emerging capabilities, and better understand the full array of manufacturers needs.

Lack of Incentives for Cross-Referrals – No real incentives exist to make referrals. Although most receive state investments, centers are generally not part of state government. Further, because they have a different business model, centers are not always well integrated into the traditional economic development landscape. As a result, cross-referrals are inhibited. Unless there are strong personal relationships between MEP center staff and partners, combined with a good understanding of what MEP offers, then partner organizations are unlikely to make cross-referrals.

Inconsistency Among Centers – Trade and professional associations, as well as government programs, indicated that inconsistencies among centers can be impediments to partnering with MEP on a national basis. Several associations indicated that differences in the approach of individual centers made them resistant to deal with MEP as a bona fide national organization. Each center has different priorities with regard to partnerships. As a result, associations and other programs may receive very different receptions from each center. Due to this inconsistency, some partnerships have been developed at the regional or center level, which adds considerable effort for potential partners in building relationships with the national MEP system.

Measurement/Evaluation

The MEP measurement and evaluation system is considered robust as compared to other economic development programs. Interviews indicate that MEP's two-pronged approach, combining a center panel review process and a client impact survey, provide valuable data to both drive strong program performance, and document these impacts for stakeholders. However, three aspects of the current evaluation and measurement approach constrain the program from reaching its full potential.

Incentives for High Performance – First, the system does not measure or provide any benefit for exceptional or strong performance. While the system generates information that can be used to thoroughly evaluate performance, and the panel reviews leverage this information to provide feedback to center management, there is no clear incentive for performance beyond the minimums or above average. Like all organizations, if centers can gain additional benefits for strong performance, they will be more likely to excel beyond minimum requirements.

Reluctance to Invest in New Offerings – Second, centers perceive the evaluation system as reinforcing their reluctance to invest in new service offerings, as centers must achieve minimum federal performance requirements along a variety of metrics which measure their client impact (sales increase/retention, cost reduction, investment) and reach (number of clients impacted and served) per federal dollar. If performance falls below these thresholds, centers can be placed on probation and ultimately lose funding. Centers are reluctant to invest in new services where the revenue and impact generated is uncertain.

Inability to Measure Growth in Value Added and Productivity – Third, the measurement system does not directly measure growth in client value added or productivity. As argued earlier in this paper, these are the key measures by which MEP should evaluate its success. Today, the measurement system tracks increased sales and cost reduction. While these measures are related to value added and productivity growth, they do not clearly and unequivocally capture success in these key measures.

National System Organization

The MEP national system evolved as 60 autonomous centers. This approach has been effective, to some degree, in allowing each center to establish itself with an organizational structure and service mix tailored to the needs of the community and client base in each particular region.

However, this structure misses opportunities to achieve economies of scale, results in duplication of effort among centers, and makes it challenging for NIST MEP to drive national initiatives and strategic priorities throughout the system.

Specific activities or functions are particularly well-suited to national level coordination or investment:

>> Product and service development, as it is has proved inefficient for centers to do it individually;

>> Research on market trends and firm needs, in order to reduce duplication of research among centers, to achieve efficient project scale, and attain large (statistically significant) sample sizes;

>> Research on program performance, again to avoid duplication, achieve statistically significant sample sizes, and achieve efficient project scale;

>> National partnership development, to lay the groundwork for and facilitate local collaborations;

>> Training and certification programs for centers and partners to achieve efficiencies in the delivery of training, and to promote consistency among center approaches; offering training opportunities to service partners is critical to ensure high quality delivery, regardless of whether the services are provided by in-house center staff or 3rd parties;

- Training and mentoring related to outreach and client relationship development are of particular importance, as improvements in these areas directly increase staff utilization and productivity.

>> Identification of best practices and further development of peer-to-peer collaboration opportunities among field staff, both of which require national coordination and data collection.

As discussed in the next section, national coordination and investment in these and other areas may be required to improve the efficiency and effectiveness of these activities.

These changes would not compromise the centers' ability to meet the distinct needs of clients in its region, but would lay the foundation for a stronger, more unified and efficient national network.

SECTION 6

Changing the MEP Model

This section discusses aspects of the MEP program that must change to expand its reach to more companies, and have a greater impact on manufacturing sector performance. The goal is to overcome the constraints discussed in the previous section.

The changes required define a medium-long term future state model for MEP, intended to be 3-5 years into the future. These changes are not expected to be immediate, and some will require legislative changes.

Four elements of the MEP model must change. First, in order to reach more firms and have a greater impact on manufacturing sector performance, the scale of the program must increase. Three additional sets of changes relate to NIST MEP's role as an investor in centers, as a catalyst of change in the center's business and service model, and as a coordinator of national functions and investments.

The Scale of the Program Must Increase

MEP has a very positive impact on its client base, but the program's scale is too limited to have a significant impact on the overall manufacturing sector. Today the program provides in-depth assistance to only 2% of the manufacturing base and 5% of companies with 20-499 employees, generating $9.1 billion in new or retained sales for clients (i.e., sales that would probably not have been generated without MEP assistance). That translates to an annual impact on SME manufacturing sales/output of only 0.3%.[70]

To meaningfully "move the needle" on manufacturing sector performance, a larger program scale is required. To achieve a meaningful impact on SME manufacturing, MEP would need the resources to expand its reach to work in-depth with over 30,000 firms (and serve over 80,000 when workshops and events are included). The basis for 30,000 clients receiving in-depth assistance is that it would approach a reasonable upper limit in terms of market penetration for the 20-499 segment, and could (along with the expansion to a broader range of service offerings) **result in an increase in SME manufacturing output approaching 2.0%.** (Again, this includes displacement effects.) This expanded system would offer substantially greater impact on the manufacturing sector as compared to the current state.

In our future state model, we assumed MEP would expand its reach across all size categories within manufacturing, but the key assumption is related to the core available market of 60 K firms within the 20-499 category that are willing to work with outside assistance providers. In the future state model, it is assumed that the MEP network provides in-depth assistance to 40% of these firms every year.

In order to achieve these results, MEP would need to substantially grow its service delivery capacity. We estimate the required total budget for the MEP network would be $875M. Our future state model estimates the federal investment required to be $406M, and this federal contribution is estimated to leverage an additional $469M in state funds and client fees.

If the federal government were to make these investments, the future state of the system and the results it could generate include (Figure 20): $45-57 billion of sales increase and retention, thereby increasing SME manufacturing output by 1.6-2.0%; $9-11 billion in total bottom line impact; and 250,000 jobs created or retained.

>> The MEP program must change to expand its reach to more companies, and have a greater impact on manufacturing sector performance.

We recommend that MEP establish a program goal to develop this larger system within 3-5 years, the timeline partly determined by the rate at which federal and state tax revenue recovers from the recession.

MEP as Federal Investor in Centers

Another set of recommended changes to the model relate to NIST MEP's role as an investor in centers. These changes are intended to achieve a better "return" for the federal contribution.

Reduce Cost-share Requirement to 1:1 - The first change is to decrease cost-share requirements, and thus the emphasis centers must place on fee revenue. A 1:1 cost-share requirement is consistent with many other economic development programs, and a number of recent legislative proposals. Cost-share and fee requirements have had many positive effects, but an overemphasis on fees has led to a series of issues for centers, including:

>> An overemphasis on repeat clients and longer engagements, which reduce reach and actually diminish client impact by missing 'low hanging fruit" opportunities with new clients;

>> A lack of affordable services for the smallest firms (with less than 20 employees);

>> A reluctance by centers to invest in new service offerings, which initially don't generate as much revenue or impact;

Figure 20: MEP Future State Model (3-5 Years)

MEP Current versus Future State Comparison		
Measure	**Current State (FY 2008 except where noted)**	**Future State (3-5 Years)**
Number Clients – In-depth Assistance	7,412 (typically 7,000-8,500/year)	30,285
Clients Receiving In-depth Assistance as a Percent of All U.S. Manufacturers	2.2% (typical range: 2-2.5%)	9.1%
Percent of Available Market Assisted Annually (in-depth interactions with 20-499 firms willing to work with outside assistance providers)	9%	40%
Number Clients Served (including less intensive interactions)	31,961	83,703
Number Clients Served as a Percent of total U.S. Manufacturers	10%	25%
Budget Total (cash $M)	$274 (FY 2009)	$ 875
- federal investment	$ 110	$ 406
- state investment	$ 66	$ 163
- private/client investment	$ 98	$ 306
Total Center Staff	1,536 [71] (Q2 2009)	3,934
Total Bottom Line Impact	$2.4 Billion	$9-11 Billion
Total Sales Increase/ Retention	$9 Billion	$45-57 Billion
Sales Increase/Retention for MEP Clients as Percent of Total SME Manufacturing Output	0.3%	1.6-2.0%
Total Jobs / Created Retained	53,000	~250,000

>> Barriers to expansion of the program to serve more firms (due to the inability to meet larger cost-share requirements);

>> Barriers to partnerships with other economic development organizations.

The major argument against reducing the cost-share requirement is the risk of losing state funding. However this concern assumes that states would continue providing cost-share at the current levels if cost-share requirements remained at 2:1. In the current fiscal environment, states are likely to continue scaling back their current investments. In calendar year 2009 some states scaled back their investments in MEP centers. And centers are bracing for additional cuts in 2010. In other words, state investment has been in decline despite the cost-share requirement. In this context, the risk of losing additional state funds as a result of reducing the cost-share requirement appears to be limited.

Over the longer term, as state budget outlooks improve, the MEP system's expansion into innovation, technology, growth and sustainability, opens up new opportunities for potential state investment. In FY 2009, states invested approximately $687M in innovation-related economic development investments. Expanding activities in innovation and growth may allow the MEP program to capture a greater share[72] of this state investment, if states see established manufacturers – as well as start-ups – as a source of innovation and entrepreneurial activity. So while it may prove difficult to attract additional state investment in traditional core manufacturing process improvement offerings, MEP's expansion into innovation and technology acceleration may make it a more attractive option.

In addition to changing the cost-share level required, NIST MEP should more severely restrict in-kind cost-share. Many centers apply "in-kind" support to meet their cost-share requirements, which in some cases does not substantially add to the capacity of the system to serve clients. As a result, in concert with the shift to 1:1, in-kind cost-share should be more severely restricted.

Incentives for High Performance – NIST MEP can enhance system effectiveness by creating incentives for strong center performance beyond minimum standards. Today, NIST MEP does not *systematically* employ the resources at its disposal to incent strong performance beyond minimum acceptable levels.

The most important mechanism for influencing center behavior is to incorporate center performance into the criteria for awarding additional increments of new funding. High performing centers will be more likely to secure additional funding for investment in new service offerings or expansion of the center. (See the discussion below related to specifically designating new increments of center funding for new service offerings.) If MEP's budget gradually increases, as proposed by the current administration, new funding increments will become available that can be used to incent strong performance among the centers.

Other incentives are also critical to encouraging strong center performance, such as providing the highest performing centers with additional training funds or opportunities, access to expert resources, or service delivery support from national service delivery teams and contractors. Over the long-term, it may be possible to revise cooperative agreements to offer other incentives to encourage strong performance.

This also implies that NIST MEP will need to modify its center evaluation and scoring system to assess not only whether centers meet minimum threshold performance levels, but also whether they are achieving above average or exceptional performance. To put it simply, a scoring system or dashboard will need to be adopted which quantifies

center performance at different levels. These measures will become critical as MEP shifts resources to incent centers that perform well on both impact and reach measures.

Strategic Review – As an investor, NIST MEP should periodically conduct an in-depth strategic review of each center/cooperative agreement holder. The review process would provide a critical new leverage point during which NIST MEP and the center can assess performance, and negotiate substantial strategic changes, such as a shift in participating partners or a change in state investment. This strategic review would also provide an opportunity for a change in funding level or a realignment of partnerships to better support the mission of the program.

To avoid an undue burden, NIST MEP would conduct the strategic reviews for each center once every 5 years (i.e., 20 percent of the centers would be reviewed each year). At the same time, NIST MEP should conduct a review to simplify the interim center progress reviews to better align with the strategic reviews. The objective would be to keep the overall level of time required to conduct the review process from increasing overall.

For those few centers where performance, based on the strategic reviews, is not meeting minimum thresholds, NIST MEP would have the option to re-compete the cooperative agreement.

As compared with the current annual and bi-annual review processes, the strategic review would have a longer time horizon and would become a focal point for performance evaluation and decisions about the continuation of center funding. Interim reviews would become a summary checkpoint on key performance measures to ensure continued strong performance between strategic reviews.

State Cost-share – In the context of these strategic reviews, and given the proposed reduction of cost-share requirements, MEP should also re-energize its efforts to leverage federal investment by targeting a minimum state cost-share contribution for each center. The MEP program was designed based on a partnership model, with shared federal and state investment. During the strategic review process, each center should be evaluated in part based on the state cost-share it has secured (to meet state and federal economic development objectives).

This target should be instituted after the current recession and state budgetary challenges have abated. The proposed target level is that the state investment should be at least 1/2 of the federal investment, recognizing that the federal role will increase, and state budget levels have decreased.

If the national program dramatically expands its scale, as discussed earlier in this section, then the total combined funding contributed by states would be significantly larger than it is today, though realistically its percentage share of program funding may decline.

While this target level of state investment (1/2 the federal level) would not be a requirement in order for a center to continue receiving federal funding, a lack of state funding will make it more challenging for a center to perform well versus other centers, potentially resulting in missed opportunities for new funding increments and potentially triggering an early strategic review process if performance falls below minimum thresholds.

The state contribution could come from state training funds, or in the form of a fund to offset the cost of client assistance projects (such as the Minnesota Growth Acceleration Program), rather than as a contribution directly to a center's operating budget.

While the target level of state funding would be a minimum of 1/2 of the federal level, a higher state contribution would be viewed as more favorable during the strategic review process and would contribute to improved center performance.

SME Fund – Changing the cost-share requirement to 1:1 should help make MEP services more affordable, while still requiring clients to make an investment in their own improvements. However, to ensure that services are affordable even to the smallest firms, MEP could provide targeted funding to offset the fees for smaller companies with less than 20 employees. Most of the ideas uncovered from the research involve either establishing a fund which can be applied to offset a portion of the cost of projects for smaller firms, or setting up a voucher system where firms can obtain and apply vouchers to cover a portion of the costs of eligible projects. Figure 21 includes some examples.

While there are a number of approaches to establishing this fund or voucher system, the simplest approach might be to establish a fund at the federal level, managed by NIST MEP, and allocate a quarterly allotment to each region. Only companies with 20 or fewer employees would be eligible. Companies would be required to match the funds, i.e., pay a portion of the project cost. Besides the size eligibility criteria, centers would naturally be incented to use the funds for companies and projects that generate high impact and contribute to strong center performance – since as discussed above, high performance will be measured and rewarded.

Centers could also propose additional criteria to determine which clients and projects are eligible. For example, some centers might propose reserving the fund for state defined target industries, or giving preference to renewable energy related projects or companies.

Measurement and Evaluation – The measurement system should be modified in four important ways:

>> As discussed above, any new performance measurement system should quantify positive and above average performance, as well as minimum thresholds. The current measures are designed to primarily assess whether centers are meeting minimum performance thresholds. Like their client companies, the MEP system needs a simple dashboard of key metrics that can be used as a starting point for monitoring center performance.

>> The system should find ways to directly track growth in total value added and productivity (value added per employee). These measures should define the program's success, and thus they must be tracked and highlighted continuously.

>> The system must add metrics related to innovation and growth, in particular revenue growth generated by new products, entry into new markets, and international/export sales. Even current questions should be re-examined and potentially revised to capture additional and more accurate information related to growth.

>> NIST MEP should establish an approach for 5-year strategic reviews, building on the evaluation criteria and tools developed for panel reviews.

While these adjustments are being made, NIST-MEP, with input from centers, should take the opportunity to revise and improve the client survey process and measurement system to ensure continued confidence in the results generated. It is beyond the scope of this paper to re-engineer the measurement system in detail. Any such effort to improve the system should be highly collaborative and involve a range of stakeholders. The objective here is to identify the major changes required to expand the reach and performance of the MEP national system.

Catalyst of Service Expansion and Innovation at Centers

Another component of the model that must shift, is that NIST MEP must play a more active role as a catalyst of change at centers. The MEP network is a distributed group of 60 autonomous entities, in which NIST MEP is a major investor. However there are co-investors, and MEP is often only one program among several at each center's parent/host organization. As a result, though NIST MEP can exert significant influence over centers, the relationship is not a parent/subsidiary or headquarters/branch structure. NIST MEP must define its preferred model (or models) for centers, and systematically use its resources and influence to encourage centers to move toward this approach.

Figure 21: Making Services Affordable for Small Firms

Minnesota Growth Acceleration Program. In Minnesota, the Growth Acceleration Program (GAP) has been established to pay for a portion of the cost of MEP center (Enterprise Minnesota) project assistance. The fund pays a larger percentage of the project for the smallest firms. For example, a company with fewer than 50 employees must match $1 for every $3 dollars of GAP investment. On the other end, a company with 101 to 250 employees must match three dollars for every $1 of GAP investment. The GAP program provides funding directly to manufacturers to help reduce the cost of MEP services.

Foreign Innovation Programs – Vouchers. Manufacturing assistance and innovation programs in foreign countries have also created mechanisms to reduce the cost of services, while allowing clients to decide for themselves when and where to apply these funds. One approach is the provision of vouchers to pre-qualified SMEs to purchase "innovation services" of their choice. In the UK, research sponsored by the National Endowment for Science, Technology and the Arts (NESTA), suggests that certain types of "creative businesses" help firms innovate more effectively by addressing behavioral failures, such as risk aversion, status quo bias and myopia. Accordingly, NESTA has proposed the use of innovation vouchers for firms to purchase services from creative industries.

Other countries have also used vouchers in similar ways. For instance, Nutek, the Swedish agency for economic and regional growth, provides funding to small businesses to purchase external services to help develop new products or services. Alberta, Canada has implemented a pilot project providing innovation vouchers that SMEs can use for specialized services, relevant business services, technology commercialization, product testing or certification. In the Netherlands, knowledge vouchers for research or consulting are intended to facilitate knowledge transfer between SMEs and knowledge providers, including companies, research institutions and educational institutions.

Other countries have also implemented similar voucher programs intended to encourage companies to purchase services for research projects with designated universities or technology centers. Most voucher amounts are relatively small and require the company to co-pay for the services. The company selects the service provider with which it wishes to work.

NIST MEP should promote two categories of change in center models. They should drive centers to:

>> Expand their range of service offerings; and

>> Spur innovation in their business and delivery models.

Expanding the Range of Services

MEP's traditional focus on lean and process improvement is aimed at primarily increasing productivity (value added per hour), but this focus is a less efficient way of generating increases in total manufacturing output and value added. Assisting companies to grow their top line revenue and innovate will increase total value added and output, as well as productivity.

New Money Awarded Specifically for New Growth, Innovation and Green/Sustainability Services – To overcome the barriers to centers investing in new services and skill sets, new increments of federal funding for centers should be *specifically designated for these new services*. Otherwise, given cost-share requirements and evaluation measures, many centers will be slow to invest in new areas required by manufacturers (since these new service offerings may not generate sufficient revenue or impact in the short-term).

The President's "Framework for Revitalizing American Manufacturing"[73] proposes to double the MEP budget with gradual increases through FY2015. As discussed above, our future state model suggests that to reach a greater number of firms, federal investment in the program should be closer to 3.7 times the current level. Regardless, as new increments of money become available, significant portions of these funds should be specifically designated in new service offerings related to growth, innovation and sustainability. As a result, the MEP network will have a significant set of activity in both process improvement services (core) and in growth, innovation and sustainability (new).

In our future state model we assumed that growth, innovation and sustainability would eventually become 40% of the network's activity in 3-5 years (versus 60% focused on core lean, process improvement and quality related services). In this model, both core and new service offerings grow substantially and reach a much larger number of companies; however new growth, innovation and sustainability services grow at a faster rate and thus become a significant portion of total services. While we cannot predict the amount of federal funding that becomes available, the 60%/40% breakdown between core versus new services is a reasonable long-term goal and guideline for determining what portion of the new increments of funding should be designated for new services.

These new funding increments should be competitively bid, to ensure that centers develop and attract people with the appropriate skill sets – either through partnerships or new hires. Redeploying staff that primarily have lean/process improvement skills has not proven to be effective in offering growth and innovation services. Additional staff and partners with appropriate skill sets will be required to complement existing center capabilities. The UK Manufacturing Advisory Service program contracts directly with management consulting firms and innovation consultancies to provide growth services to clients. In contrast, the proposed model for MEP is to act as strategic account managers that manage and coordinate service delivery to clients. Nevertheless, the UK approach illustrates the importance of ensuring that staff or partners with the proper skill sets are brought into the program.

The new increments of funding should be used to invest in new service areas that centers have been reluctant to invest in, but which are critical to improving the health of manufacturing. Specifically, the funding increases should be reserved for:

>> Top-line growth and innovation, including:

- Technology acceleration and commercialization
- Market development and diversification
- Product development assistance, lean product development
- "Front end" new product and growth idea generation, prioritization, planning
- Marketing and selling
- Market and competitive research
- Development of new green/sustainable products or entry into "green" markets

>> Leadership and management skills development, including:

- Strategy and planning
- Executive coaching
- Other leadership training (except lean executive programs)

>> Export/international growth assistance

>> Expansion of lean services to include "green/ sustainability" elements, such as energy efficiency, reduction of carbon footprint, waste minimization, green design, etc.

It is not feasible to drive all centers to have the same standard core skill sets, as each one has a different regional market with a different mix of local industries, and differences in market size and density. Some centers serve rural areas where it is difficult to offer a wide a range of service offerings, because outside expertise is not readily available in these regions. In other cases, the center's size is too small to effectively offer expertise in a wide range of areas. This is true even when using outside service partners, because center project managers, account managers, and business development people must have enough knowledge and skill in each service offering to credibly and effectively explain services to clients and manage outside partners. Thus it is difficult for a small center, even if it delivers a large percentage of its services with 3rd party service partners, to offer *too broad* a range of services.

However, NIST MEP can use its resources to encourage centers to expand its range of services, adding various types of growth, innovation, sustainability and other services that the market requires. The NIST Account Manager will have a critical role here in working with each individual center to design a plan to expand service offerings. Ultimately, while centers will not be highly standardized, they will end up with increasing commonality in service mix over time.

Designating specific new increments of funding for growth, innovation and sustainability services will by itself cause centers to overcome their resistance to investment in new services. For that reason, we have not suggested that measures be changed to encourage investment in new services.[74]

Positioning MEP as the Field Implementation Network for other Federal Agencies – The expansion of MEP service offerings also provides an important opportunity for the network to become the field implementation force for other programs that want to reach manufacturers. Already, MEP helps the Environmental Protection Agency (EPA) to reduce hazardous waste from manufacturers, helps the Defense Logistics Agency to find suppliers of difficult to source parts, helps the Department of Energy to increase energy efficiency, and helps the Department of Labor to enhance manufacturing workforce skills. Increasingly MEP can exploit opportunities to help other agencies achieve their objectives, as long as they are compatible with MEP's mission, capabilities and metrics.

Spurring Innovation in Center Service Delivery and Business Models

NIST MEP must also spur innovation in service delivery models, in order to reach more companies and generate more economic impact. There are a variety of changes described below that NIST MEP should encourage at centers.

Innovation in Service Models, such as Hybrid Models, Peer-to-Peer Groups and Web Tools – NIST MEP should encourage the development of new service models that generate impact in an efficient manner. Currently, much of MEP centers' service delivery and measurable impact is achieved through in-depth, one-on-one assistance projects. The MEP system needs to find new ways to generate higher impact per hour of service delivery.

Figure 22: Hybrid Model: Example of ExporTech

ExporTech is an example of a hybrid service model. ExporTech assists groups of 6-8 companies to develop a plan to enter or expand in global markets. The program is built around three group sessions spread over 2.5 months, with individual coaching in between sessions. The model benefits from the efficiency of group sessions, which substantially streamlines the number of hours required to provide training and expert resources to the companies, but also offers individual coaching to make sure each client's needs are satisfied. Results from the program to date yield both high impact and reduced delivery hours per company.

One example is "hybrid models" which combine the lower cost of group education with the higher impacts of one-on-one implementation and coaching. Several examples of these hybrid models have now emerged in the system, including the Eureka! Winning Ways multi-company projects, ExporTech and various multi-company lean programs (see Figure 22). Greater use of these models should efficiently generate impact without expending as many hours per company, thus allowing centers to assist more companies.

Peer-to-peer learning is also a critical model given the importance of helping SME leaders face difficult competitive challenges. One of the most effective and efficient ways to motivate change among leaders is to offer them the opportunity to benchmark against each other, as well as coach each other, in structured group interactions. The Enterprise Minnesota center's Peer Council has used this approach very effectively to motivate change and improvement at the CEO level. It also is a highly efficient way to conduct outreach and persuade companies to invest in their companies, as compared to expending many hours on individual outreach to each firm.

Web-based tools can also be ways of both enhancing value for the customer and reducing cost at the same time – making the most from each federal investment dollar. It also is an efficient way of expanding reach and market awareness to a larger portion of the market. The MEP network has limited experience with web tools (the new National Innovation Marketplace is a recent example). The current assumption is that web tools would supplement, and not replace, direct hands on consulting assistance.

Partnership Incentives – As discussed in the previous section, MEP has a different model than other economic development organizations. Revenue requirements and a lack of understanding of MEP's capabilities often inhibit partnership development, resulting in missed opportunities for centers to improve their effectiveness in marketing and referrals, service delivery and state relationship development. In addition, while partnerships yield significant benefits, they can take time to develop and may not contribute immediately to a center's bottom-line performance.

To overcome these barriers to partnership development, NIST MEP should offer incentives to encourage centers to take the time to become familiar with the capabilities of potential partners and other economic development organizations, and to discuss potential collaboration.

Specifically, we propose:

>> Offer grants to local/state partners to engage in outreach on behalf of centers. Some centers already use this model (e.g., Impact Washington), by paying state or local economic development partners for marketing and outreach services aimed at informing their clients about MEP services. One way to accomplish this would be modeled on the Census Bureau's 2010 partnership outreach program in which NIST MEP provides targeted organizations with a series of annual grants for MEP-related outreach to companies. The grants might average about $50 K per center or region (but would vary depending on the size of the region and other factors), and would require no federal cost-share. Grant recipients would be measured based on the number of referrals made directly to MEP centers, and the number of those referrals eventually served as clients. The grants could be used for company visits and sales calls, as well as other business development activities, such as participation in joint state or regional events.

>> Provide direct funding, not subject to cost-share requirements, for MEP centers to engage in partnership relationship development. The funding would encourage MEP centers to spend time working with state economic, workforce, environmental, and other agencies whose policies and investments could impact manufacturing. The grants could be used to fund time spent educating partners on MEP services and target clients, investigating the service capabilities of potential partners, and working with partners to plan and orchestrate joint activities and events. Centers could use these resources to develop partner "asset maps" designed to identify the capabilities of partners that might contribute to MEP's mission, as well as to support collaborative planning exercises. Key partners that might be targeted include the delivery networks of the Small Business Development Centers, the international trade development organizations (Federal, state, and local), or the state's community college network.

>> Establish a "State Manufacturing & Cluster Strategy Development Fund" to support specific collaborations with priority state partners, either to develop overall state manufacturing strategies or cluster strategies.

>> At the national level, NIST MEP should identify a target list of priority organizations with which to build strong national partnerships to support the manufacturing sector and to facilitate local center partnerships. These include national trade and professional associations, federal agencies, or other groups. We suggest the following three criteria for determining which partnerships to prioritize:

- **Outreach -** Will the organization be able to assist MEP centers in reaching a large number of manufacturing firms?
- **Service Capabilities** – Will the organization provide a skill set that MEP centers need to better serve clients?
- **Resources** – Will the organization be able to bring funding or other resources to support assistance to manufacturers?

With other federal programs, there may be opportunities to collaborate on: joint marketing efforts; training to cross-market each other's services; joint product development; and facilitation of local collaboration with centers. With associations, national partnership activities would explore ways that MEP can provide content or services to their memberships, in exchange for opportunities to reach new audiences and build a stronger brand identity for the MEP program.

National Service Delivery / Rapid Response Teams – NIST MEP should selectively mobilize national service delivery teams to supplement local center delivery capacity. These teams can be used for two purposes:

>> To test and introduce new service offerings (as was done with Eureka! Winning Ways, ExporTech and Technology Scouting) so that centers do not have to invest prematurely before new services are fully tested. These teams will also help MEP to accelerate the process of expanding MEP's range of service offerings into new areas. These teams will be tightly linked to and guided by the product and service teams discussed below.

>> To respond to immediate needs and opportunities (e.g., disaster response, opportunities to work on a national basis with associations, severe economic adjustments related to industry downsizing).

National Product/Service Teams – Because MEP is a distributed system of semi-autonomous centers, the process of developing and introducing new product and service offerings can be complex. Many ideas for effective new services emerge from individual centers and are then disseminated to the rest of the network. At the same time, NIST MEP has also successfully spearheaded the deployment of new programs at the national level. Both nationally-driven and center-led models have merits. National initiatives offer greater scale, coordination and can reduce duplication of effort among centers. However, centers are often closer to the marketplace and can sometimes better evaluate new product offerings and provide "real time" feedback from potential customers. Thus, MEP product and service offerings should be coordinated and managed by national teams that include staff from centers, NIST MEP, outside partners, and external content experts, combining nationally-driven and center-led product development models.

These teams would be provided with resources that could be allocated to pilot fund new products and deploy successful ideas post-pilot. These teams could be used to develop structured product development and deployment plans, identify promising new product/service opportunities, reduce the potential for duplication among centers, achieve economies of scale in collaborative development efforts, and ensure center buy-in as emerging new services are being developed. As an integral part of their work, the teams would look for promising new services to be tested and later, if successful, deployed nationally. They would also help provide immediate client feedback on how well these new services are meeting market needs. To receive funding for their product development activities, each team would be required to develop objective criteria and timetables for assessing whether to continue making investments in new product development or project deployment activities.[75]

Based on past experience, the teams should be managed based on an approach that rapidly develops and tests new services with customers, then adjusts the design based on market feedback. Failure would be expected on some new products and services, but pilot tests would quickly confirm whether a product has potential, and thus whether it deserves additional investment.

Use of Outside (3rd Party) Service Delivery Partners – Centers are evaluated based largely on their performance in terms of generating impact and reaching a large number of clients. Some centers are able to perform well according to these measures with a large percentage of services delivered by in-house staff. Others perform well while delivering most of their services using outside service partners. Each center determines its own model based on a number of factors, including local market conditions, the availability of qualified 3rd parties in each service region, staff skills, and other factors.

Currently 71% of service delivery hours are provided by center in-house staff, much of it focused around the MEP network's core skill sets in lean, process improvement and quality. While each center determines its own delivery model, our analysis suggests that centers in general will need to consider expanding the percentage of services delivered with outside partners over the next several years. An increased use of outside partners will probably be required for centers to:

1. *Respond to a broader and changing set of market needs.* Increased use of outside service delivery partners will allow MEP centers to more easily expand their range of service capabilities. Outside service delivery is particularly important for growth and innovation services, which require new skill sets, and where private sector providers exist, but may have difficulty reaching the market without MEP centers (as centers can reduce the cost of sales). It is sometimes easier, and reduces risk, for centers to partner with other organizations to gain new skills sets, than try to hire them in-house.

2. *Adjust capacity to match demand.* Increased use of outside delivery partners provides flexibility to adjust service capacity to demand. The recession forced a number of centers to reduce internal staff (fixed cost), and become more reliant on outside service partners (variable cost).

3. *Expand reach to a larger number of clients.* This model means that on average, each center staff person can reach (substantively impact) more clients, as their time is not as consumed by in-depth delivery engagements. This also means that the federal investment is more appropriately focusing its resources, by reducing the amount of money it spends on downtime of underutilized in-house delivery staff. As shown in Figure 23, the client survey data suggest that on average centers with a higher percentage of in-house service delivery tend to impact fewer clients per million dollars of center budget, though this is only one factor that determines a center's reach.[76]

Increased use of outside service delivery shifts the role of MEP center in-house staff to focus more on outreach, strategic client management, project management, and qualification of partners – as opposed to service delivery. MEP center staff should maintain client relationships, even when service delivery is shifted to a 3rd party. MEP center staff should play a critical role in defining and managing projects, ensuring that client needs are met, delivering alongside 3rd parties, and working with the client to see and manage the bigger picture, i.e., to focus on key strategic issues and jointly define an improvement plan and growth path for the company.

Figure 23: Number of Impacted Clients (Reach) per $1M of Center Budget

Interestingly, it is often thought that there is a tradeoff for centers that use a greater percentage of outside service delivery, in that they may not generate as much impact. But the data suggest that differences in center impact performance – measured as bottom line impact per million dollars of center budget, or per delivery hour – are not explained by the percentage of delivery performed in-house. Other factors are much more important in determining impact performance.[77]

Finally, it should also be noted that use of outside partners helps to create opportunities for private consultants and other organizations to offer services economically, since centers have the benefit of federal and state investment to support outreach to small firms. The UK Manufacturing Advisory Service (MAS) program sees its role as developing the market for private consultants.[78] An increased emphasis on outside service delivery at MEP would presumably further develop the consulting industry that serves small firms in the U.S..

Centers that employ a greater percentage of outside service delivery, generate revenue from project management fees (which cover the centers' cost and value related to outreach, needs assessment and qualification of service partners) and from service delivery hours working side by side with outside partners. As a result, these centers are able to generate revenue to meet cost-share requirements and are able to capture a portion of that revenue to sustain and expand the operations of the center.

The outside service model increases the importance of outreach and marketing skills of center staff. The unique skills required in this role are already increasingly recognized by center management, who describe the importance of having staff with the experience to have a "strategic conversation" with top management to identify their priority issues. The role of center staff thus becomes more focused on becoming a strategic account manager to C-level clients, identifying their critical needs, defining a plan for growth and improvement, and bringing in qualified expert resources to implement the game plan.

To be clear, the objective is not to shift all centers to an outside service delivery model, but to take a more balanced approach that combines internal and outside resources. Internal service delivery staff have been very effective at delivering process improvement services, and internal expertise is required to effectively manage 3rd party service partners. In addition, centers in smaller rural markets may need to continue to offer services predominantly in-house due to a lack of local expertise. And finally if centers are able to perform well – in terms of reaching clients, expanding the range of services, and managing capacity – while delivering services predominantly in-house, then they should not be discouraged from doing so. However we believe most centers will need to use outside service partners more extensively to perform well along these dimensions. Each center, working with its NIST MEP Account Manager, should develop its own plan for exploring an increased use of outside service partners. For purposes of the future state model, we have assumed that in-house service delivery hours for the national network are reduced over the next 3-5 years from 71% to 50%.

Motivating Centers to Innovate Their Model – NIST MEP has several levers that it must systematically employ to drive centers to perform well and adopt these preferred business models (e.g., innovation in service models, expanded range of offerings, openness to use of outside service partners, etc.). These levers include:

>> Awarding new increments of funding partly in response to adopting NIST MEP's preferred model;

>> Strategic review of each center every five years;

>> Providing training, expert resources, and service delivery support in response to adopting this model;

>> Employing NIST MEP Account Managers to encourage center behavior in these directions.

Coordinator of National Functions and Investments

Specific activities are particularly well-suited to national level investment or coordination. Performing these activities on a national level captures economies of scale and

can avoid duplication of effort among centers. National initiatives can also drive key improvements and NIST MEP priorities throughout the system.

Our recommendations include:

>> Product and service development should be expanded at the national level, as it is has proved inefficient for centers to do it alone, and centers have been reluctant to invest in some new service offerings.

>> National research on market trends and firm needs should be expanded, to provide a shared baseline of market information that can be used for product development and marketing decisions. Leading these efforts at the national level also reduces duplication of research effort among centers, and achieves more effective and accurate results.

>> Additional research on program performance would be extremely valuable to determine how to maximize client impact and improve program effectiveness. Conducting this research and analysis on a national level avoids obvious duplication and inefficiency.

>> Investment in training and certification programs for center and partner staff should be expanded to achieve efficiencies in the delivery of training, and to promote consistency among center approaches. Training opportunities, as discussed above, are also a lever to influence center performance and changes in their business models.

- In particular, a major national investment should be made in training related to outreach and development of client relationships. In order to assist companies, centers must first convince companies that they have opportunities for improvement and growth, and that MEP and its partners can help. The more effective MEP centers are at outreach and marketing, the better utilized they will be and the greater the impact they will have on the economy. So an investment in this type of training is an investment in productivity of the center network. This is an obvious area where the system should invest and coordinate at the national level to be cost effective. This activity might be most effective if it focuses on mentoring, coaching and peer-to-peer learning, as opposed to classroom training.
- Training and development investment should be focused on center leadership and management as well as field staff. Effective leadership is just as important to center performance as delivery and outreach skills.

>> The national system should expand its efforts to systematically share best practices and offer peer-to-peer collaboration opportunities among field staff. This effort requires national data collection to identify best practices and should be coordinated with NIST MEP performance research. This should include funding opportunities for center staff to collaborate on projects and learn from each other.

>> National partnership development (with other federal and state programs, non-profit service providers, and associations) will facilitate local collaborations – achieving significant time savings for centers, and making the MEP network more attractive to national organizations who do not have to coordinate with 60 separate entities.

- One of the objectives of this partnership development effort should be to position the MEP network as the field implementation force for other programs that want to reach manufacturers. As mentioned above MEP is already collaborating with the EPA, DOE, DOL, and DLA to reach and service manufacturers. An expanded range of offerings should allow MEP to exploit opportunities to help other agencies achieve their objectives.
- NIST MEP should also expand its presence at the regional level to facilitate partnership development. NIST MEP Account Managers are already deployed at the regional level, and expanded regional capacity would allow them to be more effective at facilitating collaboration between NIST MEP, MEP centers, and state and regional partners.

SECTION 7

Summary of Recommendations for MEP

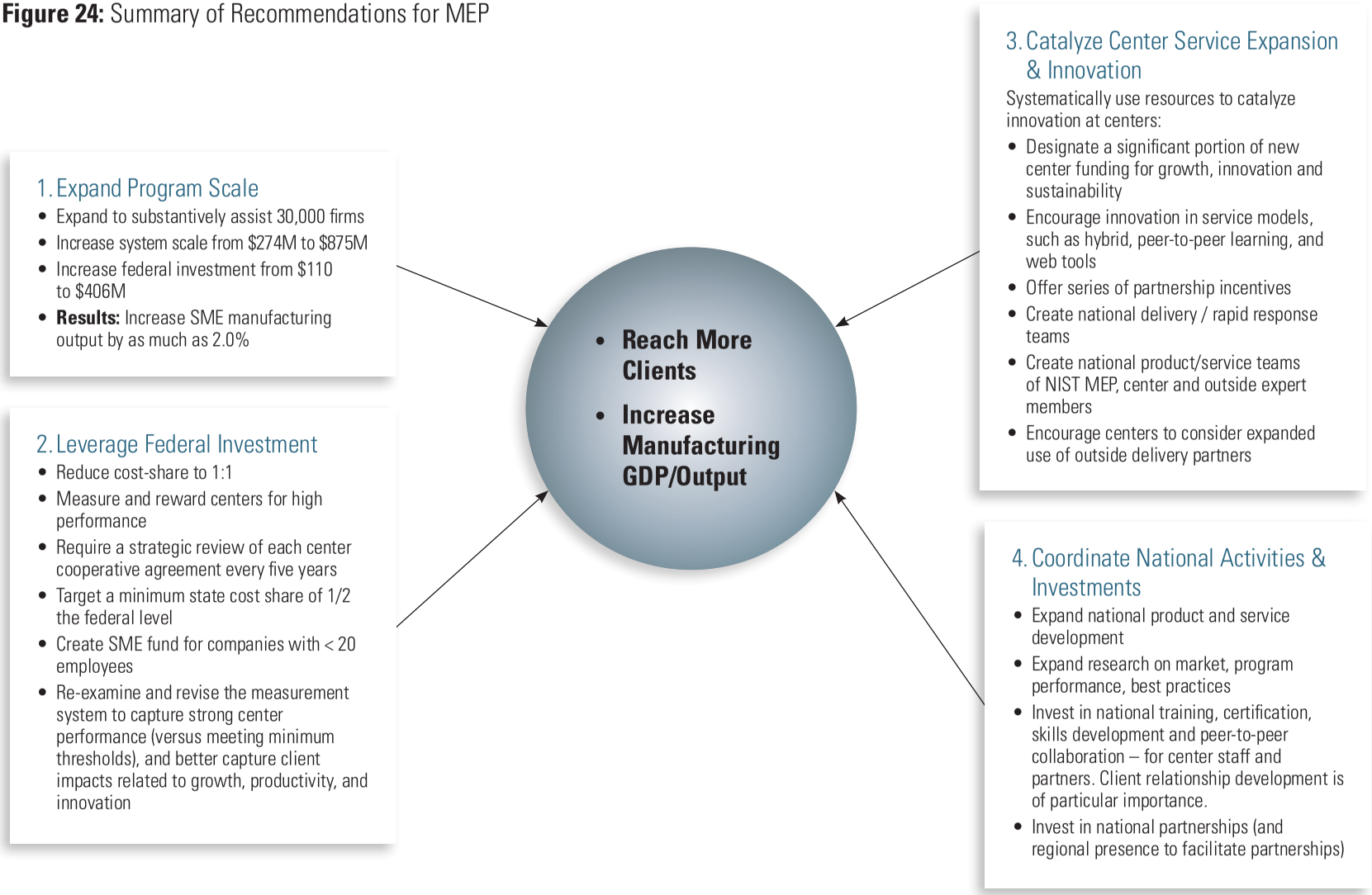
Figure 24 provides a summary of recommendations for MEP, in each of the four areas discussed in Section 6:

1. Expanding program scale
2. Leveraging the federal investment
3. Catalyzing service expansion and innovation at centers
4. Coordinating national activities and investments

These recommendations taken together define a future state model for MEP in 3-5 years. **The recommendations are integrated and reinforce each other, and should not be taken individually.** For example, decreasing the cost-share requirement is necessary to dramatically expand program scale, and will make it economically feasible for centers to expand into new service offerings. Expanding the range of service offerings will require specifically designating new increments of center funding for new growth, innovation and sustainability services. The impact of each recommendation is either magnified, or made more efficient, by the others. The result will be an MEP network that assists 4 times as many firms as it does today, and delivers services in a highly efficient manner that provides a high return to the federal investment.

Nothing short of the future of manufacturing is at stake. With a modest federal investment, that leverages state and private sector funds, we can renew our commitment to a strong manufacturing base – where growing sectors are outpacing declining ones, where thousands of firms are not only improving their manufacturing processes, but are developing innovative new products, entering global markets and capturing a greater share of green market opportunities, and where MEP is providing indispensable assistance to the thousands of small and mid-size manufacturing firms that make a major contribution to U.S. economic prosperity.

Figure 24: Summary of Recommendations for MEP



Endnotes

1 NIST MEP Overview Presentation, February 2010, and NIST MEP provided client data. MEP tracks two categories of clients: 1) those who received in-depth or substantive services that are likely to generate measurable impact on performance, including sales growth or retention, cost reduction, employment increase or retention, or new investment; and 2) clients that received less intensive services, such as training and workshops.

2 NIST MEP, *Delivering Measurable Results to Its Clients,* Fiscal Year 2008 Results, January 2010.

3 *The Future of the Hollings Manufacturing Extension Partnership, Next Generation MEP Strategy,* December 2008.

4 Bureau of Labor Statistics.

5 National Science Foundation, Division of Science Resources Statistics, *National Patterns of R&D Resources: 2007 Data Update,* NSF 08-318, 2008; and National Science Foundation, Directorate for Social, Behavioral, and Economic Sciences, *U.S. Business R&D Expenditures Increase in 2007, Small Companies Performed 19% of Nation's Business R&D,* NSF 09-316, July 2009.

6 Bureau of Economic Analysis, Gross Domestic Product by Industry Accounts.

7 Bureau of Labor Statistics, Business Employment Dynamics.

8 Bureau of Labor Statistics, Business Employment Dynamics; and Stone & Associates, *Competing Against Manufacturing in Low Cost Regions: Focus on China,* Final Report, March 2004, prepared for NIST-MEP.

9 U.S. Economic Census 2002; and Manufacturing Performance Institute, *Next Generation Manufacturing Study: Overview and Findings,* prepared for the American Small Manufacturers Coalition, June 2009.

10 SME leadership and innovation is discussed in section 2, based on a variety of sources cited there.

11 Report entitled, *Rising Tigers Sleeping Giant,* by the Breakthrough Institute and Information Technology and Innovation Foundation, quoted in Manufacturing News, December 15, 2009; and Press Release from U.S. Senator Sherrod Brown's office, November 4, 2009, summarizing report from Blue Green Alliance entitled *Building a Clean Energy Assembly Line: How Renewable Energy Can Revitalize U.S. Manufacturing and the American Middle Class.*

12 Census Bureau, Survey of Business Owners, 2002; and Stone & Associates, *NIST-MEP Market Research and Analysis Project,* 1997.

13 See citations in Section 2. Interviews with centers, along with results from the Georgia Manufacturing Survey 2008, indicate that private consultants have a limited presence in the small firm market. *(Innovation in Manufacturing: Needs, Practices and Performance in Georgia, 2005-2008, Jan Youtie et al; Georgia Tech Program in Science, Technology, and Innovation Policy, October 2008).*

14 The Business Dynamics Statistics series from the US Census Bureau indicates that manufacturing establishment "exit rates" for firms of 1-2 years of age (start-ups/early stage) are significantly higher than established firms. As an example, for the year 2005 (the most recent year available) establishment exit rates for establishments within firms that are 1-2 years old are 2 to 6 times the average exit rate for firms of all ages in each size category.

15 Conclusions based on study teams' knowledge of programs, plus a review of various National Governors Association (NGA) and SSTI reports on science and technology based economic development, and interviews with SSTI. Studies include: NGA, *Innovation America: A Final Report, 2007;* SSTI, *A Resource Guide for Technology-Based Economic Development,* August 2006; NGA Center for Best Practices Issue Brief, *Enhancing Competitiveness: A Review of Recent State Economic Development Initiatives*—2005, published May 2006.

16 See discussion and citations in Section 3.

17 While this state investment would not be a strict requirement, centers that lack state funds may be disadvantaged in terms of performance, which could in turn lead to missed opportunities for new increments of funding and other resources.

18 As long as these objectives are consistent with MEP's mission and metrics.

19 NIST MEP Overview Presentation, February 2010, and NIST MEP provided client data. MEP tracks two categories of clients: 1) those who received in-depth or substantive services that are likely to generate measurable impact on performance, including sales growth or retention, cost reduction, employment increase or retention, or new investment; and 2) clients that received less intensive services, such as training and workshops.

20 *The Future of the Hollings Manufacturing Extension Partnership, Next Generation MEP Strategy,* December 2008.

21 Bureau of Economic Analysis.

22 National Science Foundation, Division of Science Resources Statistics, *National Patterns of R&D Resources: 2007 Data Update,* NSF 08-318, 2008; and National Science Foundation, Directorate for Social, Behavioral, and Economic Sciences, *U.S. Business R&D Expenditures Increase in 2007; Small Companies Performed 19% of Nation's Business R&D,* NSF 09-316, July 2009

23 Bureau of Labor Statistics, Current Employment Statistics.

24 Small Business Administration data by firm size, 2006, based on data provided by the U.S. Census Bureau.

25 Based on 2002 Economic Census Data; 2007 data by establishment size class is not yet available.

26 Based on the U.S. Census Bureau, Business Dynamics Series dataset.

27 Edward Lowe Foundation, www.youreconomy.org. Data source: D&B Longitudinal data series.

28 *Innovation and Product Development in the 21st Century,* Hollings Manufacturing Extension Partnership Advisory Board, December 1, 2009.

29 Output is parallel to firm sales, and includes purchased materials and services that are predominantly produced domestically and thus also drive U.S. income and wealth.

30 Census Bureau as reported in *Making a Difference for America's Manufacturers,* NIST MEP, 2009.

31 Manufacturing Performance Institute, *Next Generation Manufacturing Study: Overview and Findings,* prepared for the American Small Manufacturers Coalition, June 2009.

32 Press Release from U.S. Senator Sherrod Brown's office, November 4, 2009, summarizing report from Blue Green Alliance entitled *Building a Clean Energy Assembly Line: How Renewable Energy Can Revitalize U.S. Manufacturing and the American Middle Class.*

33 Breakthrough Institute and Information Technology and Innovation Foundation, *Rising Tigers Sleeping Giant: Asian Nations Set to Dominate the Clean Energy Race by Out-investing the United States* November 2009.

34 *Rising Tigers Sleeping Giant*

35 The characterizations in this section are based on repeated conversations with MEP center practitioners, and confirmed by recent published observations, including Bob Kill, Enterprise Minnesota, "The Future of Manufacturing" in *The State of Manufacturing 2009: A Comprehensive Survey of Minnesota's Manufacturers* and Doug Hall, Eureka Ranch, presentation at 3-10-10 webcast, *The Secret to Selling Innovation to Small and Medium Size Manufacturing Companies.*

36 Roy Rothwell, Mark Dodgson, "External linkages and innovation in small and medium-sized enterprises," *R&D Management,* Volume 21 Issue 2, May 2007.

37 *Innovation and Sustainability: Highlights from the 2008 Georgia Manufacturing Survey,* Georgia Tech School of Public Policy and the Georgia Tech Enterprise Innovation Institute, 2008.

38 *The National Institute of Standards and Technology's Manufacturing Extension Partnership Program: Report 1 Re-examining the Core Premise of the MEP Program,* National Academy of Public Administration. September 2003.

39 Census Bureau, Survey of Business Owners, 2002; and Stone & Associates, *NIST-MEP Market Research and Analysis Project,* 1997.

40 Manufacturing Performance Institute.

41 Joseph Astrachan, Ph.D., editor, Family Business Review, Family Firm Institute.

42 This section is largely extracted from Stone & Associates, *Competing Against Manufacturing in Low Cost Regions: Focus on China, Final Report,* March 2004, prepared for NIST-MEP.

43 Conclusions based on study teams' knowledge of programs, plus a review of various National Governors Association (NGA) and SSTI reports on science and technology based economic development, and interviews with SSTI. Studies include: NGA, *Innovation America: A Final Report,* 2007; SSTI, *A Resource Guide for Technology-Based Economic Development,* August 2006; NGA Center for Best Practices Issue Brief, *Enhancing Competitiveness: A Review of Recent State Economic Development Initiatives—2005,* published May 2006.

44 Analysis of the Census Bureau, Business Dynamics dataset covering 1990-2005 indicates that firms 5 years or older represented 43% of new jobs created in firms with less than 500 employees, where firm age can be identified.

45 This chapter can be skimmed if the reader is already familiar with the program.

46 The data were aggregated from the MEP national survey of center clients reporting company's performance through the 4th quarter of 2006 to the 1st quarter of 2008. Of more than 10,700 clients completed the survey, 8,919 companies quantified impacts from MEP assistance in terms of sales increases/ retention, cost reduction, or job created/retained.

47 NIST MEP, *Delivering Measurable Results to Its Clients, FY 2008.*

48 $3,697 of federal investment per job, according to EDA's Fiscal Year 2008 Annual Report.

49 Stone & Associates, *Small Business Assistance Partnership Project,* prepared for NIST MEP, August 2006.

50 *The Future of the Hollings Manufacturing Extension Partnership, Next Generation MEP Strategy,* December 2008.

51 This shift was prompted in part by the National Academy of Public Administration (NAPA) report on MEP, *Report 2: Alternative Business Models*, May 2004

52 NIST MEP, *Delivering Measurable Results to its Clients,* FY 2008.

53 Furthermore, that percentage is overstated because it includes sales increases for clients that may "displace" sales of other domestic manufacturers. Source: 0.3% calculated based on MEP FY 2008 client sales increase and retention ($9.1mm) divided by the estimated share of total gross manufacturing output accounted for by small and mid-size establishments (estimated by applying 2002 Economic Census data by size class to 2007 total manufacturing output from the Bureau of Economic Analysis).

54 *Innovation in Manufacturing: Needs, Practices and Performance in Georgia, 2005-2008,* Jan Youtie et al; Georgia Tech Program in Science, Technology, and Innovation Policy, October 2008.,

55 Bob Kill, Enterprise Minnesota, Chapter 5: *The Future of Manufacturing.*

56 Georgia Manufacturing Survey, *Innovation in Manufacturing: Needs, Practices and Performance, 2005-2008;* and Responses to the MEP Client Impact Survey, top 3 challenges companies will face in the future.

57 Manufacturing Performance Institute, *Manufacturing 2008 Executive Summary,* based on plant data from North America in the IndustryWeek/MPI Census of Manufacturers 2007.

58 "The Future of Manufacturing," Bob Kill, Chapter 5, in *The State of Manufacturing 2009,* a Comprehensive Survey of Minnesota Manufacturers.

59 Deloitte/National Association of Manufacturers, 2005 *Skills Gap Report, A Survey of the American Manufacturing Workforce.*

60 *The Business Council Survey of Chief Executives: CEO Survey Results,* October 2006.

61 The Information Technology and Innovation Foundation's study, *The Atlantic Century: Benchmarking EU and U.S. Innovation and Competitiveness,* February 2009.

62 Georgia Manufacturing Survey.

63 Georgia Manufacturing Survey.

64 U.S. Government Accountability Office, *Technology Transfer: Clearer Priorities and Greater Use of Innovative Approaches Could Increase the Effectiveness of Technology Transfer at Department of Energy Laboratories,* (GAO-09-548), June 2009.

65 MPI, *Next Generation Manufacturing Study.*

66 Stone & Associates, *International Growth, Successful Export Strategies for Manufacturing CEOs,* prepared for NIST-MEP, February 2006; and Stone & Associates, *Competing Against Manufacturing in Low Cost Regions: Focus on China,* Final Report, March 2004, prepared for NIST-MEP.

67 Stone & Associates, *International Growth, Successful Export Strategies for Manufacturing CEOs,* prepared for NIST-MEP, February 2006.

68 Foreign programs verify the importance of MEP's shift in emphasis to growth, innovation, sustainability and firm leadership. The UK Manufacturing Advisory Service defines two sets of services: *core* lean and process improvement, and *enhanced* services which include new product introduction and low carbon design, among other offerings. Source: Interview with UK MAS.

69 Conclusion based on interviews and discussions with MEP center directors.

70 Note that this impact is overstated since a portion of these sales displace other domestic manufacturers, and thus do not add to the total output of the U.S. manufacturing sector.

71 1602 total Center staff used in current state model, reflecting Fy 07-08 time period.

72 Some of this additional state investment will not come at the expense of other innovation programs, but by partnering with them to provide services to established manufacturers.

73 *A Framework for Revitalizing American Manufacturing, Executive Office of the President,* December 2009.

74 For example, NIST MEP's evaluation system could add a measure of the percentage of center projects or delivery hours derived from new growth, innovation and sustainability services, introduced within the last two years. This measure could be factored into a center's overall evaluation or performance score, so they would receive "credit" for investing in new service areas. This "balanced scorecard" approach ensures that investments are made in future offerings. However this approach is not necessary, *as long as* new increments of funding are specifically designated for new services.

75 These teams will be influencing decisions about where to make investments in new products and services, and may direct NIST funding to support specific centers to conduct pilots or even take a lead role in developing specific service offerings. However if NIST funds are to be invested, the new services (and intellectual property) that result would ideally be freely shared with other centers in the system. The challenge for centers in this scenario is the match requirement. How can centers be responsible for developing a new service for the entire national system, investing 50% of the funds required (due to the cost-share requirement), and not be able to charge license or consulting fees to recoup some of their development costs. As a result, NIST MEP should consider making investments in new product pilots and development without a cost-share requirement.

76 The coefficient of determination suggests that it is only one important factor in determining a center's ability to reach a large number of clients.

77 For instance, centers with high concentrations of manufacturers in their region generate high impact per dollar, and centers with low concentrations of manufacturers, often rural, do less well. So market size and density is a much more important driver of impact performance than choice of service model.

78 Interview with UK MAS.