Innovation and Product Development in the 21st Century

Hollings Manufacturing Extension Partnership Advisory Board February 2010

Gary Yakimov and Lindsey Woolsey with Contributions from MEP Staff

EXECUTIVE SUMMARY

MEP • MANUFACTURING EXTENSION PARTNERSHIP
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

CSW Corporation for a Skilled Workforce

Letter from the Chair

Edward W. (Ned) Hill, Chair

Manufacturing policy in the U.S. is at a critically important juncture. No fewer than a dozen reports and studies with various conclusions and recommendations have been issued regarding manufacturing since the Presidential Election of 2008. Most of these reports were drafted by special interests with pre-determined agendas that paint manufacturing as either a leaner, stronger sector than ever before or an industry in dire condition. At the Hollings Manufacturing Extension Partnership Advisory Board ("MEP Board") we believe the truth lies somewhere in between. The reality about manufacturing is that it is complicated and not easily captured by a single data point or a single picture of either impending demise or dramatic revival.

Our report and the subsequent Opportunities for Action call for a federal policy that promotes technical assistance over compliance and recognizes that America's manufacturers need the public, private, and education sectors operating in unison and taking responsibility for a competitive future based on reasonable economic fundamentals. No one entity can address what ails manufacturing, nor can one successful firm be held up as indicative of appropriate solutions.

This paper lays out the complex realities of the manufacturing industry, identifies responses of successful firms to the dynamic technological and economic changes in front of them, and suggests opportunities for action that can be taken to help leading manufacturers retain their global competitiveness while helping all manufacturers navigate the difficult terrain before them. On behalf of the MEP Advisory Board I want to stress the need to move forward with a manufacturing policy. While some will argue that we should not have a formal industrial policy, we believe we already have one. What has evolved as our policy is a disjointed set of interventions related to taxation, trade, health care, tort reform, energy, regulation of the financial sector, and the by-product of a near-heroic effort to restructure the domestic automobile assembly industry. The law of unintended consequences is our de facto policy. The U.S. has a choice: do nothing and continue as is, or establish a set of policies that help leading American manufacturing firms make the transition to product innovation, development, and deployment in new sales and new markets.

We are encouraged by the events of late 2009 and the efforts of the Vice-President's Middle Class Task Force to recommend formal manufacturing policy options. We look forward to a renewed conversation about the future importance and direction of manufacturing as the economy continues its recovery. We also encourage that federal and state governments recognize that this is a time of transition for many programs of relevance to the nation's manufacturing base. They will need to respond to new policy mandates related to climate change and environmental quality. They will need to help employers respond to structural changes in the value of the dollar versus other currencies. And they will have to work hand-in-hand with employers to sustain a globally competitive workforce.

Just as the MEP program systematized and popularized lean manufacturing over the past 20 years, there is an important role for intermediary organizations in developing tools and systems of practice that will sustain American manufacturing competitiveness in the future. Many of these organizations and their contributions are cited in this report; some are not. However, all are part of the important industrial commons that is the public's contribution to a prosperous future. We can do more to learn about these programs, anticipate demands that will be made upon them, and make them more responsive to the increasingly competitive marketplace.

The MEP Board, MEP national program office and the nationwide system of MEP affiliates look forward to the continued conversation about the future of U.S. manufacturing.

Sincerely.

Edward W. (Ned) Hill, Chair
Hollings MEP Advisory Board and
Dean, Maxine Goodman Levin College of Urban Affairs, Cleveland State University

Executive Summary

Introduction and Purpose

U.S. manufacturing is at a critical crossroads. Policymakers have a choice to establish a framework to guide the future of manufacturing in the U.S. and to accelerate adjustments to markets or leave its future up to serendipity, chance, complacency, and indifference. U.S. policymakers can help manufacturing firms change, innovate, move into new markets, and adapt to a constantly changing global economic environment or operate under the false assumptions that the industry is not worth the effort. As the third largest economic sector in the U.S. economy, one that pays premium wages, and creates more total direct and indirect jobs than any other sector, manufacturing is worth a focused, pro-active federal policy agenda. Without one, the risks to U.S. living standards, national security, and economic security are too great.

Manufacturing is an important part of the nation's competitive backbone and represents a large, complex and diverse cluster of industries made up of individual firms that undertake a broad spectrum of activities. These activities extend far beyond production. They include research, design, logistics and distribution, technological services, back-office support, and customer care, among others. Over the past several decades, each of these activities has been outsourced to some degree, depending on the precise cost and quality needs of an individual firm.

As a result, manufacturing has become a decentralized, complex web of suppliers and distributors that extends across the globe. Indeed, in this era of globalization, it is often hard to identify the nationality of a firm. Traditional large U.S. manufacturers have many overseas operations, while foreign companies like Toyota and Novartis have U.S. facilities that employ thousands of U.S. workers. It is this picture that makes defining U.S. manufacturing more complex than it once was, but perhaps more important too. Acknowledging its complexity, the MEP Advisory Board believes, will lead to a set of modern and relevant public policies that will increase competitiveness for all manufacturers, and therefore be good for U.S. workers, communities, and consumers.

Exploring the Complex Realities of Manufacturing Today

Recent reports and studies paint a diverse portrait of the health and vitality of the current and future manufacturing industry in the U.S., as well as its importance in the U.S. economy. Is it thriving or merely surviving? Manufacturers themselves disagree about the health of their industry, some painting a rosy picture of a leaner, stronger sector than ever before; others warning that the industry is in dire condition. The reality lies somewhere in between; manufacturing is complicated and cannot be captured in a single data point nor is it captured in a single picture of impending demise or dramatic revival. However, there are a set of complex realities that apply to the industry broadly. Understanding these complex realities is critical to understanding how and why federal policy action can help shape a more vital industry, and therefore more prosperous communities. Consider the following points:

- Manufacturing remains a significant part of the U.S. economy, generating $1.64 trillion worth of goods in 2008. If U.S. manufacturing were a country in itself it would represent the 8th largest economy in the world. But…

  …Manufacturing is no longer the dominant sector of the U.S. economy but it remains a critically important component. As of 2008, it represented 12% of GDP, down from nearly 30% in the early 1950's.

- The U.S. share of global manufacturing value added is holding steady and among all U.S. exports, manufactured products are the most dominant, accounting for 57% of total value. But….

  …The U.S. trade deficit for high-tech products in 2007 was $54 billion, nearly doubling the $29 billion deficit of 2000.

- Manufacturing pays nine percent higher in wages and benefits than the overall economy, and nearly one in five jobs in science and engineering are in the manufacturing sector (2nd highest). But…

  …Employment in manufacturing as a share of total U.S. employment has fallen from about one in three jobs in 1950 to one in ten jobs today.

- In 2006 the U.S. performed an estimated $62 billion of basic research, $75 billion of applied research, and $204 billion of development. But…

  …Both the business sector's share of research and development as well as the federal share are in decline. More than half of all basic research in the U.S. is now performed at universities and colleges.

Characteristics of Successful Manufacturers and Opportunities for Action

The Hollings Manufacturing Extension Partnership Advisory Board ("MEP Board") believes that rebuilding a strong, sustainable innovation and product development and deployment capacity in the U.S. will require building on what works for firms. Through a literature review of dozens of reports and studies and interviews with Board members, the following four interconnected responses to change emerged. The Advisory Board is encouraged that for each of the four major opportunity areas, there is an MEP or MEP Center partner related program already in place that can help foster these changes in new firms, or to help leading firms reach even higher levels.

Innovate constantly to adapt to economic and technological changes

1. Streamline innovation and growth services targeted to manufacturers.
2. R&D investments should be targeted to where measures and outcomes indicate.

Only 20 percent of manufacturers can be considered truly advanced and engaged in that they: (a) do not panic in the face of bad economic news and look for long-term opportunities; (b) will not be caught flat-footed by the impending worker imbalance and shortages; (c) do not fear the growing influence of China, India, and other low-cost producers; and (d) do not allow their products to be commoditized by purchasing agents at their OEM customers.[1] According to a survey of over 1,000 manufacturers, having a well-defined process for innovation was identified as the primary driver of excellence in a disciplined approach to manufacturing. This includes designing structured, standardized processes for generating ideas, developing them, and bringing them to market.[2] Customer-focused innovation and mass customization were other innovation trends among leading manufacturers.

Embrace green and green lean

3. Invest in clean energy innovation and expand the clean energy supply chain while clarifying linkages between green lean and continuous improvement and product development.
4. Increase awareness, understanding of, and implementation of green and new energy economy industrial standards.
5. Create market opportunities for global challenges.

Manufacturers have been embracing the concept of lean for many years. There are many variants to lean but MEP defines lean manufacturing as the establishment of a systematic approach to eliminating waste and creating flow throughout the whole company. Companies that are both green and lean are seeking to reduce their environmental impact while simultaneously increasing their efficiency, productivity, and profitability. An example of this is reduced water consumption that helps to reduce work-in-process costs, increase productivity and quality, and increase profits. More and more manufacturers are requesting that their suppliers adhere to standards of environmental quality and processes. These include firms such as Hewlett-Packard, Nokia, Ericsson, and Bristol-Myers-Squibb. MEP partners with the Environmental Protection Agency to provide the Green Suppliers Network that helps reduce the environmental impact of small and mid-sized manufacturers while simultaneously increasing those companies' efficiency, productivity, and profitability, and thus their competitiveness within and across the supply chain.

Recognize and navigate opportunities in the global value chain

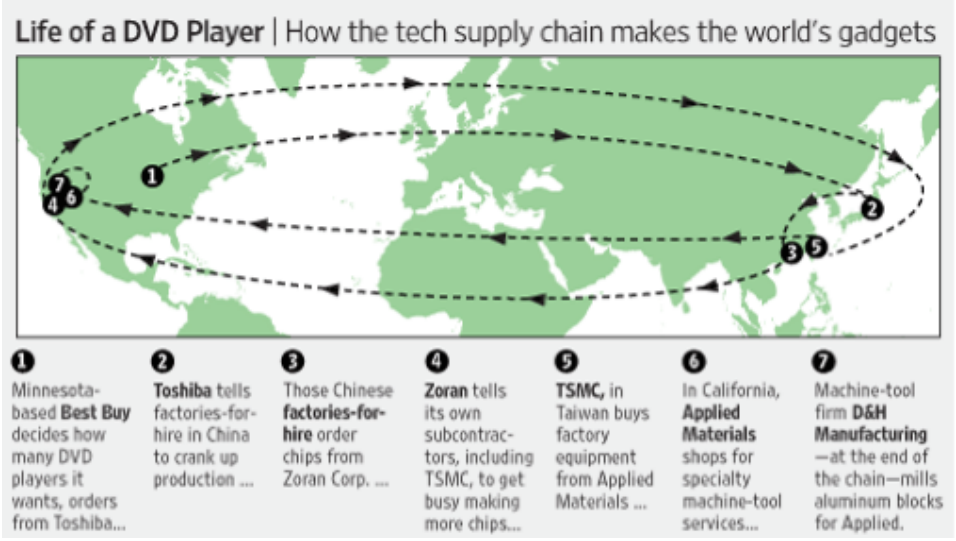
6. Increase efforts to help manufacturers navigate export markets and streamline technology export processes.
7. Increase efforts to help manufacturers diversify their markets.
8. Improve the data available to present the value of manufacturing.

Manufacturers are thinking about globalization, offshoring, and the supply chain in different ways. Success in the global marketplace for manufacturers looks different depending on the sub-sector and the size of the firm. For example, some firms are finding that as expertise develops overseas they have even more reason to send design, development, and production across the world. Other manufacturers are moving production and design back to the U.S. as the transportation and logistics costs of supply chain management become prohibitive and energy costs continue to increase. Still others are expecting that future production may be accomplished in many smaller facilities in the U.S. and abroad to meet environmental concerns and react to special market demands.

In this emerging structure, supply chains are evolving and becoming less linear. First-tier suppliers and customers are now involved in design, manufacturing, and delivery, and original equipment manufacturers are forming partnerships with firms deeper into the supply chain because they are attracted to unique technical knowledge, process, and production

1. The State of Manufacturing 2009, Enterprise Minnesota, 2009.
2. Andrew, James and Emily Stover DeRocco and Andrew Taylor, "The Innovation Imperative in Manufacturing: How the United States Can Restore its Edge," The Boston Consulting Group, March 2009.

expertise.[3] One way to maintain competitiveness in this environment is through collaboration and cluster-based partnerships between like firms, government, and educational institutions. Some manufacturers are morphing their product and service offerings. Regardless, navigating the complexities of the global supply chain will continue to be important to manufacturers. The National Innovation Marketplace (www.usinnovation.org) is an MEP initiative connecting manufacturers to one another and to innovators looking to take their product to market.



Source: "Clarity is Missing Link in Supply Chain," Phred Dovorak, Wall Street Journal, 5/18/2009

Develop and retain current and future talent

9. Rebrand manufacturing as "product innovation, development, and deployment."
10. Promote and expand career pathways.
11. Endorse and promote national certification and skill standards related to manufacturing.
12. Partner with federal, state, and local workforce system to proactively avert layoffs.

Despite the economic downturn and a perceived lack of jobs, data from a May 2009 survey of manufacturers indicate that skills shortages still exist, especially for the most profitable companies and for skilled production workers, scientists, and engineers.[4] Evidence exists to suggest the lack of skilled workers extends to all levels of a manufacturing enterprise. The National Association of Manufacturers ("NAM") has identified many workforce challenges including dissatisfaction among manufacturers with the quality of K-12 education and the lack of adequate and accurate career counseling as well as the negative perceptions and attitudes of young workers with careers and job satisfaction in manufacturing.[5] Perhaps rebranding manufacturing as the process of moving from product innovation into product development and deployment (including new sales and new markets) is a way to engage young workers who are interested in idea generation and research and development.

A critical partner in training the current and future workforce is the community college system. More than half of the community colleges (55% or approximately 1,200 institutions) offer specialized training in manufacturing skills. There are about 871,000 students enrolled in these courses.[6]

Beyond the skill gap issues is a deeper issue around developing a talent-driven firm. According to the recent report by the Aspen Institute, most businesses are still based on well-established command and control structures and have a hard time accepting systems, like those built on web-based social networking tools, that encourage bottom-up horizontal collaboration, even internally.[7] As a result, the most exciting innovations in building talent-driven firms may well occur in smaller entrepreneurial firms and at the edge of large enterprises rather than their core.

3. "Supply Chain Globalization: How Surviving SMEs Can Position Themselves for the Future," Manufacturing a Better Future for America, Alliance for American Manufacturing, 2009.
4. "People and Profitability: A 2009 People Management Practices Survey of the Manufacturing Industry," The Manufacturing Institute, Deloitte, and Oracle, May 2009.
5. "2005 Skills Gap Report – A Survey of the American Manufacturing Workforce," Deloitte, NAM, and The Manufacturing Institute, 2005.
6. Jacobs, James, "The Diminished Role of Training and Education in American Manufacturing and the Imperative for Change," Manufacturing a Better Future for America, Alliance for Manufacturing, 2009.
7. Adler, Richard P., "Talent Reframed: Moving to the Talent Driven Firm," The Aspen Institute, 2009.