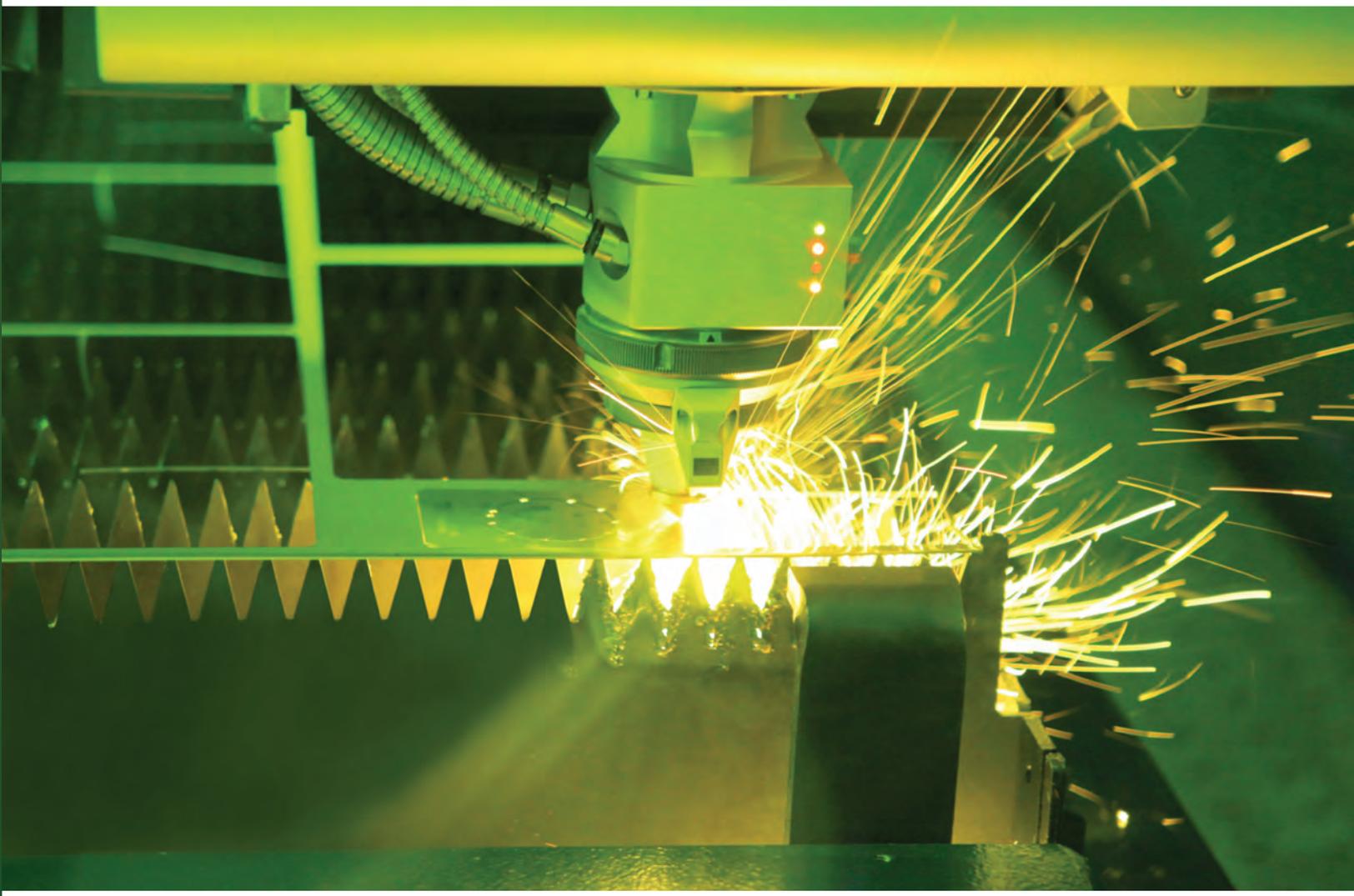


Summary Findings of the ASPEN SEMINAR ON POLICY PRIORITIES FOR MANUFACTURING IN THE 21ST CENTURY

Edited by Thomas J. Duesterberg, Executive Director,
Manufacturing and Society in the 21st Century, The Aspen Institute

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INTRODUCTION

From August 15-17, 2012, a group of high-level leaders of manufacturing firms and associated membership organizations met in Aspen, Colorado, in a seminar organized by The Aspen Institute's program on Manufacturing and Society in the 21st Century. The purpose of the discussions was to address a series of public policy issues important to the future performance of the manufacturing sector. The group considered various alternatives to resolving these issues, and, where possible, provided suggestions representing a majority of views on the best approaches to help ensure the future of a prosperous and sustainable manufacturing sector in the United States. The seminar program is given in Appendix A and a list of participants in Appendix B. A summary of discussions and findings follows.

EXECUTIVE SUMMARY

Consensus recommendations¹ from the Seminar on Policy Priorities for Manufacturing in the 21st Century include:

- A. *Education*: Business must take the lead in closing the wide “skills gap” and “education deficit” which results in hundreds of thousands of manufacturing jobs going unfilled each year and is slowly undermining U.S. technological leadership. Emphasis should be on K-12 STEM (science, technology, engineering, and math) skills starting as early as in the fourth or fifth grade. Basic literacy and numeracy skills, as well as problem-solving skills must be improved. Both business leaders and educators must do a better job of motivating students to enter STEM fields. Advanced students from other countries must be given incentives and opportunities to remain in the United States after receiving their degrees, and U.S. investment in science and engineering must be kept at levels allowing global leadership.
- B. *Trade Policy*: The United States urgently requires a more robust market-opening trade policy to avoid falling further behind competitors in global market share. The United States has a trade surplus in manufactured goods with countries with which it already has free trade agreements. Efforts should focus on: building a comprehensive U.S.-European Union (EU) trade and investment agreement; passing permanent trade promotion authority; working toward a market-based exchange rate with major trading partners; providing expanded export-promotion assistance to manufacturers and ensuring that competitive trade finance is available; and expanding bilateral or regional free trade agreements with rapidly growing

¹ It is important to note that not all participants agreed with all recommendations presented here. The recommendations represent the majority views of the participants in all cases; some participants did not weigh in on several of the subjects. Any recommendations expressed in this material do not necessarily reflect the views of the National Science Foundation.

nations, including the incorporation of Japan into the ongoing Trans-Pacific Partnership negotiations.

- C. *Energy Policy:* Adequate supplies of and reasonable prices for domestic energy are a long-term source of competitive strength for U.S. manufacturing. Policy should support the current expansion of natural gas and oil production as well as other conventional (including nuclear) and new sources of clean and sustainable energy. Attention should be paid to conservation as large opportunities to reduce consumption and enhance efficiency await further development.
- D. *Regulatory Issues:* The burden of regulation on manufacturing has steadily increased in recent decades, raising the cost of compliance by 7.6 percent at an annual rate, reducing annual output (due to a higher cost structure) by about 6 percent, and exports by 17 percent, according to a new study released at the Seminar. Reform efforts should emphasize reducing the burden and balancing costs and benefits of new regulation when and where politically feasible. Reducing the gap between regulatory costs in the United States and its major trading competitors is a high priority.
- E. *The Role of Science and Engineering Excellence in Supporting Manufacturing:* The United States remains the world leader in science, technology, and engineering, but the gap with traditional and, especially, emerging competitors is narrowing. Manufacturing is the source of the majority of funding and performs most of the applied research in scientific fields, generates the most patents, and is a world leader in bringing new technology to market. Numerous programs funded and operated by the National Science Foundation to educate students, support basic research, and bring new technology to market provide valuable support to technological leadership by U.S. manufacturers and should be supported and expanded to maintain this leadership.
- F. *Tax Policy:* The United States has the highest corporate tax rate in the world, and its competitive position in global-intensive manufacturing is eroding as other nations reduce their direct tax burdens. Tax simplification and lower rates are a major focus of efforts to restore U.S. global competitiveness in terms of taxation. Key elements of U.S. tax reform must include: (1) lowering the corporate income tax rate to the OECD averages (i.e., 25 percent or lower); (2) making the U.S. research and development (R&D) tax credit rate higher, permanent, and inclusive of company-to-company and company-to-university joint ventures and ensuring the tax system is technology neutral; and (3) very importantly, moving the United States from a worldwide to a territorial tax regime. Finally, given that fully half of American companies are partnerships, LLCs, or Sub-Chapter S entities, U.S. corporate tax reform must also keep them on a level playing field.
- G. *Improving the Economic Environment for Domestic Investment:* In addition to the recommendations advanced in Sections A-F, a few other over-arching themes emerged in the summary discussions of how best to improve the domestic conditions favoring manufacturing investment. The need for tort reform was raised in the context of reducing the gap on regulatory costs. A cultural theme also was emphasized: unlike some other countries (Germany and China were mentioned in this context), U.S. culture does not particularly promote careers, investment, and public policy favoring manufacturing. This is in part due to a negative perception of the future of industry and historical perceptions of the sector as “dark, dirty, and dangerous.” This perception is misleading, especially since the sector has regained economic competitiveness, is growing again as part of the economy, and still leads in technological investment. Business leaders must do a better job of fostering a more accurate and positive understanding of the future of manufacturing, and work more constructively

with both educators and government officials to promote the policies that will help deliver growth and investment in the future.

SUMMARY OF SEMINAR DISCUSSIONS: AUGUST 15-17, 2012

1. The Importance of Education to a Successful Workforce for the Manufacturing Economy

Following the opening dinner for the seminar, Greg Cappelli, Co-CEO of The Apollo Group, addressed the participants on the subject of the state of the U.S. education system and whether it was meeting the needs of the manufacturing sector for a skilled factory-floor workforce and for an innovative and globally competitive science and engineering workforce doing research in areas key to technological excellence in manufacturing.

The speaker noted that after a steady advance in the average number of years of schooling for students in the United States from the late nineteenth century through the 1970s, the typical number of schooling years leveled off after the critical generation of baby boomers reached adulthood. Since the 1980s there has been little or no advance in educational attainment. If the rate of growth in the years of schooling level continued into the 21st century at the same level as previously, the United States would have seen an additional 100 million years of schooling for the entire population. Each year of this “education deficit” represents a decision not to finish high school, not to enter college, not to stay in college—or a decision not to return. Since the modern factory requires both increasingly skilled—in literacy, numeracy, and problem-solving—workers and advanced science and engineering researchers, this educational deficit is of increasing concern to the ability of the manufacturing sector to thrive in the future. This is especially the case in view of the increasingly high levels of achievement and broadening of educational attainment in nations that compete for manufacturing and technological leadership such as China, India, Russia, East and Southeast Asia, Israel, Brazil, and many others in Europe.

Mr. Cappelli also provided some evidence that U.S. students are falling behind in the skills learned in schooling, especially at the primary and secondary levels. Test scores indicate that the United States ranks in the lower half of the countries tested in language, mathematics, and science achievement. Moreover, testing evidence indicates that the skill levels achieved by U.S. students of Generation X only advanced by 2 percent, whereas those of comparable generations in the G20 and OECD areas increased by averages of 16 percent and 18 percent, respectively. Although U.S. higher education is still the best in the world, gaps with competitor nations are narrowing rapidly, and students from around the world make up an increasingly large proportion of graduate students in science and engineering in the United States, many of those students now choose to return home as opposed to remaining in the United States after obtaining their degrees. At the skilled worker level too, U.S. students frequently leave school and enter the workforce without the literacy and numeracy skills needed on the modern factory floor. Community colleges and universities frequently must offer remedial schooling for their students, and companies must provide training to entering workers. One measure of the “skills gap” noted was that around 600,000 job openings in manufacturing are unfilled due to difficulty in finding workers with the proper skills sets. Mr. Cappelli cited research to show that recovering the 100 million lost school years and improving achievement would result in an additional \$400-\$670 billion in GDP per year in the United States.

Mr. Cappelli noted that the challenge of raising standards was one that can be met with a concerted effort and that pessimism about doing this was overblown. Making up the missing years of schooling and improving achievement are goals of the Apollo Group's major investment in developing new curricula for teaching the skills needed by manufacturers. He noted that the National Association of Manufacturers' (NAM) Manufacturing Institute (MI) is also leading an effort to identify and develop standards for "stackable" skills sets that are nationally recognized and certified so that students can have confidence in making the necessary financial and time commitments to obtain the related degrees and certifications. Manufacturing firms are working with both community colleges and private schools to develop curricula and nationally recognized standards for manufacturing-related skills.

In the discussion that followed, meeting participants advanced a number of ideas and suggestions: that charter schools be given more leeway; that high schools make a better effort to offer the skills training related to manufacturing; that the German model of vocational education be taken seriously and adapted to U.S. circumstances; that the United States make a more concerted effort to incent foreign students in science and engineering to remain in the United States after graduation; that local training programs, community colleges, private schools such as the University of Phoenix, and even high schools do a better job of helping disadvantaged students, adults, and under-motivated students to remain in school; and that efforts be made to overcome the cultural bias against obtaining the skills for factory work or even science education which results from a perception that manufacturing does not have a bright future in the United States.

2. Is U.S. Trade Policy Helping or Hurting American Manufacturing?

Former NAM Vice President for International Economic Affairs, Frank Vargo, led a discussion on the importance of trade policy in the future performance of U.S. manufacturing. Mr. Vargo began by stating that U.S. trade policy is generally hurting manufacturing because it is too timid in an era of globalization and increasing competition. Both the Administration and the Congress have not given a positive trade policy the priority it needs and have too frequently subordinated trade policy to many in foreign policy objectives and concerns rather than its economic impact.

Mr. Vargo reviewed recent economic data to show that: the United States still has regained the level of output (and jobs) in manufacturing reached at the early 2008 peak; that manufacturing productivity has continued to grow at levels much higher than the overall economy, increasing global competitiveness while dampening job recovery; that five of the six million manufacturing jobs lost in 2007-2010 were due to the domestic recession and the remainder due to increased import share of domestic consumption and to productivity growth; and that the growth of the trade deficit is *not* due to free trade agreements because the United States has a trade surplus in manufactured goods with countries with whom we have free trade agreements (FTAs). The United States has a \$70 billion trade surplus in manufactured goods with FTA partners but a \$430 billion deficit with all other nations.

Mr. Vargo noted that U.S. FTAs cover countries with only 12.5 percent of global GDP and that we are partners in only 12 of the 220 FTAs now in effect around in the world. The European Union (EU), Canada, Chile, Australia, and even China and East Asian countries are moving more rapidly than we are to build networks of FTAs, which are increasingly important to stimulating growth in trade, especially in view of the all but certain failure of the Doha Round of global free trade negotiations.

In view of slow domestic growth, the United States needs to do a better job of accessing fast-growing nations around the world through trade agreements. U.S. manufacturing growth has been stronger than overall GDP growth since 2009, due in part to faster export growth, but it is *not* an export powerhouse like China, Germany, Japan, or even Taiwan, even though our manufacturers are the most productive in the world. The United States has lost global market share in manufactured goods, going from 14 percent export market share in 2010 to 8 percent in 2011, even though we produce about 20 percent of total global output of manufacturing goods.

Given these circumstances, Mr. Vargo recommended a much more aggressive and growth-oriented trade policy in order to support manufacturing expansion in the future, especially in fast-growing areas such as Asia and Latin America where the United States has lost market share. He noted that sound macroeconomic support for manufacturing in terms of tax policy, regulation, labor policy, and support for science education and skills training are all necessary. Additionally, maintaining a reasonable valuation of the dollar in view of currency undervaluation by trading powerhouses like China and even Germany is needed. Participants had different views about how aggressive to be in regard to confronting China about its persistent undervaluation of the yuan, but most agreed at a minimum that China needs to have a more market-based means of valuing their currency. Additionally, Mr. Vargo noted that 80 percent of U.S. export promotion dollars go to the agriculture sector, which has only one-tenth the level of exports as manufacturing. The United States needs to do a better job of assisting small-to-medium manufacturers to access foreign markets. Finally, Mr. Vargo noted that putting labor and environmental standards into FTAs is an impediment to completing them, especially since other nations don't require them.

Based on Mr. Vargo's analysis, the participants agreed that a much more aggressive, market-opening trade policy was needed to help manufacturers access the fastest growing markets in the world. In particular, these priorities were agreed:

- A. A concerted effort to establish a U.S.-EU comprehensive trade and investment agreement. The United States and the EU are leaders in supporting the global trading system and are already huge trade and investment partners. A new comprehensive market-opening agreement would reaffirm U.S. and EU leadership and boost growth prospects for manufacturing.
- B. Generally promote a free trade agenda by passing permanent trade promotion authority (giving the Administration the negotiating authority and flexibility it needs to negotiate new agreements, and providing for "fast track" approval consideration by Congress).
- C. Work toward a reasonable, market-based exchange rate with major trading partners.
- D. Provide expanded export promotion assistance to manufacturers and adequate trade finance through the Export-Import Bank.
- E. Expand negotiations for bilateral or regional FTAs with rapidly growing nations, such as India and Southeast Asia, and incorporating Japan into existing Trans-Pacific Partnership (TPP) negotiations.

Participants agreed that business needs to be more aggressive and do a better job of promoting a single message that free trade helps manufacturing, creates jobs, and consequently will be an engine of growth for the U.S. economy. Some attention was given to the need to modernize export control statutes and regulations.

3. Energy Policy and Its Impact on Manufacturing

NAM President and Chief Executive Officer Jay Timmons gave a presentation and led a lively discussion on the impact of energy policy on U.S. manufacturing. He noted at the outset that we Americans deal every day with energy needs, that prices have a major impact on daily lives, and that affordable and reliable energy supplies are a key to economic prosperity and national security. He also emphasized that we need to take a long-term view about energy, as it is subject to short- and long-term fluctuations in prices and supply, and that our goal ought to be to ensure the sustainability of an abundant supply base at reasonable prices. In general, this suggests national policies which support a diverse supply of energy, or an “all of the above” strategy, which would include conventional fossil fuels; thermal; nuclear; alternative sources such as solar, wind, and water power; and enhanced conservation efforts.

Mr. Timmons noted that, especially in view of new techniques for extracting oil and gas and good supplies of energy within the North American Free Trade Agreement (NAFTA) area, the United States now enjoys a considerable cost advantage in energy, which is of significant benefit to manufacturers. He cited the recent 2011² NAM-MAPI “Structural Cost Study” to show that, in contrast to five years ago, energy costs are now a significant advantage to U.S. manufacturers in comparison with nine large global trading competitors. He also noted a 2012 PWC study³ showing the various benefits to the United States and especially to manufacturers of lower energy costs due to the shale gas renaissance. Among these are: an annual savings of approximately \$11-\$12 billion in cost to manufacturers; greater domestic investment in extraction but also in energy-intensive industries, such as chemicals, plastics, and metals; an increase of one million manufacturing jobs by 2025; and lower consumer energy costs.

Mr. Timmons noted that the current regulatory regime leads to the elimination of coal use in the United States, and that lack of confidence in nuclear energy is also tending to diminish the use of this source of energy. He also noted that the lack of skilled workers is holding back any potential growth in nuclear energy. These forces undermine an “all of the above” strategy and tend to mute somewhat the impact of new oil and gas supplies. He also observed that U.S. electric utilities are no longer strongly pushing for new nuclear plants due to investment costs and public doubts about that energy resource. Finally, Mr. Timmons noted that U.S. energy regulatory agencies place health and safety as first priorities in their discussions to the exclusion of most economic considerations, while thoughtful balance is needed.

Higher energy prices in the past, plus the relentless impact of global competition in costs have led manufacturers to become increasingly efficient in the use of energy. This both reduces their costs and helps reduce demand for energy imports, thus resulting in both better competitiveness and longer term stability in energy supply and cost. One participant observed that the U.S. public will not tolerate total elimination of coal-fueled electricity because it would drive up costs. Another noted that even more energy efficiencies could be achieved through simple cost-effective measures, such as using new LED or fluorescent lighting. Utilities often see better investment opportunities in promoting conservation strategies for lighting and heating, especially since regulators promote these strategies.

² *2011 Report on the Structural Cost of Manufacturing*, The Manufacturing Institute and the Manufacturers Alliance for Productivity and Innovation (MAPI), October 2011.

³ *Shale Gas: A Renaissance in US Manufacturing*, PricewaterhouseCoopers LLP, December 2011.

Several participants also noted that sustained underinvestment in the nation's utility and transmission grid was a long-term problem for sustaining energy supplies and price stability. New sources of wind energy, for example, are impeded by lack of transmission lines. It was generally agreed that this problem should be addressed with a long-term perspective in mind and an appreciation of the importance of the "all of the above" strategy.

Participants also addressed the question of whether to export our growing supplies of natural gas and refined petroleum products, both of which are possible if current trends continue. Some policy makers and energy-intensive firms oppose exports to keep domestic prices low and to achieve an energy independence goal. Most participants expressed caution about restricting exports due to trade policy considerations and the reality that export capacity is very limited in any case. One participant suggested that we look to the NAFTA area as the base for "energy independence" and noted that we have probably already achieved this goal and it could be sustained well into the future.

In summary, the vast majority of participants agreed with Mr. Timmons' approach: supporting an "all of the above" strategy; urging caution in balancing the economic benefits of nuclear and fossil fuels against low-probability health and safety concerns; emphasizing restraint in restricting energy exports; promoting continuing advances in energy-efficiency by industry; and enthusiastically endorsing the analysis that the current, relatively low cost and abundant supply in the energy environment will provide a significant boost to U.S.-manufacturing competitiveness and growth in the years ahead.

4. Regulatory Issues Affecting Manufacturing

U.S. Chamber of Commerce Executive Vice President and Chief Operating Officer David Chavern and MAPI President and Chief Executive Officer Stephen Gold made presentations and led a spirited discussion on the impact of federal regulations on the manufacturing sector.

Mr. Chavern led off this section by providing some context for thinking about regulation. In the first place, he noted that regulatory battles are much like ground wars, fought with legions of lawyers and bureaucrats. As such, solutions to perceived regulatory problems are very hard to achieve, take long periods of time, and often involve incremental progress or regression that is hard to perceive and less clear than, for example, legislative battles. He noted that we now are facing two major rulemaking tsunamis being implemented by the Obama Administration. Both the health care legislation and the Dodd-Frank law will result in hundreds, if not thousands, of new regulations stretching out over the next ten years. Mr. Chavern also noted that the current Administration is increasingly resorting to new regulation to address its priorities, as congressional gridlock is thwarting any legislative solutions to major issues. Because of this, the upcoming 2012 elections could have a major impact on the regulatory agenda. And he cautioned that once a regulatory incentive is launched, its progress is very difficult to halt.

Mr. Chavern also offered the thought that one of the real objectives of the new health care bill is to push employers to opt out of providing health care for employees and drive them into state exchanges. This could be a major problem because employers will then be unable to control costs in any way and it is likely that such costs will resume their upward path.

Mr. Chavern closed his remarks with a generally positive outlook for the U.S. economy. His view is that, despite the huge drag on performance from the regulatory juggernaut, America has

many fundamental advantages. These include extraordinary energy resources, favorable demographics and an incredible history of initiative and entrepreneurship. Our challenge will be whether we can “get out of our own way” and address not only our regulatory challenges, but also our complex tax code, bad education system, lack of a trade agenda, and other impediments to our competitiveness.”

Mr. Gold presented the results of a new study on the “Impact of Regulation on the Manufacturing Sector,” which MAPI had commissioned from National Economic Research Associates (NERA).⁴ This new and comprehensive study catalogued the growing weight of regulations, and their accumulated costs, on the manufacturing sector. Mr. Gold noted at the outset that the costs calculated by NERA, using federal government reports, are more likely to be a *floor* rather than a *ceiling* for the total cost impact. This is the case because federal agencies are only required to quantify the costs of *major* regulations, i.e., those whose impact exceeds \$100 million dollars. All others (the vast majority of individual regulations) are generally not quantified.

Mr. Gold noted that 2,183 manufacturing-related regulations have been promulgated since 1981, an average of more than 70 per year. He emphasized that the cost of regulations has advanced at a much faster pace than U.S. GDP since at least 1998, and even faster when compared to the growth of physical output in the manufacturing sector. New, “major” regulations averaged 36 per year under the Clinton Administration, 45 per year under the George W. Bush Administration, and 72 per year under the Obama Administration. The highest proportion of new manufacturing-related regulations is from the U.S. Environmental Protection Agency, followed by the Department of Transportation, and the Department of Labor. Since 1998, the cost of compliance for manufacturing regulation grew by 7.6 percent at an annual rate, while inflation-adjusted GDP grew by only 2.2 percent and physical output of manufacturing by 0.4 percent.

NERA calculates that the regulatory burden for manufacturing over the next ten years will reduce output by almost 6 percent, and reduce the global competitiveness of U.S. manufacturing by raising production costs. Manufacturing shipments will be reduced by \$500 billion in 2012 alone, according to NERA. The largest impact will be on the chemicals, oil and gas, food, and auto industries. Exports by industrial sectors would be reduced by 12 to 29 percent. Total manufacturing exports would be reduced by 17 percent. The NERA analysis only accounts for the impact of regulations adopted by early 2012, and therefore does not include the effects of the health care and Dodd-Frank legislation.

During the group discussion, in response to a question about international comparisons, Mr. Gold said that the NERA study only looked at the United States, but that the four NAM-MAPI cost studies indicate that the United States still has a much larger regulatory burden than its major competitors. The group spent a good deal of time considering how to translate NERA’s economic data to language understood by the electorate and policy makers. Most agreed that the jobs impact of regulations was a key statistic in this regard. The NERA study does not provide job-loss data, but Mr. Timmons noted that NAM would release a study the next week analyzing the jobs impact of regulation in manufacturing.

Other suggestions from the group included these ideas: requiring government to eliminate one old regulation for each new one put in place; setting up a new congressional committee devoted to eliminating outdated or unneeded regulations; giving new teeth to the 1995 Congressional Review

⁴ *Macroeconomic Impacts of Federal Regulation of the Manufacturing Sector*, Commissioned by the Manufacturers Alliance for Productivity and Innovation (MAPI), NERA Economic Consulting, August 21, 2012.

Act; setting up a reward system of some sort for “efficiency in government administration”; trying to achieve growth “partnership” relationships between government and business; and having the President lead in establishing a culture of partnership and efficiency in government regulation.

5. How Can Companies and Educators Work Better Together To Meet the Needs of Modern Manufacturers and Modern Workers?

Bison Gear & Engineering Corporation Chairman and Chief Executive Officer Ron Bullock led a discussion on adapting education to the needs of the modern manufacturing workforce and achieving better ways of cooperation between manufacturing firms and educational institutions. Mr. Bullock emphasized from the outset that modern firms focus on the development of human capital as a key part of their long-run strategy. This is especially true for modern manufacturers, which require both skilled workers who can solve problems on the factory floor and research and design staff who can create and adopt new products to give firms a technological edge. He noted a skills gap evidenced by the 600,000 manufacturing jobs going unfilled, according to a recent Deloitte LLP survey. At the higher end of the skills spectrum, many of the scientists and engineers having trained in U.S. universities are foreign nationals and an increasing proportion of them return home after receiving their degrees. Mr. Bullock urged manufacturing firms to treat human capital as equal to, or more important than, physical capital in their long-term success.

Mr. Bullock began the discussion of how to reduce the skills gap by noting his work with the Illinois “P-20” Council, which has established a goal of raising the proportion of students getting advanced degrees (including community college degrees) from 40 to 60 percent by 2020. He then described the work of The Manufacturing Institute (MI), of which he is serving as Chairman. MI is working with a broad spectrum of educators, government agencies, manufacturing firms, trade associations, and nonprofits to develop a nationally recognized and “stackable” set of credentials that are important to modern manufacturing. MI has identified over 450 separate skills sets. These skills sets include not only technical skills and general competence in numeracy and literacy, but also interpersonal skills, such as communications, ability to work in groups, and problem solving. An MI study found that 82 percent of manufacturers perceive a skills gap and over 50 percent of job openings go unfilled because of it.

Mr. Bullock noted that an overarching problem is the still somewhat negative impression of manufacturing as “dirty, dark, and dangerous” among parents, educators, and students. As evidence of this, an MI study found that 86 percent of parents believe manufacturing is important but only one-third would encourage their children to enter the field. Mr. Bullock argued that both manufacturers and opinion leaders must work to overcome this negative impression in order to start recruiting more students to the field, and that business leaders must work more closely with educators to provide the needed skills training. MI has a goal of achieving 500,000 student certifications in the next five years, building on the 85,000 achieved in 2011. Many companies are now working with local community colleges and high schools, either independently or in conjunction with MI. One hundred and thirteen colleges are already involved in programs in 34 states.

Mr. Bullock then led a wide-ranging discussion with participants providing several local or firm-level examples to catalogue different approaches to the problem. Some attention was paid to German-type apprenticeship systems. These programs languished in high schools in recent decades due to the negative perception of manufacturing and the effort to get most high school students to go to four-

year colleges. More recently, some companies have experimented with cooperative apprenticeship programs with high schools or junior colleges. Several examples in Illinois and Wisconsin were mentioned, as well as efforts between German companies, such as BMW and VW in the southern United States to develop German style programs where the firms have large manufacturing facilities. Another participant explained the initiative of his company to attract local high school students to engineering careers by offering internships during their high school years. If they show an interest and the needed skills levels, the firm will offer to pay college tuition for them. The program has had some success in meeting the company's chronic shortage of engineers. Participants also flagged programs such as MI's "Dream It, Do It" effort to attract students to manufacturing careers, and the TV show "The Edge Factor" produced by SMEEF.org which chronicles various factories and endeavors to show how interesting and exciting manufacturing is in its modern form. The "First Robotics" summer camp program was also mentioned.

Participants generally agreed that manufacturers need to do a better job of explaining what careers in the industry look like and working with K-12 schools to make sure that basic STEM (science, technology, engineering, and math) skills are learned before entering more specific skill training or advanced college tracks. Most participants felt that the most successful efforts are and will continue to be at the local level, and involve business-educator partnerships. National-level programs, while useful in establishing recognized standards, often were plagued by a tendency to micro-manage local efforts and by managing to a level of mediocrity, which discourages many students. Participants generally were enthusiastic about the opportunities for narrowing the skills gap and creating millions of jobs as U.S. manufacturing enjoys a resurgence.

Participants also noted that special efforts are needed to attract women into manufacturing careers, including through science and engineering careers. Women now constitute a majority of college and graduate students, but lack the role models and traditions attracting them to science and engineering careers. Disadvantaged students and adults attempting to change careers also require special efforts as they must juggle life challenges with schooling to acquire needed skills. Community colleges and for-profit educators especially need to help students manage these challenges, as these groups are a growing portion of the potential workforce.

Finally, there was unanimous agreement that companies must lead the way in "embracing" and attracting the talented foreign students educated in U.S. colleges and universities. The H1-B immigration must be expanded, and most participants agreed that we should "staple a green card" to the graduate degrees received by foreign nationals in STEM fields.

6. National Science Foundation Programs in Support of Manufacturing

Steve McKnight, Director of the Civil, Mechanical and Manufacturing Innovation Division (CMMI) of the National Science Foundation (NSF), led a discussion on the role of NSF in supporting U.S. manufacturing. Dr. McKnight began his overview of NSF programs by noting that the agency has, since its founding in 1950, supported research that has benefited the manufacturing sector. This support is consistent with the mission of NSF, which includes funding of research and education to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense. He noted too that the science-oriented mission naturally benefits the manufacturing sector since recent reports indicate that roughly 90 percent of all U.S. patents originate in that sector and about two thirds of private sector research and development (R&D) is funded and performed by manufacturers.

Dr. McKnight's overview covered both some background data on the relationship of scientific research and education (which are supported by NSF to a large degree) to manufacturing, and the current state of manufacturing performance as it is affected by scientific excellence. He noted that in 1960, undergraduate engineering degrees represented approximately 10 percent of all degrees awarded, but more recently that number has declined to roughly 5 percent of the total in recent years. The total number of engineering doctorates awarded in the United States is at an all-time high, but NSF data show that only 44 percent of those awarded in 2010 were to U.S. citizens and in some specific disciplines that figure is lower. In all science and engineering fields, only 65 percent of the doctorates awarded are to U.S. citizens. Overall funding for research and education in these fields (much of it by NSF, the Department of Energy, and the Department of Defense) has received modest increases in recent years. Dr. McKnight also mentioned that NSF has placed a specific emphasis on advanced manufacturing, materials, and smart systems in their FY 2013 budget request.

Dr. McKnight noted the same concern discussed in the previous session on education: that we have a problem recruiting students into science and engineering fields, particularly from under-represented groups, and that K-12 STEM education is not adequately preparing all students to enter the advanced science and engineering fields.

Dr. McKnight also noted the declining trade-balance performance of U.S. manufacturing, especially in the Advanced Technology Products (ATP) field. He cited statistics showing that the United States began to have a trade deficit in ATP products in 2002 and it has deteriorated since. Overall R&D expenditures in the United States are still the highest in the world but the level has flattened somewhat, while both R&D outlays and production of science and engineering human capital are growing rapidly in China, India, East and Southeast Asia, Russia, Israel, and many other countries.

These factors are leading to a narrowing of the technological gap between the United States, still the world leader, and competitor nations. He also noted that some R&D work by U.S. firms is being performed in those competitor nations, although many nations, especially those in Europe, are performing more R&D work in the United States. Dr. McKnight then discussed linkages between university-based basic research and the translation of that research into commercial products. There is an acknowledged and growing gap between where basic research is performed (largely universities) and where development and applied research is conducted (largely in commercial enterprises, especially manufacturing). This so-called "valley of death" has limited the translation of basic research discoveries to product development. Many incentives for university researchers are weighted toward publications and scholarly, and fewer toward translation of research results or collaboration with industry. At the same time, he noted that matters concerning intellectual property rights (IPR) can present significant challenges to university-industry collaboration. Much of his presentation explored ways to foster university-industry collaboration including the NSF GOALI program, NSF funded research centers, and new approaches that are being implemented by the Foundation to incent interested university researchers to translate their fundamental research toward practical application. Dr. Subra Suresh, Director of NSF, has also encouraged faculty to consider commercializing products from their research through the newly created NSF iCorps initiative (described below).

Dr. McKnight also described a number of existing and new NSF programs whose goals are in broad terms to help bridge the gap between the world-leading basic research in the United States—much of it funded by NSF—and creating new products for markets. Some of these initiatives include:

- The Small Business Innovation Research Program (SBIR) which gives grants to companies to develop new technologies and apply them. All federal agencies that oversee extramural research and development budgets over \$100 million set aside 2.6 percent (FY12) of their budgets for competitively awarded research directed to small business. One participant noted how helpful an SBIR grant was to expanding his company's product line.
- Engineering Research Centers (ERCs). Since the inception of the program in the mid-1980s, NSF has supported 48 centers devoted to specific fields and involving industry in the applied research. About 748 companies have participated in the ERCs to date. At the time of the meeting NSF was providing direct support to 17 "active" ERCs and was expected to announce new ERCs shortly.
- The Manufacturing Hub, an outgrowth of a NSF ERC based at Purdue, has partnered in The National Digital Engineering and Manufacturing Consortium (NDEMC), a Department of Commerce sponsored activity that has linked several Midwest research universities, large companies, and their supply chains, to make available high-performance computing and computational tools and technical assistance to companies to solve advanced engineering and design problems.
- The "Innovation Corps" (iCorps) is a new NSF initiative targeting NSF researchers for additional support—entrepreneurial mentoring and funding—to accelerate technology transfer and attract additional third-party funding.
- Stanford "Epicenter," a new ERC that seeks to better educate engineers and scientists in innovation and entrepreneurial activities to foster the more efficient and effective development of new products and companies.
- Research support for specific fields important to manufacturing, such as nano-technology, cyber physical systems, robotics, and advanced materials.

Dr. McKnight also gave an overview of NSF's programs to support both science and engineering education and attract students to those fields, and efforts to help community colleges develop curricula for training the skilled workers required by modern manufacturing. The Advanced Technological Education (ATE) program prepares technicians for the high-technology workplaces that the United States needs to prosper. ATE centers serve as the program's flagships and work on national and regional approaches to key issues in specific technology fields. ATE projects focus on particular technical education challenges. The strategies used by both centers and projects include educational resources, faculty enrichment, outreach and recruitment, industry involvement, and research. The programs are designed to help develop and share (largely among community colleges) the best practices for teaching needed skills and sharing curricula in fields such as advanced manufacturing technologies. Dr. McKnight also reiterated the need to address the same perception problem surfaced by Mr. Bullock. Many of the NSF programs are designed in an effort to introduce students at a young age to the excitement of STEM fields, such as robotics, and also to interest and train more teachers in STEM fields.

7. Major Factors Facilitating Location Decisions

Craig Giffi, U.S. National Industry Leader, Consumer & Industrial Products for Deloitte LLP, led a discussion on the factors which must be considered in making location decisions, especially those involving considerations of locating plants abroad instead of in the United States. One of the

participants had earlier framed a question that underscored the importance of this discussion. A company for which he has broad responsibility is wrestling with a decision on where to site a very energy-intensive basic materials plant. Other participants reiterated the importance of this type of real-world decision, and noted that most of the issues discussed in this seminar have an impact on these location decisions.

Mr. Giffi began his overview by presenting a typology for making location decisions: they can be based on “market building,” “talent seeking,” or “cost cutting” factors as the primary motivations for moving a plant. Discussion in the group generally supported the market building model as the most prevalent, followed by cost cutting. Most CEOs at the seminar noted that market building is generally their first consideration, as evidenced partly by the fact that many “outsourced” production facilities are in Europe, Canada, and Japan, all high cost locations. Mr. Giffi also presented a typical “hard cost” typology for weighting factors which must be considered in benchmark locations. These are typical weightings:

- Transport, market access—25 percent
- Risk factors (political, social, etc.)—20 percent
- Business environment (legal, regulatory, etc.)—10 percent
- Human resources (labor cost, skills, productivity, etc.)—30 percent
- Site and utility infrastructure—15 percent

Mr. Giffi provided some background data on recent foreign direct investment (FDI) trends. These show that the United States and China are the leading recipients of FDI, although India, Brazil, Indonesia, Mexico, Malaysia, and Saudi Arabia attract significant and growing FDI. U.S. outward FDI is still concentrated (80 percent) in countries led by China, Brazil, the United Kingdom, Canada, India, and Mexico.⁵ The trend for investment in China generally indicates that traditional “cost cutter” FDI projects have been on a downward trend the past three years, but that “talent seeking” investments in China are on the rise. Mr. Giffi also noted that companies increasingly consider the “industrial policy” of target countries and the incentives offered to locate there.

In the open discussion one participant commented that he had brought production back to the United States from China due to quality and timely delivery problems. Another noted he had built up Chinese production to meet local demand, but that also involved building employment in the United States to support the foreign facilities. Another noted that customized products and “solution oriented” sales need to be done close to the customer for obvious reasons. Along with others, he noted that labor costs are often less than 10 percent of total costs and, given rising labor costs in China and elsewhere, this is a decreasingly important consideration in location decisions—higher value added products, often involving important IPR, can still be profitably built in the United States. Several participants reiterated that customized products are best built in local markets. Protecting IPR by keeping production close to home was a general theme of the discussion.

Another participant offered the idea that U.S. firms must not let China or other major competitors have a free hand in their home market: that is, U.S. producers must contest home markets so as not to allow them to provide a highly profitable base from which to attack the U.S. market. Another

⁵ Disposable income is growing in emerging economies thus attracting more “market-seeking” U.S. investment.

theme was that multinational firms expect their suppliers to follow them and service them in all the markets in which they participate.

One participant noted that he had opened a plant in Brazil because protectionist measures there made that the only means to participate in that market. Others noted that currency policies around the world are an important factor in location decisions. Another common theme was that manufacturing flexibility is becoming a more important consideration even as labor prices wane somewhat in importance. Although labor costs and indeed total cost advantages in locations such as China are diminishing, participants generally agreed that no “tsunami of reshoring” is likely to occur because other factors such as market access and customization to local markets are key considerations. Finally, although most participants agreed that while access to Chinese and Indian talent (science and engineering) is a growing consideration, they were not ready to say that engineers and scientists in those emerging markets could do all the things needed from them as well as many in the United States.

Mr. Giffi closed by leading the group in considering the most important actions U.S. policy makers could take to improve the U.S. operating environment so that more plants would locate domestically. The group focused on a short list of policy measures or actions that would be helpful in making choices to locate or relocate production facilities in the United States:

- Reduce the 20 percent “structural” cost differential identified in the most recent NAM-MAPI study between the United States and nine leading competitors and resulting from policy measures related to energy, regulation, tax, the tort environment, and health care costs.
- Improve human capital in the United States, including improvements in STEM education at all levels, and including a more welcoming environment for foreign-born talent to choose to live and work in the United States.
- Adopt a more aggressive market-opening trade policy, especially with the larger emerging markets which offer the best possibilities for growth in coming decades, and also including better enforcement of existing WTO trade rules.
- Reform the tort system so as to reduce litigation costs and unneeded precautionary expenditures related to tort risks.
- Bring U.S. tax rates closer to international (or OECD) norms, as U.S. corporate rates (both statutory and effective) are the highest in the OECD.
- Adopt policy to sustain the current favorable energy cost and supply in the United States.

The group generally agreed that the top priority was tax reform, as this would have the most beneficial impact on competing in global markets and ensuring a domestic environment favorable for both home-grown and foreign investment. Participants emphasized the need to be practical and pragmatic in seeking reforms and changes that the political environment could support. Finally, the group again emphasized the urgency of business leaders working with opinion leaders and government to change the cultural perception of manufacturing as “dark, dirty and dangerous” and without a viable economic future. And both business and government leaders should promote the idea that manufacturing is a good source of jobs, innovation, and economic growth in the future to help reverse the somewhat negative cultural bias in the United States.

8. Importance of Tax Reform to Manufacturing in the United States

Michael Maibach, President & CEO of the European American Business Council (EABC), led the discussion about the impact of U.S. tax policy on manufacturing. In his opening remarks he stated that “capital is a coward.” Mr. Maibach meant that tax policy affects the willingness of companies to make capital investments due to high risk and the long-term nature of capital investments, especially in capital-intensive sectors, such as manufacturing. Mr. Maibach gave the example of semiconductor manufacturing, where capital investment is an especially important component of overall costs. He also stated that: “If U.S. manufacturing cannot compete in the world, the United States cannot compete,” since “innovation” is centered within manufacturing innovation, and growth in service industries follows the movement of manufacturing industries. He noted that manufacturers are the biggest investors in both capital and R&D, and both require sustainable profits to continue to fund. The semiconductor industry, for example, reinvests over 25 percent of its profits into R&D, and also supports the development of human capital and large investment in plant and equipment to sustain technological leadership.

Mr. Maibach noted that the United States has the highest corporate tax rate in the world (35 percent of the federal level alone) and also lags behind competitors in tax measures that support R&D. According to the OCED, the U.S. R&D credit is the 21st most generous in the world, for example. And the United States does not use “patent boxes” that several nations now have added to their corporate tax code.

He also noted that the United States is the only major trading nation that uses a “worldwide” rather than a “territorial” corporate tax system. This means that when U.S. companies earn after-tax profits abroad, those funds will be taxed again by the U.S. government if reinvested into the United States. This policy serves to keep capital invested outside of the United States. Related to this, most of our competitor nations utilize value added taxes (VATs) as major sources of revenue, which curbs local consumption to some extent while enhancing exports by refunding the VAT at the border. By its nature a VAT system supports exports and discourages imports. The United States is at some disadvantage relative to nations with VAT taxes because U.S. imports are not subject to this tax cost. Despite the trade advantages of VAT tax schemes, most participants were reluctant to endorse the creation of a VAT in the United States—unless it was part of a major reduction or elimination of the business income tax system.

In general discussion almost all participants agreed that: lower U.S. corporate tax rates are an imperative; the United States should make the R&D tax credit permanent and more valuable; and the United States should adopt a territorial tax system. Participants also supported replacing the United States’ complicated depreciation schedules with 100 percent expensing, an investment incentive many nations now offer. Participants were open to the idea of reducing some current “preference items” such as “last in, first out” (LIFO) accounting, a manufacturing tax credit, and certain extraction preferences as a means to offset lost federal revenue from lowering rates and extending investment and R&D preferences. There was some discussion of how far to lower the U.S. corporate rate. Although there was no clear consensus, a discussion centered on a range of 20-25 percent as a pragmatic solution, since elimination of all corporate income taxes was deemed politically impossible. When asked to set priorities for reform, participants settled on the following priorities list of U.S. tax changes:

1. Lower U.S. corporate (and private company) income tax rates, along with a simplified code.
2. Make R&D credit permanent [some argued for doubling the rate].
3. Moving to a territorial system.

Several participants noted that there are several hundred thousand non-corporate manufacturing companies who are taxed as pass-through organizations at the U.S. individual tax rate. These include Sub-Chapter S firms, LLCs, partnerships, and family-owned firms. Pass-through companies represent some 36 percent of U.S. GDP and 54 percent of all U.S. income. Manufacturing pass-throughs are often taxed at personal tax rates, but generally enjoy the same preferences as C-corporations. Hence, change in preferences, especially LIFO or investment depreciation schedules, will also impact pass-throughs. Participants stressed the need to keep C-corporation income tax rates on par with pass-throughs, and stressed the need for simplification of the overall tax code. Otherwise, the incentives would be for pass-throughs to convert to C-corporations. And most [small and medium size] pass-throughs can ill-afford the greater complication and compliance cost of C-corporations today. U.S. Congressman David Camp, Chairman of the House Ways & Means Committee, has indicated that he would like any reform of the U.S. corporate tax code to be mirrored in treatment of the kind of private companies noted here.

The discussion closed with another call to find more persuasive ways to explain how manufacturing benefits society as a whole, especially through job creation, higher wages, innovation, and community involvement. Related to this is the need to overcome the long-standing cultural bias against manufacturing and manufacturing careers. Early exposure to manufacturing sites and careers for young Americans is needed. And as Mr. Maibach remarked, perhaps Hollywood will one day give us a television program entitled “LA Engineer”!



Seminar on Policy Priorities for Manufacturing in the 21st Century

PROGRAM

August 15-17, 2012
Aspen Meadows Resort
Aspen, Colorado

Importance of Tax Reform to Manufacturing in the United States

Michael C. Maibach
President and Chief Executive Officer
European-American Business Council

Energy Policy and Its Impact on Manufacturing

Jay Timmons
President and Chief Executive Officer
National Association of Manufacturers

Regulatory Issues Affecting Manufacturing, Presentation of New Study

Stephen V. Gold
President and Chief Executive Officer
Manufacturers Alliance for Productivity and
Innovation (MAPI)

David Chavern
Executive Vice President and Chief
Operating Officer
U.S. Chamber of Commerce

Is U.S. Trade Policy Helping or Hurting Manufacturing? Directions for the Future

Franklin J. Vargo
Former Vice President, International
Economic Affairs
National Association of Manufacturers

How Can Companies and Educators Work Better Together To Meet the Needs of Modern Manufacturers and Modern Workers

Ronald D. Bullock
Chairman and Chief Executive Officer
Bison Gear and Manufacturing Corporation
and Chairman, Board of Trustees
The Manufacturing Institute

Discussion of National Science Foundation Programs in Support of Manufacturing

Steven H. McKnight
Director
Civil, Mechanical and Manufacturing
Innovation Division (CMMI)
National Science Foundation

Major Factors Influencing Plant Location Decisions—Insource-Outsource Decisions

Craig Giffi
Vice Chairman and U.S. Leader
Consumer and Industrial Products
Deloitte LLP

Open Discussion and Summary, Other Issues of Interest and Next Steps



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