Metropolitan Policy Program at BROOKINGS

Strengthening American Manufacturing: A New Federal Approach

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Manufacturing is essential to America's economic well-being. It accounts for the bulk of United States exports, is key for innovation, and provides many high-wage jobs, especially for less educated workers. It is the economic lifeblood of much of the Great Lakes region. Yet the United States has lost manufacturing jobs for the last three decades, and manufacturing output has grown much more slowly than GDP.

During this time, federal policy has done little to stem the loss of manufacturing jobs or improve the economic performance of U.S. manufacturing plants. Manufacturing's decline has contributed to the nation's huge trade deficit and worsening earnings distribution, and puts America's innovation potential at risk. To address these problems, the federal government should adopt policies to improve the performance of manufacturing firms in the United States. It should support the development and diffusion of improved manufacturing technologies, ways of organizing work, and relationships between final goods producers (typically, assemblers) and their suppliers; help groups of manufacturers within an industry work together to improve performance; and promote understanding of the importance of the economic and geographic ties that among U.S. manufacturers that contribute to U.S. manufacturing performance. These policies would not favor any particular industries, but would help solve problems that exist in both newer manufacturing industries (such as solar panels) and older ones (such as auto assembly).

America's Challenge

Improving manufacturing's performance is a crucial part of the solution to America's trade, innovation, and income distribution problems and is especially important to the well-being of metropolitan areas throughout the Great Lakes region.

Manufacturing employment has fallen and output has grown slowly. U.S. manufacturing employment has trended downward since 1980, and job losses have been especially severe in the past decade.[2] Between 2000 and 2009, the nation lost 31.2 percent of its manufacturing jobs, and manufacturing fell from 13.1 percent of total employment to 9.1 percent.[3] The nation's manufacturing output grew by only 11.0 percent during this period, while GDP grew by 15.7 percent. As a result, manufacturing's share of GDP fell from 14.2 percent to 11.0 percent.[4]

The loss of manufacturing capacity threatens the nation's ability to innovate. Manufacturing employs 36.4 percent of the nation's engineers and accounts for 70 percent of industry-funded R&D.[5] With few exceptions, product development cannot be geographically separated from production without threatening a firm's long-run ability to innovate, and innovation in high tech services depends heavily on innovation in high tech manufacturing. For example, in the 1980s, U.S. personal computer manufacturers offshored assembly of printed circuit boards to Asia. Their subcontractors gradually moved into complete product assembly, supply-chain management, and now design.[6] Such loss of capability can make it difficult to compete in new industries as well; the outmigration of semiconductor manufacturing has hurt the development of U.S. capability in solar panels.[7]

The decline of manufacturing employment has contributed to stagnation of wages for middle-income workers. Average weekly earnings in manufacturing are 19.3 percent higher than the national private sector average, even though manufacturing employs a greater than average share of workers without a college degree. [8]

The decline of manufacturing employment has been especially severe in the Great Lakes region, where auto assembly and parts manufacturing underpin much of the economic base. Manufacturing employment is more important in the auto- and auto parts-producing portions of the Great Lakes region than in the nation as a whole. Its share of total employment is 9.1 percent nationally but 10.2 percent in Illinois and 15.9 percent in Wisconsin.[9] Manufacturing employment fell by a greater percentage in Michigan, Ohio, Indiana, and Illinois than nationwide between 2000 and 2009.[10] Auto assembly and parts manufacturing accounts for at least double its national average share of all jobs in 41 Great Lakes metropolitan areas, while other metropolitan areas in the region depend heavily on other kinds of manufacturing.

The United States is caught in the middle in international competition: stuck between high-wage countries competing on the basis of new products and processes, and developing countries competing on the basis of low wages. High wages are not necessarily a barrier to manufacturing success: Germany, with the highest industrial wages in the world, runs a trade surplus in manufacturing.[11] An important part of Germany's success is its adoption of a "high-road" strategy of seeking continuous improvement in production methods from skilled employees. This strategy can benefit workers (through high wages), consumers (through high-quality, innovative products), and owners (through fair profits)—all at the same time.

Market failures make it difficult for low-productivity manufacturers to perform as well as the best manufacturers. The most productive 10 percent of manufacturing firms have at least one and a half times the productivity of the median firm, even within narrowly defined industries.[12] In most industries, firms

that design new products and have low employee turnover have higher productivity.[13] Large productivity differences between firms persist because of three primary market failures. First, it's difficult for many firms, especially many small and medium-sized ones, to make the costly, near-simultaneous investments that are needed to design new products. The firms that can make these investments generally have, and maintain, higher productivity than the ones that can't.[14] Second, some suppliers are far more productive than others. Assemblers would benefit from having suppliers that were more capable of providing high quality or reliable delivery, but because different assemblers share the same supply chains, individual assemblers have insufficient incentive to invest in helping suppliers make such improvements.[15] Finally, because low productivity firms cannot count on retaining workers, they tend to underinvest in workers' skills—further hampering their productivity.[16] If public policy does not help firms overcome these market failures, the productivity gap between firms will remain wider than it needs to be, and the work will continue to move abroad.[17]

Limitations of Existing Federal Policy

Government action is needed to stem the loss of America's manufacturing capacity. Yet federal trade policy has contributed to the loss of manufacturing to other nations, while federal efforts to improve the performance of U.S. manufacturers have been insufficient in scale and scope and have often been conducted in isolation from one another.

U.S. trade policy has contributed to the loss of manufacturing jobs. From the late 1990s until the beginning of the Great Recession, the value of the dollar was high by historical standards, contributing to the loss of U.S. manufacturing jobs.[18] China and some other Asian countries continue to keep the value of their currencies artificially low, promoting the offshoring of U.S. manufacturing to those countries.[19] The federal government has done little to rectify these currency imbalances. In addition, most U.S. trade agreements do not contain meaningful, enforceable labor and environmental standards, so lax regulations and artificially low wages make less-developed countries attractive to manufacturers seeking low costs. Because rebuilding manufacturing capacity (supply chains and worker skills, as well as plants and equipment) involves large investments that have to be made by multiple firms, industries lost to offshoring are difficult to regain.[20] So, while small exchange rate movements might make it profitable for existing firms to expand, it would take the prospect of a large, permanent shift in exchange rates for firms to re-enter industries they have left. U.S. trade policy is thus at a critical juncture: If manufacturing job losses continue at current rates, small movements in exchange rates will not yield significant increases in exports.

Federal policies directed toward manufacturing are fragmented and diffuse. The Department of Commerce has several programs designed to improve U.S. manufacturing but these programs too often operate in isolation from one another. (Under the Obama administration, however, there has been somewhat more collaboration.) The Manufacturing Extension Partnership program (MEP), part of

Commerce's National Institute of Standards and Technology (NIST), provides technical assistance to small and medium-sized manufacturers to help them become more productive and competitive. The Manufacturing Engineering Laboratory, also part of NIST, develops measurement methods and technical standards for manufacturing. The Commerce Department has a manufacturing and services unit within its International Trade Administration, which focuses on promoting U.S. exports. Separate agencies within the Department of Energy (DOE) administer programs to improve the fuel efficiency of U.S.-made cars, improve the energy efficiency of U.S. manufacturing in general, and develop renewable energy manufacturing technologies. The national laboratories, also administered by DOE, also perform research on manufacturing technologies. Much federal R&D funding, administered by the National Science Foundation and other agencies, concerns manufacturing, but it is not systematically directed at manufacturing. The Obama administration has also implemented several *ad hoc* efforts directed at manufacturing, including the restructuring of General Motors and Chrysler, the creation of a task force on auto communities, and the appointment of a manufacturing "czar."

Technical assistance to manufacturers is underfunded and poorly targeted. Federal spending on MEP was a comparatively paltry $124.7 million in fiscal year 2010, though the increase from $110 million in fiscal year 2009 was welcome after eight years during which the administration tried to slash funding.[21] Still, the federal government spends about four times as much on agricultural extension as on MEP, despite the fact that agriculture is a much smaller proportion of the U.S. economy than manufacturing.[22] State governments are supposed to provide one-third of MEP technical-assistance funding, but many have had difficulty meeting this obligation during the Great Recession and its aftermath. MEP is highly decentralized; its centers, located throughout the nation, provide services that vary widely in content and quality and that are not necessarily targeted to the needs of manufacturers in the regions where they are located. MEP centers are required to generate substantial income from fees. This, along with the failure of policy to guide or limit them, leads them to serve all manufacturers who are willing to pay for their assistance. Because they seek to maximize fee income, and because most states view them as a jobs program rather than as a productivity program, they show no particular preference for working with high-wage, high-productivity firms or firms that could, with MEP assistance, become high-wage, high-productivity firms. Therefore, MEP may inadvertently subsidize the manufacturers that *least* serve the national economic interest. Finally, it is unknown how effective MEP has been in improving even its clients' productivity. As it applies its additional funding to help manufacturers with pre- and post-production needs (designing new products, adopting new technologies, finding new markets), it needs to understand those needs in terms of productivity and not simply sales growth, as the latter is arguably zero-sum for the United States as a whole.

Federal manufacturing R&D efforts do not focus sufficiently on commercialization or on the needs of suppliers. Historically, federal R&D funding has focused on larger firms and a few major research universities. Over the last few decades, though, suppliers, often small or medium-sized, have become responsible for designing and making much of the content of manufactured goods. Consequently, innovation in U.S. manufacturing depends increasingly on the capabilities of these firms. Yet most of them do little or no formal R&D and cannot easily take advantage of university-based R&D. The federal government does not currently fill this gap. Furthermore, federal R&D programs, with few exceptions, provide little support for later-stage applied research or early-stage development, even though manufacturers increasingly have difficulty funding those types of R&D, which are precisely the ones most closely related to commercialization.[23]

Most federal assistance to manufacturers is provided to individual firms, ignoring the interdependencies among firms that are critical to modern manufacturing. MEP centers generally work with individual firms or establishments, and grants, loans, and tax credits go to individual firms. Yet modern manufacturing depends on relationships between firms, which cannot be assumed to be efficient. For example, the clustering of firms in small geographic areas increases productivity and innovation in manufacturing as in many other industries, but industry clusters are smaller than they should be to serve the national interest, because firms do not take into account spillover benefits to others when they make location decisions. In addition, geographically proximate firms can benefit from collective efforts to solve common problems (such as training), while individual firms have little incentive to contribute to such efforts.[24] Government assistance can help remedy all these market failures, but today federal manufacturing assistance ignores them.

A New Federal Approach

The federal government should take four key steps to improve manufacturing performance:

(1) Administer a National Laboratory for Advanced Manufacturing. This lab would focus on research that is more applied than that of other government labs. The lab would do engineering research on early-stage applications that are useful in a range of manufacturing processes, but that no one else is doing right now (e.g., joining two kinds of materials together, a key capability in product weight-reduction efforts that reduce energy use). A significant piece of its research would be about best practices in manufacturing management, especially the management of shared supply chains and the diffusion of up-to-date technology and business processes. To support this research, the lab would collect and analyze data about the structure and geography of supply chains; this would enable public and private managers to identify both vulnerabilities and productive points of intervention in supply chains.[25]

The national laboratory should also include a National Supply Chain Office, which would coordinate the delivery of third-party support to large manufacturers for supply-chain upgrading. The current MEP system structure requires that these firms work separately with each MEP center where suppliers targeted for assistance are located, but those suppliers tend to be in many different states. Pilot programs have begun to develop common tools that can be used across MEPs, but lack a coordinating body to support the upgrading of large manufacturers' domestic supply chains across multiple MEPs.[26] The national lab should, therefore, improve existing tools and coordinate their delivery nationally.

Two mechanisms would help the lab avoid the insularity and remoteness from business practice that characterize other national labs.[27] First, the lab would have an advisory board that would include representatives of manufacturers (suppliers as well as assemblers), labor unions, professional engineering associations, universities, and others with expertise in manufacturing applications. Second, MEP would be responsible for helping manufacturers implement the best practices that the lab identifies. (See below.)

(2) Offer competitive grants to self-organized groups of manufacturers and related institutions. These groups could include assemblers, suppliers, or both, and supporting institutions (educational institutions, unions, etc.). The grants would help these groups come together to solve problems (e.g., worker training) that manufacturers have in common but that, as a result of market failures, they cannot solve individually. Each such group could be organized on either a regional industry cluster or national basis, depending on the geographic scope of the problem it is intended to solve.[28] The groups would provide an arena for discussion so that industry participants can make coordinated investments, both subsidized and on their own. They can identify bottlenecks and training needs among themselves and their suppliers, and nominate suppliers to receive subsidized training. The grant program would resemble two current legislative proposals: the proposed SECTORS Act and the proposal for the Economic Development Administration (EDA) to administer a small-scale cluster grant program. [29] However, unlike the SECTORS Act, the grants proposed here would not be limited to workforce development. Unlike the EDA proposal, the proposal here would not emphasize economically depressed regions. Unlike both current proposals, the proposal here would be limited to manufacturing.

(3) Administer an expanded and modernized Manufacturing Extension Program. As the President's 2011 budget proposes, MEP would have a larger federal budget ($129.7 million in 2011, increasing to $170 million by 2015). MEP would use the additional funding, in part, to provide more assistance to firms with designing new products, finding new markets for existing products, and distributing products. The new national lab would have an expanded role in diffusing best practices to MEP centers and in training MEP staff and manufacturing management and union personnel in those best practices.

MEP would also require its extension agents to be trained regularly in the practical implications of the research conducted at the National Laboratory for Advanced Manufacturing and to incorporate that training into the assistance they provide to manufacturers, much as agricultural extension agents are trained regularly to incorporate university agricultural research into the training they provide to farmers.[30] For example, MEP staff would be trained in techniques of identifying best-value materials and processes, finding causes and effects of manufacturing defects, and understanding the properties of materials used in manufacturing. They would also learn how to measure the true costs and benefits of outsourcing (including costs of poor quality, risks of long supply chains, benefits of collaborating with skilled problem-solvers) so that they could help firms include real but hard-to-measure hidden benefits of nearby suppliers and of collaboration in their purchasing decisions, and thereby reduce unprofitable offshoring.[31]

(4) Provide benefits to firms that engage in high-productivity, high-wage production in the United States. To receive benefits from any of the above programs, a firm would have to have reasonably high productivity, wages, and employee benefits relative to its industry and location or produce a credible plan describing its efforts to reach such productivity, wage, and benefit levels. Continuing receipt of benefits would be contingent on making acceptable progress on the plan. In addition, any manufacturing based on technology developed in any national laboratory would have to be done in the United States, or else the firm would have to pay the federal government a market-rate licensing fee. The potential for creating or preserving jobs in the United States would be one criterion in evaluating competitive grant applications. Similar provisions should apply to programs in which the government (directly or indirectly) is a large purchaser of manufactured goods, such as renewable energy hardware, high-speed rail equipment, and military hardware.

The policies and programs recommended here would be most effective if administered by a single federal agency. All of them could be placed under the Commerce Department's Assistant Secretary for Manufacturing and Services, a position that would be more influential if placed directly under the Secretary of Commerce rather than, as currently, under the International Trade Administration.

Conclusion

The above argument is not based on the idea that manufacturing deserves special treatment. Rather, the policies recommended here are needed to correct market and policy failures have led to a smaller and less productive sector than the United States would otherwise have. These policies would not indiscriminately seek to retain or attract all manufacturing jobs. They would, instead, help high-wage, innovative firms that produce in the United States. To help these firms, general policies to improve productivity and wages (such as policies to support education, training, and basic scientific research) are not sufficient. Manufacturing-specific policies are also needed because

manufacturing, like other industries, is subject to market and policy failures that can be corrected only with considerable industry-specific knowledge and with the participation of firms and other institutions that support the industry.[32] For example, a sectoral approach is necessary to build up simultaneously both the demand for and the supply of shared assets, such as competent customers, suppliers of other components, and shared understandings about how to do quality control.

These proposals would not, by themselves, reverse the decline of U.S. manufacturing. In addition, the federal government needs to reverse the anti-manufacturing bias of its trade policies and create additional incentives for manufacturers to locate high-wage, high-productivity jobs in the United States. To spur the growth of new manufacturing activities, including those in renewable energy, it should increase R&D spending oriented toward manufacturing, create the energy research and innovation centers recommended by Duderstadt, Muro, and Rahman, and establish a National Innovation Foundation to coordinate federal innovation policy.[33] If accompanied by these additional policies, the policies recommended here could help stem the loss of high-quality manufacturing jobs. The benefits would be nationwide—a lower trade deficit, more equal income distribution, and more innovation. Regions such as the Great Lakes, which have suffered most from policy-abetted manufacturing job losses, would especially benefit.

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[2] Authors' analysis of Bureau of Labor Statistics' Current Employment Statistics data.
[3] Authors' analysis of Bureau of Labor Statistics' Current Employment Statistics data.
[4] Authors' analysis of Bureau of Economic Analysis' Industry Accounts data. Output data are adjusted for inflation. The official data may overstate the growth of manufacturing output because they may not properly account for manufacturers' use of temporary help services and offshored services. See Susan Houseman and others, "Offshoring and the State of American Manufacturing," Upjohn Institute Working Paper 10-166 (Kalamazoo, MI: Upjohn Institute for Employment Research, 2010); and Susan Houseman, "Outsourcing, Offshoring, and Productivity Measurement in U.S. Manufacturing," Upjohn Institute Working Paper 06-130 (Kalamazoo, MI: Upjohn Institute for Employment Research, 2006).
[5] Authors' analysis of Bureau of Labor Statistics' Occupational Employment Statistics survey data for May 2009; Gregory Tassey, "Rationales and Mechanisms for Revitalizing U.S. Manufacturing R&D Strategies," December 2009.
[6] Only Apple continues to design notebook computers in the United States.

[7] Tassey, "Rationales"; Gary P. Pisano and Willy C. Shih, "Restoring American Competitiveness," *Harvard Business Review*, July-August 2009, pp. 114-125.
[8] Authors' analysis of Bureau of Labor Statistics' Current Employment Statistics data for 2009; Robert E. Scott, "The Importance of Manufacturing: Key to Economic Recovery in the States and the Nation," Briefing Paper 211 (Washington: Economic Policy Institute, 2008).
[9] Authors' analysis of Bureau of Labor Statistics' Current Employment Statistics data for 2009.
[10] Ibid.
[11] Robert Kuttner, "Playing Ourselves for Fools," *American Prospect*, December 21, 2009, available at www.prospect.org/cs/articles?article=playing_ourselves_for_fools.
[12] Daniel D. Luria, "Why Markets Tolerate Mediocre Manufacturing," *Challenge*, July-August 1996, and unpublished annual data from Michigan Manufacturing Technology Center's Performance Benchmarking Survey, 1993-2009.
[13] Ibid.
[14] Ann Bartel, Casey Ichniowski, and Kathryn Shaw, "How Does Information Technology Affect Productivity? Plant-Level Comparisons of Product Innovation, Process Improvement, and Worker Skills," *Quarterly Journal of Economics* 122 (November 2007): 1721-1758; Susan Helper, "The High Road for U.S. Manufacturing," *Issues in Science and Technology* 25 (Winter 2009), available at www.issues.org/25.2/helper.html.
[15] Susan Helper, John Paul MacDuffie, and Charles F. Sabel, "Pragmatic Collaborations: Advancing Knowledge While Controlling Opportunism," *Industrial and Corporate Change* 9 (September 2000): 443–483; John Paul MacDuffie and Susan Helper, "Collaboration in Supply Chains: With and Without Trust." In Charles Heckscher and Paul S. Adler, eds., *The Firm As a Collaborative Community* (New York: Oxford University Press, 2006).
[16] Daron Acemoglu and Jörn-Steffen Pischke, "The Structure of Wages and Investment in General Training," *Journal of Political Economy* 107 (1999): 539-572.
[17] Luria, "Why Markets Tolerate Mediocre Manufacturing."
[18] Authors' analysis of Federal Reserve Board foreign exchange rate data.
[19] Paul Krugman has estimated that China's manipulation of its currency is responsible for the loss of 1.4 million U.S. jobs, most of them in manufacturing. Paul Krugman, "Macroeconomic Effects of Chinese Mercantilism," http://krugman.blogs.nytimes.com/2009/12/31/macroeconomic-effects-of-chinese-mercantilism, December 31, 2009.
[20] Tassey, "Rationales"; Pisano and Shih, "Restoring American Competitiveness."
[21] Federal spending on MEP was $104 million in fiscal year 2007, $90 million in 2008, and $110 million in 2009. Federal obligations for MEP for fiscal year 2010 is from the NIST Web site www.nist.gov/public_affairs/budget.htm; for fiscal years 2007-2009 they are from the NIST Congressional Budget Justifications for 2009 and 2010. Earlier years' obligations are from the NIST budget office, as summarized in Robert Atkinson and Howard Wial, "Boosting Productivity, Innovation, and Growth through a National Innovation Foundation" (Washington: Brookings Institution and Information Technology and Innovation Foundation, 2008).
[22] Susan Helper, "The High Road for U.S. Manufacturing."
[23] Atkinson and Wial, "Boosting Productivity."
[24] Karen G, Mills, Elisabeth B. Reynolds, and Andrew Reamer, "Clusters and Competitiveness: A New Federal Role for Stimulating Regional Economies" (Washington: Brookings Institution, 2008).
[25] On data collection, see Midwest Economic Development Summit Recommendations.
[26] "Accelerate," at the Wisconsin MEP, is an example of such a pilot program.
[27] For these and other criticisms of the national labs as components of the national innovation system, see Michael Crow and Barry Bozeman, *Limited By Design* (New York: Columbia University Press, 1998).
[28] See Mills, Reynolds, and Reamer, "Clusters."
[29] SECTORS Act, H.R. 1855, S. 777 (111th Congress, introduced 2009); The Commerce Department's 2010 Congressional budget request included $50 million for the Economic Development Administration to fund such a program but neither house of Congress has approved full funding of the request. Mark Muro and Andrew Reamer, "Innovation's Conference Committee Hurdle," available at www.tnr.com/blog/the-avenue/innovation%E2%80%99s-conference-committee-hurdle, November 16, 2009.

[30] See David W. Cash, "'In Order to Aid in Diffusing Useful and Practical Information': Agricultural Extension and Boundary Organizations," *Science, Technology, and Human Values* 26 (Autumn 2001): 431-453.
[31] Individual extension agents need not master all these skills as long as each MEP center can draw on the full range of skills, whether from its own staff or from the staffs of other centers.
[32] The general argument is made in Dani Rodrik, "Industrial Policy for the Twenty-First Century," Kennedy School of Government Working Paper (Harvard University, 2004), and Dan Breznitz, *Innovation and the State* (New Haven: Yale University Press, 2007).
[33] On energy research and innovation centers, see James Duderstadt, Mark Muro, and Sarah Rahman, "Hubs of Transformation: Leveraging the Great Lakes Research Complex for Energy Innovation" (Washington: Brookings Institution, 2010). On a National Innovation Foundation, see Atkinson and Wial, "Boosting Productivity."