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Manufacturing Industry

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MANUFACTURING 2011

ABSTRACT: Absent from the front pages of newspapers around the country, the U.S. manufacturing sector, the nation's foundation for growth and innovation, is leading the economic recovery.[1] This message is lost as manufacturing jobs have been replaced through increased productivity. However, over the last few decades, America's preeminence has eroded as competing countries set more favorable, and some may say unfair, national conditions for their domestic manufacturers. Without a concerted and coordinated focus on maintaining American competitiveness, the manufacturing base and future growth prospects may decrease as manufacturers succumb to global competition. The 2011 ICAF Manufacturing Industry Study Group calls for a National Industrial Policy that will: set the conditions for manufacturers to prosper in the U.S.; foster government-industry-academia partnerships to produce a skilled workforce that brings innovations to market; and produce a vibrant manufacturing base, especially responsive to the U.S. national security requirements.

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INTERVIEWS AND SITE VISITS
(in chronological order)

Interviews:

Manufacturing & Technology News
National Association of Manufacturers
Department of Commerce
Bureau of Labor Statistics
AFL-CIO Industrial Union Council
Congressional Research Service
National Council of Textile Organizations
Coalition for a Prosperous America
George Washington University, Institute of Public Policy

North America:

National Association of Manufacturers (Washington, DC)
Northrop-Grumman (Gaithersburg, MD)
General Motors Transmission Plant (Baltimore, MD)
Cree, Inc (Raleigh, NC)
Integrated Manufacturing Systems Engineering Institute (Raleigh, NC)
John Deere Turf Care (Raleigh, NC)
Research Triangle Partnership (Raleigh, NC)
Department of Commerce, National Institute of Science and Technology (Washington, DC)
BAE Systems, Inc. (Arlington, VA)
National Center for Defense Manufacturing & Machine (NCDMM) (Latrobe, PA)
Hamill Manufacturing (Latrobe, PA)
Impact-RLW Systems, Inc. (Latrobe, PA)
Aggressive Grinding Service, Inc. (Latrobe, PA)
Accrotool, Inc. (Latrobe, PA)
ACS Precision, LLC (Latrobe, PA)
APEX CNC Swiss, Inc. (Latrobe, PA)
Conicity Technologies (Latrobe, PA)
Cygnus Manufacturing Company (Latrobe, PA)
The Ex One Company (Latrobe, PA)
Haas Automation, Inc. (Latrobe, PA)
JIT Global Enterprises (Latrobe, PA)
Kennametal Inc. (Latrobe, PA)
Pace Industries – Airo Division (Latrobe, PA)
Penn United Technologies, Inc. (Latrobe, PA)
PDS Industries (Latrobe, PA)
Quality Mould, Inc. (Latrobe, PA)
RNDT, Inc. (Latrobe, PA)
TriMech Solutions (Latrobe, PA)
Latrobe Specialty Steel (Latrobe, PA)
Canadian Commercial Corporation (Ottawa, Canada)

Industry Canada (Ottawa, Canada)
National Research Council Canada (Ottawa, Canada)
Defense Research and Development Canada (Ottawa, Canada)
Foreign Affairs and International Trade Canada (Ottawa, Canada)
Canadian Manufacturers and Exporters Association (Ottawa, Canada)
Canadian Advanced Technology Alliance (Ottawa, Canada)
Precarn, Inc (Ottawa, Canada)
Bombardier Aerospace (Montreal, Canada)
Pratt and Whitney Canada (Montreal, Canada)
CAE (Montreal, Canada)

International:

Slovnaft (Bratislava, Slovakia)
VOP Moldava Nad Bolvou (Trencin, Slovakia)
LOTN (Trencin, Slovakia)
BAE Systems, Inc. (Greenlawn, NY)
Ralen Research Centrum s.r.o. (Bratislava, Slovakia)
U.S. Embassy (Bratislava, Slovakia)
Sovello AG (Thalheim, Germany)
Porsche Leipzig (Leipzig, Germany)
First Solar GmbH (Berlin, Germany)
U.S. Embassy (Berlin, Germany)
United Kingdom Ministry of Defense (London, England)
United Kingdom Department of Business, Innovation, and Skills (London, England)
University of Cambridge – Institute for Manufacturing (Cambridge, England)

INTRODUCTION

> ... to be independent for the comforts of life we must fabricate them ourselves. We must now place the manufacturer by the side of the agriculturist...He, therefore, who is now against domestic manufacture, must be for reducing us either to dependence on that foreign nation, or to be clothed in skins, and to live like wild beasts in dens and caverns. I am not one of these; experience has taught me manufacturers are now as necessary to our independence as to our comfort...
>
> *-Thomas Jefferson, 1816*[2]

The issue Thomas Jefferson raised almost two hundred years ago is just as relevant today as then: either manufacture domestically or be dependent on foreign nations. While the United States (U.S.) manufacturing sector is the world's largest and most productive, its preeminence in manufacturing has eroded during the past thirty years. During the study of U.S. manufacturing, the 2011 ICAF Manufacturing Industry Study Group (MISG) became familiar with varying viewpoints on the underlying causes for the decline and the subsequent impact. While some have described the declining manufacturing workforce as the "canary in a coalmine"[3] for the overall U.S. economy, others would cry often and passionately about jobs that were lost or off-shored to China. Whether one considers the future economy or jobs as the issue, the data shows that manufacturing output as a percentage of U.S. Gross Domestic Product (GDP) has decreased from 20.0% in 1980 to 11.5% in 2008.[4] Coupled with strategic industrial policies of other nations and increasing global competition, the reduction of the manufacturing base relative to GDP raises concerns about the U.S.'s ability to produce items not only for national defense, but also for everyday life. To quell these concerns, the U.S. government should champion vision, policies, and regulations that create an environment which allows the U.S. to compete in both international and domestic markets.

To support policy recommendations, the MISG first explored the current state of the U.S. economy, and found it burdened by debt. As of April 2011, the U.S. national debt sits at $14.28 trillion, the projected budget deficit for fiscal year (FY) 2011 is $1.65 trillion, and the trade deficit for calendar year (CY) 2010 was $497.8 billion.[5] Along with debt, a jobs deficit persists. During the "Great Recession" (2007-2009), over 7.3 million jobs were lost, with manufacturing jobs making up 32% of that loss.[6] At the current rate of job recovery, the economy will not replace those lost jobs until after 2019, taking into account the annual addition of new workers. The outlook for the manufacturing workforce looks grim even as productivity and manufacturing output increase. The MISG attempted to explore this enigma between jobs, productivity, and output. However, the research often raised more questions than answers. It is not clear how much of the economy (% of GDP) should be based on manufacturing as the U.S. government (USG) struggles to implement an innovation-based economic strategy, in hope of easing current challenges.

The MISG assessed root causes to U.S. competitiveness by interviewing manufacturers, government agencies, and academics. U.S. manufacturers are saddled with one of the world's highest combined corporate tax rates, which weighs heavily on their decisions to offshore manufacturing. Many opinions were offered on the strategies and tactics used by foreign governments which put U.S. manufacturers on an uneven playing field. Within our own borders, many companies found it difficult to find and hire qualified, highly skilled workers to build

products. Experts also lamented the cost of regulation and the missed opportunities for innovation with effectively conceived standards. The Obama administration apparently heard these issues as evidenced by the short-term plans they crafted to address some of the issues. MISG analysis, however, indicates additional measures are required for the short and long-term.

In addition to the administration's short-term vision for U.S. manufacturing, the MISG offers some policy recommendations to address the long-term vision to keep the U.S. manufacturing sector competitive. The Office of the President produced the "Framework for Revitalizing American Manufacturing" in 2009, which offered seven initiatives to support manufacturing. Then in February 2011, the administration released "A Strategy for American Innovation" which described initiatives to support advanced manufacturing and science, technology, engineering, and mathematics (STEM) education. The legislation that advanced a fraction of these initiatives was the "America COMPETES Reauthorization Act of 2010." The MISG offers broader and at times potentially controversial policies to help manufacturers re-establish long-term competitiveness. The policies range from corporate tax reform, STEM education support, aggressive action in the world trade environment, new standards and regulation reform. The best place to begin the discussion is with a description of the current situation.

MANUFACTURING SECTOR CURRENT CONDITIONS

Manufacturing Defined. Manufacturing is a sector of the economy rather than an industry. The North American Industry Classification System uses three separate identifiers to capture all the industries that manufacture goods. Manufacturing can be thought of as the transformation of materials into products as well as the "decisions, processes, and activities that occur both upstream and downstream of factory floor activities."[7] Over the lifetime of a manufactured good, a variety of people and organizations add value to it. Discussions with foreign institutions both in government and the private sector revealed that many others are also struggling with the definition of manufacturing. Figure 1 presents one perspective on the stakeholders and relationships involved in the manufacturing sector. The outer circle contains the interaction of government, industry, and academia. The inner circle represents the products of those relationships. For example, the government and academia combine to incentivize the development of skilled workers to support industry. The following concepts enhance the definition of the manufacturing sector.

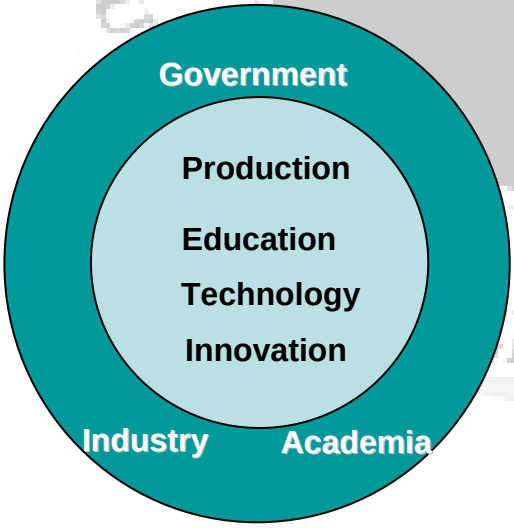

Figure 1. Manufacturing Relationships

The Multiplier Effect: In addition to economic value and job creation directly tied to manufacturing, additional value and employment is created in related and supporting industries. Economists call this a multiplier. Manufacturing jobs typically pay more than service industry jobs such as fast food or personal services.[8] This fosters a robust middle class and creates a faster path to prosperity. It also provides more revenue for the local and federal governments. Producing goods from other materials requires support from other sectors in the economy. Every $1 in final sales of manufactured goods supports another $1.40 in output from other sectors in the economy.[9] The multiplier effect applies to jobs as

well. One can think of many other jobs in a manufacturing supply chain or the services provided to a manufacturing plant and realize more jobs are created than just the one. Experts in the United Kingdom are attempting to redefine manufacturing to include jobs directly related to goods production such as those in the supply chain or services. Some estimates say each manufacturing job can be credited with creating up to four other jobs in the rest of the economy.[10] The multiplier effect can work in reverse as well; just look at the recent contraction in U.S automobile manufacturing. Closing production lines resulted in the closure of suppliers, car dealerships, and other companies.

Sector Current Status. Although manufacturing is on the road to recovery, its pace and forecasted growth are neither optimal nor structured to place it on par with its main global competitors. The manufacturing sector created $1.54 trillion worth of goods in 2009. However, output was down over 15% during the Great Recession of 2007-2009.[11] Manufacturing helped lead the recovery in 2010 with 6.6% increased output[12] and 2.9% increased employment.[13] However, if one steps back and looks at manufacturing over the past 35 years the picture is not as positive as the current recovery implies.

America's Industrial Loss. Jobs within the manufacturing sector have declined, despite the growth in U.S. manufacturing output. Since the 1970s, U.S. manufacturing jobs have decreased as a share of total employment, from 36% to 16% by 2002; Figure 2 shows the actual drop in manufacturing jobs from 1989 through 2010.[14] That number has dwindled to about 12% today.[15] In sheer numbers, that means over 5.3 million manufacturing jobs were lost over that period.[16] Manufacturing industry expert, Rose Woods, projects that by 2018 the total manufacturing employment will be 12.2 million Americans,[17] comprising only 7.4%[18] of the expected 166.2 million Americans employed in the U.S. workforce.[19] That level is a barely perceptible increase from today's low point in employment (Figure 2). The MISG attributed these losses to productivity improvements and outsourcing of traditional manufacturing jobs, in part caused by the economic and industrial policies of foreign nations.[20] Some experts used this perspective to say that manufacturing and the country's associated industrial base are in severe decline and need immediate attention. Others claim manufacturing will mimic the decline of agriculture in the 20th century.[21] Clearly, the issue is not simple.

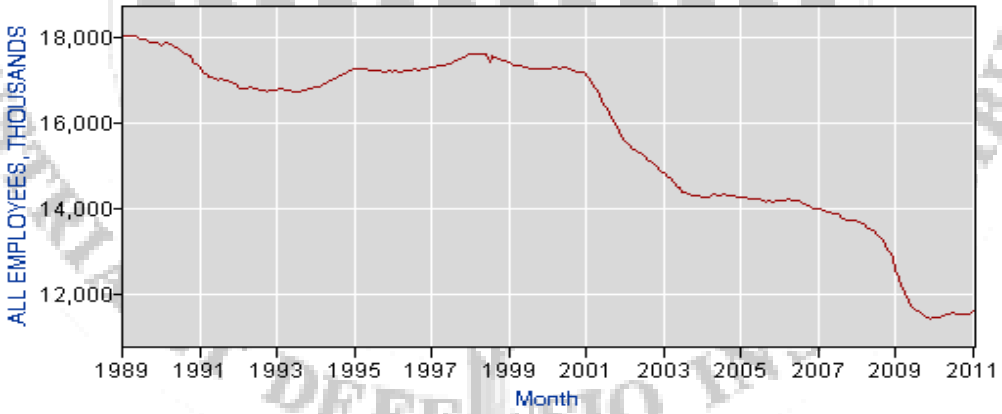

Figure 2. U.S. Manufacturing Employment (Source: Bureau of Labor and Statistics)

The definition of what comprises a manufacturing job clouds the issue for even the most astute economic analyst. In particular, simply saying that manufacturing jobs have been lost fails

to capture the interdependency of those 'lost' manufacturing jobs with the new jobs created in the service industry which support manufacturing. From the pinnacle of manufacturing employment in 1979, hiring in service jobs has been steadily increasing, which partially offset the losses.[22] Before the 1970s, manufacturers employed their own services, such as administrative, legal, and accounting, as well as their own engineering design departments because there was no option to subcontract them.[23] Beginning in the late 1970s, many of those related jobs, previously directly employed by manufacturing companies, have been outsourced, enabled by firm restructuring and major improvements in information and communication technologies.[24] As a result, they are no longer included in manufacturing job statistics. More importantly, those service jobs related to manufacturing, called producer service jobs, have blossomed and far surpassed manufacturing employment.[25]

According to Karaomerlioglu and Carlson's 1997 analysis of the declining manufacturing sector, which looked at the situation from an interdependency viewpoint (manufacturing and producer services together), the manufacturing job decline was offset quite well.[26] They argue that producer services are directly dependant on manufacturing, and therefore would not exist without manufacturing.[27] In other words, if manufacturing went away, it would be difficult to maintain the producer service industry. From a numerical standpoint, manufacturing jobs remained relatively constant (at approximately 18 million), from 1975 to 1995, and because of that, accounted for a 34% reduction in their share of total U.S. employment as the population and workforce expanded.[28] On the other hand, producer service jobs yielded an increase of 27% of total employment during the same period, or an additional 18.6 million jobs.[29] When looked at together, manufacturing and its associated producer service jobs increased 39% with 48.2 million jobs by 1995.[30] In aggregate, manufacturing and its services-related jobs only had a reduction of 3.5% of its share of total employment over the same 1975 to 1995 period.[31]

Repeating this analysis using the Bureau of Labor and Statistics data for 1998 to 2008 and beyond shows a similar trend. Due to the two recessions of 2001 and 2008, manufacturing employment plummeted to 11.6 million (See Figure 3) or down to 8.9% of total employment.[32] Interestingly enough, those similar producer services jobs used in Karaomerlioglu and Carlson's study, when combined with manufacturing in 2008, account for a nearly one-for-one job swap as shown in Figure 4. Granted, these numbers may include some overlap since many producer services support non-manufacturing clients. The trend shows that current manufacturing productivity can potentially support additional employment.

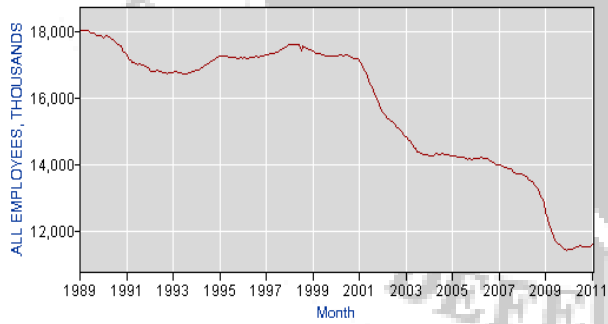

Figure 3. U.S. Manufacturing Employment
(Source: Bureau of Labor and Statistics)

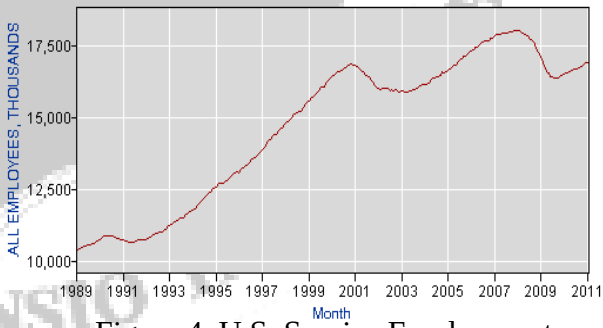

Figure 4. U.S. Service Employment
(Source: Bureau of Labor and Statistics)

Even with the job numbers, the American manufacturing sector has been the world's largest and most productive since the end of World War II. According to the most recent United Nations global measurements, if broken out, the U.S. manufacturing sector would rank as the sixth-largest economy in the world, between that of France's and the United Kingdom's entire GDPs with an annual output of more than $2 trillion.[33] This staggering number, despite current negative media hype, is still 45% higher than what China manufactured or produced in 2009.[34] Table A-1 in Appendix A expands the discussion with a comparison of various economic indicators. Another comparison puts U.S. manufacturing at 20% of the entire global manufacturing output for 2009.[35] Impressively, without changes in policy, U.S. manufacturing output is projected to increase 2.1% annually, and attain a $4.9 trillion output by 2018,[36] despite the recent recession.

The most recent recession was the biggest to hit the United States since the Great Depression. As a result, manufacturing production fell from its 2007 highs by more than 15%, but has since led the economic recovery and now stands at 8.4% (See Figure 5).[37] This downturn is quite similar to the 2001 recession, where manufacturing output fell a little more than 5% at its lowest point in 2002, then recovered and grew more than 17% by 2007.[38] Today, manufacturing seems poised to bounce back with the same vigor. Looking at another measure to demonstrate manufacturing's recovery, the nation's manufacturing utilization rate fell to a low of 65.4%, but has now climbed to the current level of 73.7%. However, this rate is still 5.4 percentage points below its average for the period from 1972 to 2010.[39] Even as overall productivity continues to increase, certain established manufacturing industries have declined in output and jobs. Examining the U.S. machine tool industry and its demise can serve as a microcosm of the challenges and potential outlook for manufacturing in general.

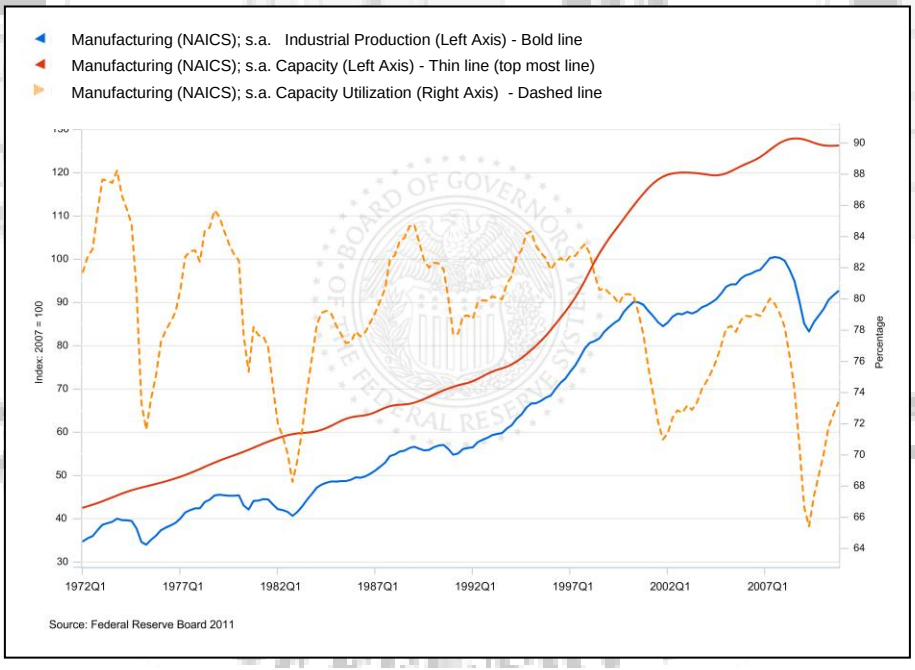

Figure 5. U.S. Manufacturing Productivity (Source: Federal Reserve Board 2011)

Machine Tools. The machine tool industry is an important manufacturing sector indicator because the inability to produce tools for advanced manufacturing processes will

eventually lead to a loss of competitive advantage in those techniques.[40] In addition to being an indicator of industry capital investment, machine tool consumption is an indicator of manufacturing sector expansion and retooling. In 2003, driven by a vastly expanding industrial base, China surpassed the U.S. in machine tools consumption, and by 2008, the U.S. fell to fourth in consumption. Between 2003 and 2008, the U.S. as a machine tool producer fell from third to seventh place behind Japan, Germany, China, Italy, Taiwan, and South Korea.[41] As the worldwide economy started to recover in 2010, the machine tool builders started to emerge from the recession as well. Exporting very little machinery, China dominates world production accounting for 30% in order to meet its domestic demand. Japan and Germany continue to fight for second and third place while the U.S. has now fallen to eighth place.[42] From 2009 to 2010, machine tool manufacturers increased their output over 21% globally, producing $66.3 billion worth of machines. China, Japan, Taiwan, South Korea, and India accounted for over 60% of this production. Germany accounts for nearly 15% of the global production while the U.S. only provides 3% (approximately $2 billion). Perhaps more telling is the foreign penetration of the U.S. machine tools market where the U.S. must import 77% of the machine tools needed for its consumption.[43]

A 1994 Rand Critical Technologies Institute study identified the following critical factors affecting the U.S. machine tool industry: 1) no critical mass of large firms nor cooperation among small companies needed to finance new investments; 2) no recognized industry standard for the machine tool control software; 3) difficulty obtaining capital to upgrade production capabilities or finance sales; 4) inadequate skill supply and disincentives for firms to invest in training; 5) weak links between the major research institutions (e.g., universities) and the firms responsible for commercializing new technologies; 6) domestic users that have been slow to demand the latest technologies; and 7) inadequate export infrastructure.[44] These challenges still exist today and have been magnified by the current economic environment. Since 2001, over 5,000 factories have closed with nearly 500,000 jobs lost in the machinery manufacturing industry.[45] Additionally, during the recession in 2009, virtually all orders for new machine tools stopped when the market for U.S. machine tools declined 72% because the recession-driven tightening of credit did not allow manufacturers to make capital investments.[46] However, recent manufacturing indicators have improved.

In 2010 and early 2011, the Purchasing Manager's Index (PMI), which evaluates manufacturer's production level, new orders, speed of supplier deliveries, inventories, and employment levels, showed improvement. JPMorgan reported that February 2011 marked the second highest reading ever of the Global Manufacturing PMI and that manufacturing production rose for the twenty-first consecutive month.[47] Typically, machine tool capitalization tends to lag economic growth while factory owners delay large capital investments until the recovery is fully on track.

While business should improve for the U.S. machine tool manufacturers, the outlook for former employees may not be as fortunate. The current unemployment rate for the sector is 9% compared to 3% in 2000. In contrast during the same period, labor productivity (measured by output per hour) increased approximately 3% per year which will undoubtedly increase structural unemployment in the machine tool sector.[48] This year should show solid improvements, except for employment, for the machine tool industry.

Additional factors should converge in 2011 to increase U.S. machine tool production as the effects of the federal stimulus, an upturn in automobile sales, and a relatively weak dollar

increase the international competiveness of American goods. However, the current surplus manufacturing capacity, a result of recession-driven reduced production, will dampen growth slightly as manufacturers deplete surplus prior to making new capital investments.[49] However, there are positive signs; having taken note of the longer order processing times, complex supply chain management, and higher shipping costs, many large manufacturers have started to return from overseas operations to domestic manufacturing. Notably, General Electric Company, Caterpillar Incorporated, Ford Motor Company, and NCR Corporation have announced plans to bring previously offshored manufacturing facilities back to the U.S.[50] Representatives from the British government report that some British companies are also eyeing the U.S. as an attractive location. These relocation decisions coupled with the positive economic outlook should provide opportunities for U.S. machine tool manufacturers to regain market share and should be encouraged by U.S. government incentives based on Buy American caveats.

In summary, the health of the manufacturing sector is defined through numerous metrics and factors. Some measures, if taken individually, can paint a picture of growth while others show a disturbing decline. For example, productivity has increased over the years and is three times its 1972 level (see Figure 5) while correspondingly, manufacturing shed millions of employee positions. Manufacturing is an integral and important sector of the American economy in the past, present and foreseeable future. Whether one believes it is growing or declining, the U.S. cannot take the risk of losing its domestic ability to produce strategically valuable products. With this in mind, the MISG identified a number of issues challenging manufacturers and recommended positive and forceful government attention.

CHALLENGES

There is a multitude of challenges facing American manufacturers after the recent recession. The challenges affected small, medium, and large manufacturers with varying intensity. The MISG focused on those challenges that appeared most during our research, interviews and site visits. The first issue discussed here is the most systemic and most important to the manufacturers visited.

Taxes. The U.S. is falling further behind in the race to attract manufacturing jobs and capital. Two major contributing factors to this collapse include the second highest corporate tax rate among Organization for Economic Cooperation and Development (OECD) countries and a system that imposes its corporate tax rate on income earned abroad by U.S. based businesses.[51] There are generally two systems nations use to assess corporate taxes: worldwide and territorial. A worldwide system taxes resident corporations on income earned from both domestic and overseas activities. Worldwide taxing systems provide credits for foreign income taxes paid by a corporation and taxes income above the foreign rate when the corporation repatriates the income to its parent jurisdiction. A territorial system taxes a corporation on income earned from activities within a nation's borders, but income earned by overseas subsidiaries is not subject to taxes within its jurisdiction of residence. The U.S. uses a worldwide system and some international companies have cited this fact as the primary reason why they decline to establish operations in the U.S. A worldwide system encourages corporations to maintain their income in foreign locations with lower corporate tax rates. This is a powerful incentive for U.S. companies to maintain earnings in foreign holdings rather than be subject to higher U.S. corporate tax rates. The deferral of foreign-earned income reduces the contribution of corporate taxes as a percentage of federal revenue and national income (GDP). During the 1960s, corporate taxes constituted over 20% of federal revenues and 3.5% of GDP; today, corporate taxes account for

only 6% of federal revenues and 1% of GDP.[52] Taxing jurisdictions look to increase collection on wages, investments and other outputs to close the gap in revenue shortfall. In addition to the revenue losses and the narrowing of the tax base, the U.S. faces large budget deficits that could balloon further if corporate tax changes are not considered to be revenue neutral. For example, some experts estimate a recent proposal by the House Ways and Means Committee chair to cut corporate tax rates by 10% would add $2 trillion dollars to the federal deficit without any equivalent offsets or spending cuts to generate the short-term loss in revenue.[53]

Manufacturing industries require significant investment in R&D and capital assets, but the tax preferences for these key drivers are limited to a selected time period that does not reflect the reality of competition for international manufacturing business activity. The R&D tax credit that provides incentives for manufacturing businesses to invest in innovation is set to expire at the end of 2011. The continuing temporary nature of this credit forces manufacturing businesses to make decisions regarding research and innovation in an uncertain environment. Additionally, the R&D tax credit does not require manufacturers to produce the resulting products within U.S. borders.[54] Furthermore, the temporary tax preferences do not take into account the complexity of capital investments in the manufacturing industry. For example, the current tax laws concerning expensing and depreciation of tangible assets only allow for an accelerated expensing and depreciation if the asset is put into place the same year it is purchased. Many manufacturing assets such as robotics and machine tools take extended periods of time to design, produce, and deliver, making it difficult for manufacturers to take advantage of the tax incentive.[55]

In addition to the challenges with temporary incentives, the U.S. corporate tax system creates economic volatility by encouraging companies to finance their investments with debt rather than equity. Within the current system, interest payments on debt are deductible while the value of dividends paid from equity financing is not. The U.S. is not alone in its subsidizing of debt financing but the scale of its practice is unique.[56] In 2007, a Treasury Department study stated, "the United States has the greatest disparity between debt and equity effective marginal tax rates in the Organization for Economic Cooperation and Development (OECD)".[57] This is especially challenging for manufacturing companies as they require greater financing for capital assets to support business expansion. Many highly leveraged companies find the prospect of growth difficult because of the high cost of servicing debt. The issue of excessive borrowing came to the forefront during the recent recession as some corporations faced the prospect of insolvency because of their heavy debt burden.

Skilled Workers. The MISG found that access to STEM skills is impacting manufacturers in North Carolina and Pennsylvania. Those companies asserted that the U.S. school system was not producing the quality and quantity of workers who were familiar with industrial practices, materials, engineering and technology. According to one industry CEO, only 17% of high school graduates are ready for STEM education, and of those, only one-third expressed an interest.[58] This makes it difficult for companies to hire local individuals with the required technical degrees, especially if a company is International Traffic in Arms Regulations (ITAR)-restricted and cannot hire foreign nationals. Without STEM education to foster the talent, knowledge, and creative thinking of America's future workforce, innovation on a scale that will keep the U.S. globally competitive will simply not be possible.

A recent STEM study identified a scarcity of scientific talent above the undergraduate level for U.S. nationals. Companies who operate in defense and national security markets are experiencing additional challenges with the supply of STEM skills in U.S. nationals. Engineers

are in particularly short supply relative to technicians; specifically, 18% of the STEM workforce, up from 13% in 1994, is foreign born and 30% of foreign-born PhD graduates do not remain in the U.S. The study also found that many STEM graduates, because of their prized problem-solving skills, enter service industry jobs, like finance, instead of traditional STEM manufacturing jobs.[59]

There is a related challenge with supporting and encouraging the immigration of STEM labor. In the past, America enticed the best minds to the U.S. by providing for ease of entry. One needs only to look at the heritage of great minds that assisted with our nuclear weapons development and space program to understand the value of importing STEM labor. However, the current U.S. immigration policy does not make it easy for manufacturing companies to bring talent to the U.S. There is real competition between countries. National education standards with an emphasis on STEM are the key to winning. Other foreign governments have identified this as key to their own economic growth and are aggressively pursuing STEM-educated workers by increasing incentives for foreign nationals to relocate, study, and obtain employment. High quality STEM education and learning environments will foster innovation and imagination. This environment will produce graduates who will germinate new inventions, develop new products, and create new solutions for many of our world's most pressing problems.[60] Even with the best STEM graduates, manufacturers still have to compete across the globe.

International Competition. The theory of comparative advantage states that countries derive an advantage by specializing in production at a lower opportunity cost than others. Countries with a comparative advantage are better off when they specialize and then trade for other goods.[61] However, this does not mean that everyone gains equally from trading. The MISG found that trade policies, subsidies, and diplomatic engagement of other nations creates incentives to move U.S. manufacturing abroad. Stiffer global competition requires policymakers to understand the limitations of economic theories before entering into or supporting trade agreements.

An important step to understanding the playing field is not truly level is to realize that some U.S. competitors, China in particular, are not operating as a free market. As part of their method of centrally creating and publishing a five-year plan, they both openly and covertly subsidize manufacturing. In particular, they incentivize manufacturing that will export goods. See Appendix D for information on China's industrial plan. During MISG site visits, corporate CEOs spoke of trips to countries like China where they were met by high ranking government officials who asked what could be done to bring their business there; and then watched as the Chinese executed a support plan in minimal time. One company executive stated that much of their fixed cost infrastructure was paid for by the Chinese government.

In addition, China's deliberate policy of not allowing the Yuan to float makes U.S. imports of Chinese goods artificially cheap and gives U.S. companies that open factories in China an unfair type of subsidy. That is good for China but bad for the U.S., and helps explain the majority of the U.S.'s trade deficit with China.[62] Many other countries also use policies that discourage imports while promoting their exports. In Brazil, the average applied tariff rate was 11.5% in 2010.[63] There is an industrial products tax that usually ranges from 0% to 15%, but goes up to 365% on cigarettes and alcoholic beverages. There is also a merchandise and service circulation tax on goods moved through Brazil, at 18% in Sao Paulo, and 12% in other Brazilian states.[64] U.S. industry competes on a global field where the competition uses rules and tactics to their advantage.

Regulations. In addition, there are concerns in industry that government regulations are too burdensome. Excessive regulations can reduce a country's competitive position in the global marketplace. Many international governments simplify this process to attract businesses. Globally, the U.S. does not score well on the burden of government regulations and there is concern that the trend is worsening. The OECD concluded the U.S. had more significant barriers to entrepreneurship, a larger administrative burden, and greater barriers to competition than many industrialized countries.[65]

Economists generally believe regulation hurts business, and small business in particular, in several ways. The first is that small businesses do not have the revenue to cover the fixed costs of complying with regulations.[66] Nicole and Mark Crain of Lafayette University estimate the cost per employee of complying with federal regulations at $10,585 for businesses with less than 20 employees, and $7,755 for businesses with greater than 499 workers.[67] Michael Friedrich is the President of Manitowoc Custom Molding (MCM) Composites, a small private company with about 60 employees. In February 2011, he testified to the Committee on House Oversight and Government Reform that the cost of federal regulations ranges from $1 trillion (Heritage Foundation) to $1.75 trillion (Small Business Administration) each year.[68] The cost of regulations stifles growth by removing some ability to invest in capital and is ultimately borne by the consumer. For example, the Patient Protection and Affordable Care Act places an undeniably onerous requirement on the company. MCM provides a high deductible health care plan that incentivizes preventive care. The firm pays 100% for visits covering physicals, mammograms, and colonoscopies, and also pays 70% of the monthly premium leaving the employee with the remaining 30%. MCM's plan likely will not meet government approval, forcing the company to use scarce budgeting resources to adjust its plan or drop coverage of employees and pay the fine.[69] A second concern is that government regulations create inefficiencies, which sometimes lead to relocating facilities to countries with less regulation. A third issue relates to uncertainty where businesses sometimes hold off on hiring and making capital investments pending the results of proposed legislation.[70] Export controls are a prime example.

Doug Palmer, a writer for Reuters, recently reported, "U.S. business groups argue overly restrictive export controls on defense, aerospace, computer and other goods have cost them billions of dollars in lost sales over the years to competitors in Europe and Asia."[71] Many U.S. companies lost contracts because the paperwork and process required to gain permission to export specific items was too burdensome. For example, a replacement washer or a bolt may require an export license because it is part of a larger item on the control list. Many items require review by different government agencies before approval. Foreign governments or corporations looking to contract U.S.-based firms for products are turning elsewhere since they cannot be certain that the Department of State will allow the transaction to continue. During MISG visits, several company executives stated that foreign companies receive an unfair advantage when not subjected to the same ITAR restrictions and advertise their products as "ITAR Free." All of this prevents companies or foreign governments from looking to the U.S. as a potential supplier and thus inhibits sales. Defense Secretary Robert Gates has proposed a new system where "higher walls are placed around fewer, more critical items."[72] Many elected officials in Congress are skeptical when these reform initiatives are applied to China. However, a January 2007 report by the Institute for Defense Analyses strongly recommended inclusion of China in any export reform. They point to the fact that U.S. businesses were losing ground to foreign competitors in a rapid growing market and any security concerns U.S. lawmakers had

about China acquiring sensitive technologies were in fact hindering rather than helping. Specifically, they argue, "On top of this, the rules could actually be counterproductive for national security if U.S. export restrictions encourage China to develop indigenous capabilities."[73] The current state of affairs contributes to the slip in U.S. technology research and development as multinational corporations are moving their operations abroad to take advantage of less restrictive export controls.[74] The current administration seems to be listening and engaging to address the situation. President Obama recently stated, "…I am directing federal agencies to do more to account for--and reduce--the burdens regulations may place on small business."[75] Any gains and long-term benefits realized from the export control initiative is highly dependent on senior leader involvement. For example, there are some concerns that the departure of Secretary Gates and Secretary Locke will lessen the political will of others to continue providing the emphasis and attention needed to improve the export control issue.

OUTLOOK FOR THE MANUFACTURING SECTOR

These challenges are daunting and there was an awakening of sorts during the last two years with respect to manufacturing in the U.S. There has been much rhetoric, many debates, plenty of studies, and some policy decisions made dealing with U.S. manufacturing and production, but these alone will not ensure the U.S. remains the leading manufacturing nation in the world. Without question, there are many viewpoints when it comes to manufacturing in the U.S. Depending on who is talking, one might hear, "the U.S. is bleeding jobs" or "the U.S. is not cost competitive anymore." That particular perspective is reinforced with the expected loss of 1.2 million manufacturing jobs from 2008 through 2018.[76] With an expected 166.2 million Americans employed in 2018,[77] manufacturing will comprise only 7.4% of the U.S. workforce.[78] Yet, manufacturing output is expected to increase by 2.1% annually over the same time period reaching $4.9 trillion by 2018.[79] The projections do not supply assessments of whether the output level or employment level are sufficient to continue steady growth. The Obama administration may not have their focus on the statistical predictions, but were concerned enough to produce a vision for manufacturing, exports, and innovation.

President Obama's Framework for Revitalizing American Manufacturing presented seven "must do" policies to support manufacturing. In summary, the policies emphasized development of skills, new technologies and business practices, and efficient and stable capital markets. In addition, the framework was intended to help communities transition to a better future, invest in transportation infrastructure, ensure market access and a level field, and finally improve the business climate. The administration pointed to the American Reinvestment and Recovery Act as a vehicle to support some of these policies while others would be supported through future budget requests. At the time, no single organization was placed in charge of the framework, but a few months later President Obama presented his vision for increasing exports.

In March 2010, President Obama announced his National Export Initiative (NEI), which mobilized departments throughout the federal government to help double U.S. exports by 2015 and support millions of jobs. The NEI will provide more funding, focus, and Cabinet-level coordination to increase U.S. exports. This represents the first time the United States will have a government-wide export-promotion strategy with focused attention from the President and his Cabinet. It is a step in the right direction, but needs to be complemented by other initiatives.

The administration and Congress added another dimension of support for the manufacturing sector in early 2011. In the span of a few weeks, a manufacturing czar was

named, Congress passed the America COMPETES Reauthorization Act of 2010, and the President's National Economic Council (and others on the White House staff) produced a Strategy for American Innovation. There are many moving parts but the combination provides a short-term outlook on the USG vision for manufacturing support. In January 2011, Rob Bloom was elevated to an Assistant to the President for Manufacturing Policy within the National Economic Council. Other than being a czar for the administration, it is unclear what specific tasks Mr. Bloom will perform or what budgets he will control. That same National Economic Council was responsible for publishing an innovation strategy for the U.S., which covered some of the same ground as by the revitalization framework. The administration intends to invest in the building blocks of innovation through STEM education, infrastructure improvements, and promoting innovative, open and competitive markets. The strategy creates new initiatives in fundamental research, tax credits for research and experimentation, and prioritizes where the government can help spur technology advances. The USG decided to provide research funds in energy, biotechnology, nanotechnology, advanced manufacturing, space, health care, and education technology. While these initiatives appear to be steps in the right direction, other administration priorities run counter to the needs of manufacturers. During site visits, the MISG captured concerns with increased costs from health care reform and current uncertainty in tax code changes for small business. Synergy exists among the framework, strategy, and export initiatives but legislation to enact the policies is lagging.

The most recent step to capitalize on the initiatives happened when Congress passed the America COMPETES Reauthorization Act. Its focus was on coordinating and streamlining STEM education programs and fundamental research within the multitude of government agencies. The President's framework called for the doubling of R&D in key agencies while improving coordination of that R&D. The strategy also called for doubling R&D for portions of the National Science Foundation (NSF), National Institute for Standards and Technology (NIST), and Department of Energy (DoE) budgets.[80] The America COMPETES Reauthorization directed a committee to form under the Office of Science and Technology Policy (OSTP) to develop a strategic plan and coordinate federal programs in advanced manufacturing R&D. NIST will continue its Manufacturing Extension Partnership to assist small- and medium-sized manufacturers with new products. The NSF will award grants to universities to support advances in manufacturing. DoE will support advanced manufacturing through its Advanced Research Projects Agency-Energy.[81] The outlook for the 2012 proposed budget shows continuing support for NSF, NIST, and DoE. However, the appropriators in Congress may not support funding the authorized initiatives in the America COMPETES Act.

The administration and Congress have promoted several measures that will affect the manufacturing sector over both the short and long-term. While having a vision for supporting manufacturing, the administration has not translated all of it into concrete actions that will help manufacturers thrive and prosper. With that in mind, the MISG offers some recommendations in the next section to provide immediate and long-term, positive impact on the manufacturing sector.

RECOMMENDATIONS FOR GOVERNMENT POLICIES, GOALS, AND ROLES

Despite the significant effort invested in frameworks, strategies, and legislation, the collective system does not appear sufficient to support a national strategy of long-term innovation. While the proposed legal, economic, and diplomatic remedies are well known, they are not aligned to establishing the necessary business climate that will retain competitive

capabilities within the U.S. The MISG offers the following specific recommendations to increase competitiveness of U.S. manufacturing. These recommendations cannot be implemented independently and require a holistic approach within government and industry to create a U.S. Industrial Policy. The MSIG also recognized that U.S. decision makers must have the courage to preserve the "seed corn" of the nation's future during what will be intense budget cutting decisions. The policy is not meant as 'so-called' corporate welfare to prolong the life of declining industries, but rather creates the environment in which U.S. manufacturers can thrive and prosper by staying in the U.S. A good place to start is with the MISG's recommended changes to tax policy.

Reform Tax Policy

1. ***Lower statutory rates and move toward a territorial tax system***. The U.S. should reduce the corporate tax rate to the average of the thirty OECD countries (see Table A-1 in Appendix A) and move to establish a territorial tax system. This would eliminate the need for preferences enacted to offset the current worldwide taxation system: offshore deferral and foreign tax credits. A new taxation system would reduce the outflows from U.S. companies and provide incentives for increased foreign direct investment. It would provide a tax code that ensures American manufacturing companies pay a more competitive tax rate compared to those of other OECD countries. It would prompt U.S. manufacturers to be more competitive abroad and allow for the repatriation of foreign earnings to invest in domestic job growth and business expansion. Manufacturing companies would function on a level playing field with foreign competitors with no need to develop costly tax avoidance strategies. Additionally, companies would realize a greater after-tax profit that would spur stronger confidence, further business investment, and increase financial strength in the U.S. manufacturing industry.[82]

2. ***Expand and make permanent credits for investment in R&D and link them to U.S. manufacturing activities.*** The U.S. should take steps to expand, make permanent and link the Alternative Simplified Credit (ASC) to domestic manufacturing activities, aligning incentives to match the intended benefit and outcome. The credit is an effective targeted incentive that encourages risk-taking and provides manufacturing businesses a global competitive advantage. As the leader in R&D investments, the manufacturing industry would greatly benefit from an expanded credit. Manufacturing R&D projects typically average 5-10 years in duration and a permanent credit would guarantee access to the credit over the duration of those activities.[83] Linking the credit to U.S. manufacturing activities would negate the use of U.S. tax dollars to develop technology, only to manufacture the resulting product overseas.

3. ***Do away with depreciation and allow expensing of capital assets in the first year (equipment and information technology).*** The U.S. tax code should allow manufacturing companies to expense the cost of capital assets during the year of purchase. The move to a first-year expensing policy lets a company recover its capital expenditures quicker, which in return reduces the cost of investments and lessens the risk of capital purchases. These outcomes will encourage further spending on capital equipment and enhance worker productivity. In addition, the U.S. should eliminate the archaic and bureaucratic depreciation schedule for capital equipment and information technology because it does not take into account the difference in use and true lifespan for equipment used in modern manufacturing.[84] A first-year expensing policy would greatly enhance a company's cash flow position, decreasing the dependence on debt financing and reducing credit restrictions on small manufacturing companies.

4. ***Reduce the tax code's favoritism with regard to debt financing.*** The U.S. needs to make changes to the tax code to discourage manufacturing companies from excessive reliance on debt rather than equity to finance investments. To encourage greater use of equity financing, the tax code should allow companies to deduct a percentage of the dividends paid to shareholders. Equity financing will strengthen company risk profiles, protect their solvency during periods of economic instability and provide more capital for manufacturing companies to expand.

5. ***Tax small businesses and manufacturers as corporations and lower their rates.*** Small business represents a major share of the U.S. manufacturing industry and is the engine of job growth for expanding the manufacturing industrial base. The U.S. should make changes to the tax code by taxing these businesses as a corporation (entity) and reducing the statutory rate on their business income. This would permit small manufacturers to retain more of their earnings and expand their business through the acquisition of new equipment and hiring of additional employees.[85] This change will also permit small manufacturers to prioritize their structure based on their business and not a complex tax code. The new construct would spur the type of risk-taking that drives innovation and maintains a long-term competitive advantage in the global manufacturing economy.

STEM Labor – The Future of Manufacturing

The U.S. should continue to encourage America's young people to become the scientists, engineers, and technical experts of tomorrow, and provide them with the proper STEM-focused education they need to compete in the global job market. Long-term thinking should also prevail in order to refocus America's education system on STEM. This approach will be a challenge in an environment of fiscal austerity and where politicians are beholden to two-year election cycles. Members of Congress who have been sent by their constituents to Capitol Hill to cut spending must at the same time have the courage and vision to fight for increased funding in STEM education as a long-term investment. In the long run, increased investment in STEM education will make the difference and reap enormous benefits for America's competitiveness. Additionally, revising the immigration process offers a realistic, proven solution to attract and retain STEM workers. The following recommendations are what the MISG feels are necessary to revitalize and sustain America's STEM labor.

1. ***Reform K-12 system to advance STEM education.*** The U.S. education system needs to be reformed and restructured in order to ensure students have adequate exposure and access to curricula focused on STEM. President Obama spoke of reforming America's K-12 education system and training 100,000 new math and science teachers during a recent address to the Chamber of Commerce.[86] The MISG recommends careful consideration of the changes to the K-12 arena proposed in a recent Information Technology and Innovation Foundation report.[87] Additionally, students should be encouraged to pursue higher education in these areas, and careers that capitalize on STEM education.

2. ***Encourage industry and academia partnerships to improve access to STEM labor.*** The MISG encountered a number of examples of cooperative relationships between industry and education in its research and industry visits. Manufacturing companies are employing internship and work-study programs to create the high-tech workers needed for success. Consider the internship program between John Deere Turf Care and North Carolina State University. The engineering students from NC State get practical experience, the company gets innovative ideas, and the university gets financial support. These John Deere interns are usually hired full-time, at substantially higher pay grades than their peers, according to an intern program official.[88] In

addition, GE in Schenectady has partnered with a local community college. While students there train for jobs at GE, they earn a paycheck and have their tuition paid. The students have a job, GE gets the engineering technicians they need, and the region becomes more attractive overall.[89] In addition, consider a workaround used by companies in the U.S. and Canada. The companies hire graduates with only a bachelor's degree and then train them, similar to an in-house 'Boot Camp' or graduate school. These are just a few examples of the creative solutions the U.S. needs for boosting STEM education incentives while waiting for K-12 reforms to come to fruition. The OSTP committee should look for ways to encourage and reward this behavior in companies.

3. ***Adjust grant incentive.*** A slight change in Pell grants to require more studies in STEM would increase the number of students graduating with skills that manufacturers need. Another more radical approach would create full STEM scholarships with the stipulation that graduates work in education or the manufacturing sector for four to six years. Comparable NSF graduate fellowships cost $40,500 a year with no obligation for further service.[90] In addition, a campaign should be launched to ensure students are aware of PhD support mechanisms available via fellowships, scholarships and/or assistantships from various government agencies (e.g., National Aeronautics and Space Administration (NASA), Department of Defense (DoD), Department of Homeland Security (DHS)).[91]

4. ***Streamline the current immigration processes.*** The current process requires that the applicant or sponsor of the applicant coordinate the approval process through three separate federal departments. While making the processes customer focused, remove the H1B visa cap when businesses demonstrate they cannot fill the positions with available U.S labor.[92] Allow U.S. STEM degree holders who have a job offer to transition directly from student visa to green card, if employment is available.[93] These reforms serve business while protecting U.S. interests and preserving available jobs for Americans that want and are qualified for them.

Reform Regulation

Several key steps can be taken to enhance U.S. competitiveness and improve the regulatory environment. The primary focus areas relate to export controls of defense items and a better focus on government regulation. In the area of export controls of defense items, the primary improvements needed are more reasonable processes for determining the items that should be on the export control list, as well as Congressional approval of new standards for export controls. The regulatory environment can be improved by better communication and coordination between regulatory agencies and the public, use of metrics by regulatory agencies to assess results, and a rigorous assessment of the impact of existing and proposed regulations.

1. ***Adjust U.S. Export Control List inclusion standards.*** One of the biggest criteria as to whether or not an item should be on the controlled list is its availability through other commercial vendors. If a customer can purchase an advanced system on the open market that is comparable to what is sold by a U.S. company, then American businesses should be allowed to compete for the contract. The government should streamline the process to identify truly sensitive components or items and, based on a risk analysis, determine their suitability for inclusion on controlled lists. Items classified as dual-use should be coded at the lowest possible level dependent on both a risk to national security approach and ability to obtain the item through foreign/commercial procurement. The process should be extremely user friendly and time efficient. Some company requests currently require different agencies to review and approve, which only hinders their ability to compete globally. Once proposed, Congress should rapidly approve the new standards for export control. In line with this, the government should increase

cooperation with allied governments, industries, and corporations in its attempts to accurately regulate items and ensure continuity of effort.

2. ***Improve communication between regulatory agencies and the public.*** Having an open dialogue in advance of mandating the regulations will add value. Agencies should develop and make available to the public the regulatory impact analyses well before regulations are written. Accomplishing the analyses after the key decisions have been made gives the federal government a monopoly on producing regulatory impact analysis, which adversely impacts the public's ability to affect or assess the analysis quality and agency decisions.[94] Open communications will allow all parties to understand each other's perspectives. It is clear companies understand the economic situation better than regulators do and if they are successful in building an atmosphere of trust and transparency, they can be better positioned to respond.[95]

3. ***Improve metrics to implement regulations successfully.*** The Government Performance and Results Modernization Act of 2010 outlines the need for goals and measures for major regulations.[96] The Act also requires the Office of Management and Budget (OMB) to establish performance goals for the government. Individual agencies should document how their regulations support the high-priority performance goals and also assess the progress of how agency regulations contribute to agency priority goals.

Innovation

The US is pursuing a strategy of maintaining a technological advantage through innovation and as part of its national strategy. To be successful, this approach requires sustained investment in R&D, mechanisms to delay technological imitation by other nations, and a system that aligns business decision making to national priorities. The deliberate economic and social policies of other nations to enhance their influence, power, and prosperity create challenges and risks for this strategy.

The public, Congress, and the executive branch should understand that a market failure exists when it comes to research and development. It is often not in the best interests of a corporation to invest large amounts of capital in technologies that will not provide a profit for 5 or 10 years. The government should continue to fund basic research and development, improve coordination of manufacturing-related R&D, and explore new options to stimulate innovations and technological breakthroughs.

One company representative told the MISG that the key to success is to create markets to drive innovation, and manufacturing will follow, not the other way around. The U.S. should stop chasing the past and incentivize the future. Secretary of Commerce Gary Locke apparently agrees, as he said he wants the U.S. to grow businesses that create long-lasting economic value.[97] However, according to Secretary Locke, no advanced industrialized economy had done less over the last decade to improve its economic competitiveness than the United States.[98] Asian countries such as India and China far outpace the United States in growth in R&D investment."[99]

1. ***Create and support public-private partnerships.*** The Committee on Technology, as required by the America COMPETES Reauthorization Act, has broad responsibilities that can be augmented with some different strategies. Public-private partnerships, similar to the Semiconductor Manufacturing Technology (SEMATECH) consortium, but with academia added, can serve as centers of excellence for various aspects of advanced manufacturing. The private-public-academic centers can help implement the requirements in the law.

2***. Create new standards to drive innovation***. The Committee on Technology, with the Environmental Protection Agency, Department of Transportation, and other regulatory agencies, can establish policies that drive manufacturers to create new technology to meet regulations. Currently, fuel efficiency standards are set to rise to an average of 35 miles per gallon by 2020. The fuel efficiency standards should be broadened to all forms of transportation (e.g., heavy/light trucks, rail, aircraft, and watercraft) and all types of combustion engines (e.g., landscaping/construction equipment, generators, etc.). Additional efficiency standards could be applied to power generation. A renewable electricity standard that mandates utilities obtain at least 25% of their power from renewables by 2025 with interim goals and flexibility for states to exceed this minimum standard is essential to creating market demand for green energy. This will provide assurances to manufacturers, workers, and investors that they can count on the clean energy economy to be a stable source of power, revenue, and jobs for the foreseeable future.[100] While the economic cost of fossil fuel generated electricity is currently lower than green electricity, over the long term, the environmental and social cost of traditional electricity generation is substantial.[101] Such a standard also spurs innovation to create the products and processes to meet the goal. Germany has identified renewable energy as a major factor in its long-term manufacturing and economic growth. Currently, it is the leading manufacturer of photovoltaic solar panels and is aggressively reducing its dependence on foreign energy imports. Given some predictions as to future costs of fossil fuels, it is positioning itself to reap a cost advantage over the long term. Admittedly, this adds costs in direct and indirect ways, but will drive the market to create innovative solutions. There is also the potential risk of other unintended effects that policymakers must think through before implementation. Involving industry in developing these policies could further mitigate unintended consequences.

3. ***Alternative funding incentives.*** Creating alternative funding incentives for research and development could mitigate some of the risk the USG assumes when it tries to pick winners by awarding grants. The America COMPETES Act authorizes federal agencies to award prizes in competitions that stimulate innovation associated with that agency.[102] This would allow the USG to reward the winner after the competition finishes rather than before it starts. A very different concept incentivizes venture capital firms to find or manage winning innovations using federal funds. Specifically, venture capitalists (VC) would bid for the use of public funds that they would in turn use to fund companies based upon their rules and expertise. The VCs bid for federal funds at the start of an idea, then during an R&D phase, and lastly negotiating a royalty split between the USG and the VCs.[103] Obviously, this concept requires additional review but has the potential to create a partial return on investment that is certainly better than just giving the money away.

4. ***Target innovation strategically.*** Policymakers should consider targeting incentives for innovation in areas deemed strategic to the future U.S. economy. Recognizing when other nations are pursuing policies that risk our future prosperity and defending against them is essential. As policymakers consider the impracticality of protecting all technologies, they must be prepared to make tradeoffs. In order to be successful, they should expect a requirement for significant incentives in areas deemed strategic by other nations. For example, the MISG recommends going beyond the renewable energy goals in the administration's innovation strategy.

Establishing a competitive edge in the 'new' renewable energy sources like solar and wind is only possible through substantial investment in R&D. The key to establishing and

maintaining a competitive advantage in green energy technology for U.S. manufacturing is sustained government investment in research and development. The amount of investment directed toward renewables over the past decade has been inadequate, and focused primarily on products rather than improving manufacturing techniques and processes.[104] Without significant investment in energy R&D, the U.S. risks seeing the next generation of clean energy technologies invented and commercialized by one of our foreign competitors.[105] To avoid this, the government should increase the R&D budgets primarily for existing science and technology agencies, such as the DoE's Office of Science and its eight proposed Energy Innovation Hubs, the NSF, and the NIST.[106] One existing piece of legislation that already addresses this area is the Energy Independence and Security Act (EISA) of 2007. Section 451 of this law directs the Department of Energy to conduct research on, develop, and demonstrate new processes, technologies, and operating practices and techniques to significantly improve the energy efficiency of equipment and processes used by energy-intensive industries.[107] The government should ensure that this R&D effort is fully funded.

Assertive Competition Against Sovereign States

U.S. manufacturers compete not only with other companies but with other sovereign states as well. The U.S. needs a "new policy tradeoff that strikes a better balance between the efficiency and overall economic growth that globalization delivers and the inequality of income and job opportunities that it creates."[108] Ultimately, a collaborative solution must be found for aggressive trade practices by competitor countries, while not alienating potential foreign markets. Solutions to this problem will require innovative thinking and leadership to steer through the confusion and get to the truth regarding foreign tariffs and subsidies. Perhaps it is time the U.S. federal government started to act like state governments.

1. ***Negotiate and enforce international fair trade laws***. The U.S. should assertively represent its manufacturers before World Trade Organization forums when companies identify unfair trade practices. Based upon MISG interviews, it has been the policy of the last few administrations to let the market decide the outcome when companies witness illegal trade tactics. Of course, exceptions exist with claims against Airbus subsidies and Chinese 'dumping' in the tire market. If the USG does not actively pursue trade violators through international venues, then it should incentivize companies to bring suits before the WTO by granting tax credits for the legal costs.[109] The U.S. can also use other diplomatic and economic levers to bring about desired behavior. The USG will need its best diplomatic negotiating skills, persuasive communication, and courage to complete the next Doha Round of trade talks to eliminate exceptions for countries that no longer need them because they can compete globally.[110] The U.S. should be prepared to eliminate agriculture subsidies to negotiate gains in manufacturing areas.

2. ***Negotiate trade agreements to give U.S. manufacturers full access to new markets.*** Broad free trade agreements have been the goal of the last four presidential administrations. However, completely free trade doesn't appear to be one of the negotiated goals. Treaties with Canada, Mexico, Central America, South Korea and others still to be ratified, open the U.S. markets to foreign goods with little to no tariffs. However, the foreign markets retain the ability to protect their industries from U.S. products.[111]

Desired End State: Create an industrial policy

The President should grant the Assistant to the President for Manufacturing Policy the authority to create an Industrial Policy based upon the administration's current initiatives, the America COMPETES Act, and the preceding MISG recommendations. The private sector is filled with similar initiatives that can inform the policy. Douglas Woods, President of Association of Manufacturing Technology, released a Manufacturing Mandate which calls for a coordinated national strategy that: incentivizes innovation and R&D in new products and manufacturing technologies; assures the availability of capital; increases global competitiveness; minimizes structural cost burdens; enhances collaboration between government, industry, and academia; and builds a better educated and trained "smart force."[112]

Internationally, foreign companies are supported and aligned to national objectives. In fact, one can argue that governments, not just companies, compete. For example, the European Committee for the Cooperation of the Machine Tools Industries represents fifteen countries and is charged with facilitating industry standards and market studies, directing and sharing the results of research and development, and working to ensure European Union (EU) legislation passed is favorable to the machine tool industry.[113] Another example of intervention and direct subsidy by the EU is their Regional Development policy. The EU provides millions of euros each year to companies as an incentive to build factories in high unemployment areas. Possessing 51% of the global market share, their mission statement is, "The Machine Tool Industry is a strategic sector to sustain long-term competitiveness and independency of the European economy."[114] Japanese machine tool firms have focused on strategic R&D alliances and precision part makers. These alliances in Japan result in an information-sharing system and the early participation of front-line skilled workers in assembly. Additionally, the Japanese Ministry of International Trade and Industry oversees mergers and product line divestment, funds coordinated R&D, and encourages capital investment via special depreciation allowances.[115] To compete, the U.S. requires a vision beyond a national manufacturing strategy that means a coherent industrial policy to foster collaboration between companies and the federal government to support the best, retainable industries.

CONCLUSIONS

The manufacturing sector is crucial to the health of the U.S. economy and its ability to maintain a strong industrial base in support of national security interests. To the public, the measure of performance of the U.S. manufacturing sector is an enigma. Output is expected to increase in the future. However, relative to GDP, both the output and the ratio of working population employed in manufacturing will decrease. The U.S. must determine the sector's position as an economic engine of the future and how it can support that objective. As other nations recognize the realities of the global economy and provide support to their manufacturing companies, U.S. companies continue to endure a fragmented USG approach. To support integrating the pieces together, the MISG examined the dynamics between industry, government, and academia as well as how their interaction affects the future of U.S. manufacturing. The MISG spent four months researching, conducting interviews, and performing site visits in the U.S. and abroad. The site visits covered a broad range of the manufacturing sector in the U.S., Canada, Slovakia, Germany, and the United Kingdom. The group studied the challenges faced by small, medium, and large manufacturers in a variety of industries. The group also identified some concerns within the USG that something should be done to 'increase' manufacturing, but the efforts lacked urgency.

The U.S. manufacturing sector faces tremendous pressures from worldwide competition, making it difficult for its companies to succeed in the global economy. During the 2007-09 recession, over 7.3 million jobs were lost, with manufacturing jobs making up 32% of that loss.[116] The sector continues to contract as overseas operations take advantage of lower labor costs, favorable tax policies and regulation, greater emphasis on innovation and proximity to emerging markets. Further supporting this decline are the improvements in global technology and significant growth of a skilled workforce outside the United States. Specifically, the MISG investigated most of the top concerns of the business executives interviewed during site visits. Number one on nearly all the lists was corporate taxes. The U.S. rate of 35% ultimately ensures that international manufacturers, based in the U.S., are going to find ways to offshore their production to meet shareholders' desire for profit. The difficulty of finding skilled workers, (i.e., skilled U.S. citizens) to create the next generation of manufactured goods made it into the executives' top five concerns. Beyond that, various manufacturers were concerned with export controls, regulations, a level yet competitive playing field, and access to capital. For U.S. manufacturing companies to remain viable there should be changes made to foster a business climate where they can compete.

Given the right set of actions and policies supported by government, academic and business leaders, the manufacturing industry can remain a competitive leader in the global economy. The cost of inaction would be detrimental to U.S. manufacturers and place them at a great disadvantage in comparison to their international competitors. The President and Congress have recently begun to pay attention to manufacturing, as evidenced by the Framework for Revitalizing American Manufacturing. The President's National Export Initiative and Strategy for American Innovation added new initiatives that could apply outside of the manufacturing sector. In addition, the America COMPETES Reauthorization Act tasked the President's OSTP to become much more proactive in coordinating efforts of the various agencies involved in manufacturing. Specifically, a committee under the OSTP will coordinate the STEM education programs as well as research and development of advanced manufacturing among various agencies. These actions will have minor impacts on the manufacturing sector. The MISG believes more dramatic steps must be taken to keep U.S. manufacturing competitive.

The U.S. is at a critical juncture in defining the manufacturing industry's role in the future of our prosperity, national security, and position to compete in a global economy. This is not only a short-term challenge, but also one that demands the development of long-term policies and actions to achieve a sustainable effort. The group identified several factors that contribute to a loss of competitiveness and if the USG does not take swift and decisive action, the manufacturing sector may descend to a point of no return. Policy makers should take the necessary measures to support the industry in reaching its full potential and maintaining the U.S. status as the world's leading manufacturer. There exists an immense opportunity to invest in programs that set the foundation for making the manufacturing industry more competitive. Actions should be broad-based and include an emphasis on structural changes that lead to a leveling of the playing field for U.S. manufacturing companies.

The MISG recommendations merged with the administration's efforts already underway represent more than a manufacturing strategy. The combination should be considered a U.S. Industrial Policy that, if implemented, will increase manufacturers' competitiveness. This is not an industrial policy like Europe used in the 1980s. The policy does not attempt to resurrect or prop up certain industries within the manufacturing sector. This industrial policy recognizes that

measured steps should be made to promote and sustain the environment in which U.S. manufacturers can succeed globally by producing goods in the U.S. The first priority in this policy is to reduce corporate taxes to the OECD average and limit them to a territorial system. Other tax initiatives can further increase competitiveness. Next, the MISG endorses the administration's plans in STEM education. Further tweaking some of the policies will help to fill the technical skills void that U.S. manufacturers face. Future trade agreements should have equal *quid pro quo* so that U.S. goods have the same market access as foreign goods have to U.S. markets. In addition, the U.S. should aggressively enforce trade practices within the WTO structure as well as working through the next Doha Round of trade negotiations. Finally, the USG should completely revamp export controls, reduce regulations that stifle competitiveness, and implement standards to spur innovation while continuing to support innovation in its various research and development forms. The MISG recognizes that this Industrial Policy will be tough to resource with USG leadership focused on fiscal realities. However, this is a long-term strategy, which requires near-term funding to keep the sector globally competitive.

The U.S. is still the largest, most productive manufacturing country in the world. However, U.S.'s manufacturing lead in the global economy has gradually eroded. U.S. policy makers must take the time to assess how best to leverage the proposed Industrial Policy in maintaining and growing U.S. competitiveness. With this policy, the U.S. takes ownership of its own economic engine, creating an environment that supports U.S. manufacturing business decisions and increases competitiveness in a world where other nations take deliberate and focused actions to enhance their influence, power, and prosperity, often at the expense of the U.S. The revitalization of the manufacturing industry will lead the U.S. to greater growth and foster an environment for business expansion by foreign companies within our borders. The challenges facing the manufacturing industry are great but can be met with effective leadership, pro-growth policies, and actions to enhance its competitiveness now and in decades to follow.

Appendix A
GERMANY'S INNOVATION STRATEGY[117]

Germany's High Tech Strategy establishes the following innovation policy priorities:

1. Developing Lead Markets

a. Defining clear objectives and fields of action: In its High-Tech Strategy, the Federal Government has defined objectives for 17 cutting-edge fields. These include, for example, health research, security research and energy research. There is a clear time table for initiatives in each of these fields. Both research funding and the prevailing conditions are taken into account.

b. Establishing a clear profile: For the first time, an analysis of strengths and weaknesses clearly shows where Germany stands in the various cutting-edge fields and where further action is needed. The central task is to open up new markets for products and services and to develop existing markets into lead markets. Within the cutting-edge fields, the High-Tech Strategy focuses on areas which are of outstanding national interest and which have economic and scientific potential.

c. Designing roadmap processes with industry and science: Coordination between politics, science and industry is necessary for enhancing Germany's competitiveness on international markets. It is a task for innovation policy to shape and steer this process, to support it and to provide for suitable conditions. Strategic partnerships are of particular importance in this respect.

2. Improving the Cooperation Between Science and Industry

a. Pooling the strengths of industry and science: High-Tech Strategy forges links between industry and science. Collaborations and joint projects will receive greater support than ever before, for example through the introduction of a new type of research grant, the funding of leading edge clusters and by spotlighting the best examples of cooperation between industry and science.

b. Investing in minds: The systems of initial and continuing vocational training will be developed further in keeping with future needs, and support for the highly talented and for young researchers will be extended. The Pact for Higher Education 2020 aims to ensure that a growing number of students will find favorable conditions for study and research.

c. Actively shaping European research and innovation policy: The national innovation system forms part of the European Research Area. The Federal Government therefore aims to link its innovation policy to European initiatives. This will also be an objective of the German EU Council Presidency during the first half of 2007.

3. Accelerating Direct Application of Research Findings

a. Shortening the time to market: Standards enable the successful marketing of products throughout the world. The High-Tech Strategy will assist industry in establishing such standards more quickly, thus increasing the competitiveness of industrial products. Furthermore, public procurement will be designed as a driver of innovation.

b. Improving conditions for high-tech start-ups and innovative SMEs: Young entrepreneurs will be assisted in entering the market, companies will receive support in establishing contacts with the scientific community and in translating their own research findings

into products, and the funding policy for small and medium-sized enterprises will be streamlined. General conditions will also be improved.

The Federal Government's High-Tech Strategy initiates an interdepartmental process for the entire legislative period. The Industry-Science Research Alliance, which includes representatives from industry and the scientific community, will support the implementation and further development of the High-Tech Strategy together with the competent government departments. The process of implementing the High-Tech Strategy will be regularly reviewed.

Table A-1. Economic Statistics--Country Comparison

COUNTRY SUMMARY							
Economic Indicator	**US**	**Canada**	**China**	**Germany**	**UK**	**Slovakia**	**EU**
Population (Millions) **	311.2	34.4	1,341.0	81.8	62.0	5.4	501.1
GDP (Nom) (Billions of USD)*	14,657.8	1,574.1	5,878.2	3,315.6	2,247.5	86.2	16,282.2
Trade Balance w/US (Millions of USD)*****	N/A	2,890.1	18,841.5	3,322.1	(164.4)	57.8	6,945.9
Current Account Balance (% of GDP)*	(3.2)	(3.1)	5.2	5.3	(2.5)	(3.4)	0.1
Manufacturing (% of GDP)***	13.0	14.0	34.0	19.0	11.0	19.0	24.4
R&D (% of GDP)****	2.7	1.87	1.22	2.50	1.87	0.59	1.86
Exports (% of GDP) ***	11.0	29.0	27.0	41.0	28.0	99.0	13.0
Net Debt (% of GDP)*	64.8	32.2	17.5	53.8	69.4	41.0	64.4
Unemployment (%)*	8.8	8.0	4.3	7.3	7.9	14.1	9.6
Corporate Tax Rate ***	39.2	27.6	25.0	30.2	26.0	19.0	N/A

* IMF World Economic Outlook April 2011 (2010 Data)

** UN Dept of Economic and Social Affairs 2010

*** World Bank / OECD National Accounts Data 2010

**** National Science Foundation Data 2011

***** US Census Bureau 2011

Appendix B
EUROPE 2020 STRATEGY[118]

Europe faces a moment of transformation. The crisis has wiped out years of economic and social progress and exposed structural weaknesses in Europe's economy. In the meantime, the world is moving fast and long-term challenges – globalization, pressure on resources, ageing – intensify. The EU must now take charge of its future. Europe can succeed if it acts collectively, as a Union. A strategy to will help the EU come out stronger from the crisis and turn the EU into a smart, sustainable and inclusive economy delivering high levels of employment, productivity and social cohesion. Europe 2020 sets out a vision of Europe's social market economy for the 21st century.

Europe 2020 puts forward three mutually reinforcing priorities:

1) Smart growth: developing an economy based on knowledge and innovation.
2) Sustainable growth: promoting a more resource-efficient, greener and more competitive economy.
3) Inclusive growth: fostering a high-employment economy delivering social and territorial cohesion.

The EU needs to define where it wants to be by 2020. To this end, the Commission proposes the following EU headline targets:

1) 75% of the population aged 20-64 should be employed.
2) 3% of the EU's GDP should be invested in R&D.
3) The "20/20/20" climate/energy targets should be met (including an increase to 30% of emissions reduction if the conditions are right).
4) The share of early school leavers should be under 10% and at least 40% of the younger generation should have a tertiary degree.
5) 20 million less people should be at risk of poverty.

These targets are interrelated and critical to our overall success. To ensure that each Member State tailors the Europe 2020 strategy to its particular situation, the Commission proposes that EU goals are translated into national targets and trajectories. The targets are representative of the three priorities of smart, sustainable and inclusive growth but they are not exhaustive: a wide range of actions at national, EU and international levels will be necessary to underpin them. The Commission is putting forward seven flagship initiatives to catalyze progress under each priority theme:

1) "Innovation Union" to improve framework conditions and access to finance for research and innovation so as to ensure that innovative ideas can be turned into products and services that create growth and jobs.
2) "Youth on the move" to enhance the performance of education systems and to facilitate the entry of young people to the labor market.
3) "A digital agenda for Europe" to speed up the roll-out of high-speed internet and reap the benefits of a digital single market for households and firms.
4) "Resource efficient Europe" to help decouple economic growth from the use of resources, support the shift towards a low carbon economy, increase the use of renewable energy sources, modernize our transport sector and promote energy efficiency.

5) "An industrial policy for the globalization era" to improve the business environment, notably for SMEs, and to support the development of a strong and sustainable industrial base able to compete globally.
6) "An agenda for new skills and jobs" to modernize labor markets and empower people by developing their skills throughout the lifecycle with a view to increase labor participation and better match labor supply and demand, including through labor mobility.
7) "European platform against poverty" to ensure social and territorial cohesion such that the benefits of growth and jobs are widely shared and people experiencing poverty and social exclusion are enabled to live in dignity and take an active part in society.

These seven flagship initiatives will commit both the EU and the Member States to EU-level instruments, notably the single market, financial levers, and external policy tools, and will be fully mobilized to tackle bottlenecks and deliver the Europe 2020 goals. As an immediate priority, the Commission charts what needs to be done to define a credible exit strategy, to pursue the reform of the financial system, to ensure budgetary consolidation for long-term growth, and to strengthen coordination within the Economic and Monetary Union.

Stronger economic governance will be required to deliver results. Europe 2020 will rely on two pillars: the thematic approach outlined above, combining priorities and headline targets; and country reporting, helping Member States to develop their strategies to return to sustainable growth and public finances. Integrated guidelines will be adopted at EU level to cover the scope of EU priorities and targets. Country-specific recommendations will be addressed to Member States. Policy warnings could be issued in case of inadequate response. The reporting of Europe 2020 and the Stability and Growth Pact evaluation will be done simultaneously, while keeping the instruments separate and maintaining the integrity of the Pact.

The European Council will have full ownership and be the focal point of the new strategy. The Commission will monitor progress towards the targets, facilitate policy exchange and make the necessary proposals to steer action and advance the EU flagship initiatives. The European Parliament will be a driving force to mobilize citizens and act as co-legislator on key initiatives. This partnership approach should extend to EU committees, to national parliaments and national, local and regional authorities, to social partners and to stakeholders and civil society so that everyone is involved in delivering on the vision.

Appendix C

UK'S INNOVATION STRATEGY – BLUEPRINT FOR TECHNOLOGY[119]

In the current macroeconomic climate and in the context of the Government's efforts to reduce the deficit, we need to drive the economic growth of the future. High-growth, high-tech and innovative businesses are key – they help drive productivity growth, create opportunities to export and help drive the creation of new skilled jobs. The Government is acting to reduce and remove barriers and incentivize and encourage technology innovation across three areas:

1) Getting the basics right and using all available policy levers to create the right framework for enterprise and business investment;
2) Getting behind those industries where Britain already possesses and has the clear potential to maintain competitive advantage; and
3) Making it easier for new businesses and innovation to flourish and helping to bridge the gap between innovation and commercial success.

All of these efforts will help a new innovative and high-growth economy emerge in the UK, one:

1) with a framework within which high-tech and innovative businesses can drive toward their own success;
2) that seeks out global opportunities and tells the world Britain is open for innovative businesses;
3) that helps high-tech and innovative businesses grow with support from the market and, only where necessary, government; and
4) where a technology-friendly Government has procurement processes open to Small Medium Enterprises and innovative technology businesses.

This strategy outlines a series of measures that we will take to get Britain on the right path to a high-tech future, including:

1) introducing a new Entrepreneur Visa to make sure that if you have a great business idea, and you receive serious investment from a leading investor, you are welcome to set up your business in the UK;
2) an independent review of the intellectual property framework, including considering whether there are benefits in a US-style 'fair use' copyright provision; and
3) launching a new 'peer to patent' system, which draws on the expertise of people across the globe to help maintain patent quality.

Appendix D

THE TWELFTH 5-YEAR PLAN OF THE PEOPLE'S REPUBLIC OF CHINA: CHINA INDUSTRIAL POLICY[120]

Unequivocally, there is something that is worth noting whenever talking about China's progress and prosperity in the context of economic development. First and utmost, the Chinese economy is systematically shaped by the Communist Party of China (CPC) through the plenary sessions of the Central Committee and national congress. Economically, the party plays a leading role in mapping strategies for economic development, setting growth targets, and launching reforms. It is also noteworthy that planning is a key characteristic of centralized, socialist economies, and one plan established for the entire country normally contains detailed economic development guidelines for all its regions. In this regard, it is reasonably clear that China is a case where the balance is strongly in favor of highly politicized industrial policies, which generates wealth at a certain set of costs, as is the case anywhere. The current plan is twelfth in the series of economic development guidelines which have been promulgated since 1953. The Twelfth 5-Year Plan clearly sets the guidance for the Chinese economic approaches from 2011- 2015.

The Chinese government passed the Twelfth 5-Year Plan on March 14th, 2011 to accomplish meaningful tasks, including:

- Address rising inequality and create an environment for more sustainable growth by prioritizing more equitable wealth distribution
- Increase domestic consumption and improve social infrastructure and safety nets

In addition, the plan is representative of China's efforts to rebalance its economy, shifting emphasis from investment toward consumption and from urban and coastal growth toward rural and inland development. More significantly, the plan also continues to advocate objectives set out in the Eleventh 5-Year Plan to enhance environmental protection, accelerate the process of opening and reform, and emphasize Hong Kong's role as a center of international finance.

The targets for the Twelfth 5-Year Plan are as follows:

- GDP to grow by about 8% in 2011
- 7% annual growth of per capita income
- To face the extremely complex situation for development in 2011
- To implement prudent monetary policy in 2011
- To intensify anti-corruption efforts in 2011
- To accelerate economic restructuring in 2011
- To spend 2.2% of GDP on research and development by 2015
- To control population below 1.39 billion by 2015, and
- To firmly curb excessive rise of housing prices

Additionally, it is worth noting that there are some substantial highlights having been used and discussed during the drafting consideration session, which can be summarized as follows:

- Population will be maintained below 1.39 billion
- Urbanization rate will reach 51.5%
- Value-added output of emerging strategic industries will account for 8% of GDP
- Foreign investment is welcomed in modern agriculture, high-tech, and environment protection industries
- Coastal regions to transform from "world's factory" to hubs of R&D, high-end manufacturing, and service sector
- Nuclear power will be developed more efficiently to ensure safety
- Large-scale hydropower plants will be constructed in southwest China
- Length of high-speed railway will reach 45,000 kilometers
- Length of highway network will reach 83,000 kilometers
- A new airport will be built in Beijing
- 36 million affordable apartments will be built for low-income people

To a remarkable extent, according to the essence of the twelfth plan in terms of emerging industries, there are five major industries considered the five industrial focal points, which have been discussed within the policy advisory community in Beijing.

Five industrial focal points

New energy: China is going to remain highly reliant on fossil fuels for at least the next few decades, but opportunities for developing non-carbon alternatives to coal and oil will receive additional policy support through 2015. The solar and wind power sectors, for example, have already received substantial central and provincial government support in the form of cheap land and direct fiscal support, to the extent that major trade partners are mulling WTO cases related to prohibited subsidies for the sectors. Nevertheless, these sectors offer the potential for innovation, job creation and new sources of exports, and are set to receive a second wave of preferential treatment despite their small overall contribution to China's energy supply. Nuclear power is included in this category despite the fact that it relies on mature technologies. According to estimates quoted in energy sector specific plans that have made their way into China's domestic media, investment in nuclear power will occupy a large share of overall investment targets given the cost/scale.

***Composite materials*:** Breakthroughs in China's aerospace and automotive sectors will not happen without the development of new materials to give domestic producers an edge over foreign rivals. The construction market is also an enormous market ready for more energy efficient and less environmentally unfriendly materials than those commonly used at present.

Information industries: The definition of information industries in China includes anything digital, online, non-manufacturing and many non-hospitality services industries. This plan could well include the incremental convergence of phone and internet services, as well as the expansion of 3G networks and services. The overwhelming market demand for foreign gadgets, such as Apple products and related applications, is a clear signal to industrial planners that more has to be done than enabling producers of knock-off cell phones and replicating the functionality of important applications.

Biotech and biochemistry: The surge in social welfare spending, as well as the rising incidence of prosperity-related illnesses in China, has policymakers looking for innovations that will

produce cost savings and the retention of economic value to domestic patent holders for the related drugs and technologies. As a result the medical sciences sector will receive a funding boost, as will investment in medical facilities and hospitals.

Environmental protection: The annual cost of cleaning up China's environmental woes could easily exceed 2% of GDP in the coming years. There are difficulties, however, in forcing local governments to tackle these legacy problems because these projects represent capital expenditures with no real prospect of cost recovery. New opportunities for private capital will probably arise, along with more rational pricing for the utility services provided. The idea of "retro-fitting" existing waste treatment sites, for example, with domestically developed technologies will receive significant emphasis.

Endnotes

[1] Dana Johnson, "Manufacturing Leading the Way Back," *ABA Banking Journal*, Issue 102, no. 5 (May 2010): 10.

[2] Merrill D. Peterson, *Thomas Jefferson Writings: Autobiography / Notes on the State of Virginia / Public and Private Papers / Addresses / Letters*, (New York: Library of America, 1984): 1370-1372.

[3] Testimony of Robert Baugh, Executive Director AFL-CIO Industrial Union Council, on January 19, 2007 to the Committee on Workforce and Economic Development (http://www.aflcio.org/issues/jobseconomy/manufacturing/iuc/upload/RevitalizingManufacturing.pdf).

[4] U.S. Department of Commerce, Bureau of Economic Analysis, "GDP by Industry," http:// www.bea.gov/industry.xls/GDPbyInd_VA_NAICS_1998-2009.xls, (accessed March 1, 2011).

[5] Ibid.

[6] U.S. Department of Labor, Bureau of Labor and Statistics, "Employees on Non-farm Payrolls by Major Industry sector, 1961 to date," ftp://ftp.bls.gov/pub/suppl/ empsit.ceseeb1.txt, (accessed March 1, 2011).

[7] U.S. Department of Labor, Bureau of Labor and Statistics. "Industries at a Glance: NAICS 31-33," http://www.bls.gov/iag/tgs/iag31-33.htm (accessed March 3, 2011). Manufacturing is often relegated to only the part of the building process that "bends metal." However, the manufacturing process has a significant prologue, consisting of the R&D, the branding and the design of the end product, as well as a significant logistics tail, i.e., selling, distributing, and maintaining the product. This report considered the entire manufacturing process, including those elements underpinning the process in the first place, e.g., education.

[8] Leo Hindery, Jr., "Now it's all about Results, Not Theories and More Promises," The Huffington Post, February 2, 2010 (http://www.huffingtonpost.com/leo-hindery-jr/now-its-all-about-results_b_445770.html).

[9] Emily Stover De Rocco, Thomas J. Duesterberg and Roger D. Kilmer, "The Facts about Modern Manufacturing," The Manufacturing Institute, 2009, (http://www.nam.org/Resource-Center/Facts-About-Manufacturing/~/media/0F91A0FBEA1847D087E719EAAB4D4AD8.ashx).

[10] Joseph L. Welch, "Power Boost," *Electric Perspectives* (May/June, 2010): 26.

[11] Board of Governors of the Federal Reserve System, Data Download Program, http://www.federalreserve.gov/datadownload/Choose.aspx?rel=G.17 (accessed March 3, 2011).

[12] U.S. Department of Commerce, Bureau of Economic Analysis, "GDP by Industry."

[13] U.S. Department of Labor, Bureau of Labor and Statistics, "Employees on Non-farm Payrolls by Major Industry sector, 1961 to date."

[14] Adam Hersh and Christian Weller, "Does Manufacturing Matter?" *Challenge*, Issue 46, no. 2 (March 2003): 61.

[15] U.S. Department of Labor, Bureau of Labor and Statistics, "Employees on Non-farm Payrolls by Major Industry sector, 1961 to date."

[16] Ibid.

[17] Rose A. Woods, "Industry output and employment projections to 2018," *Monthly Labor Review* 132, no. 11 (November 2009): 55.

[18] Ibid., 68.

[19] Ibid., 52-53. Table reconstructed to show statistical numbers.

	Thousands of jobs		
	1998	2008	2018
Total Employment	140,563.9	150,931.7	166,205.6
Manufacturing	17,559.5	13,431.2	12,225.2
% of Total	12.49%	8.90%	7.36%
Service Producers	29,239.7	31,874.0	35,196.3
% of Total	20.80%	21.12%	21.18%
Transportation and warehousing	4,168.1	4,504.9	4,950.4
Utilities	613.4	559.5	500.5
Wholesale trade	5,795.2	5,963.9	6,219.8
Architectural, engineering, and related services	1,114.7	1,444.7	6,336.9
Finance and insurance	5,528.7	6,015.3	1,677.2
Real estate	1,277.7	1,481.1	1,416.8
Legal services	1,021.1	1,163.7	1,844.1
Management, scientific, and technical consulting services	590.4	1,008.9	778.9
Scientific research and development services	486.0	621.7	9,033.8
Administrative and support services	7,098.9	7,693.6	931.9
Telecommunications	1,167.4	1,021.5	931.9
Data processing, hosting, related services, and other information services	378.1	395.2	574.1
Manufacturing & Service Producers	46,799.2	45,305.2	47,421.5
% of Total	33.29%	30.02%	28.53%

Note: This table includes mining and utilities in the total manufacturing output.

[20] Zhigang Tao and Y. C. Richard Wong, "Hong Kong: From an Industrialized City to a Centre of Manufacturing-related Services," *Urban Studies (Routledge)* Issue 39, no. 12 (November 2002): 2345-2358. It should noted that out-sourcing can be as simple as hiring a transport company instead of maintaining a vehicle fleet. Off-shoring means the out-sourcing has moved abroad such as a call-center.

[21] John F. Sargent Jr., "Congress and the Challenges Facing US Manufacturing," Congressional Research Service briefing to the MISG on March 3, 2011.

[22] Tao and Wong, "Hong Kong: From an Industrialized City," 2345-2358.

[23] Dilek Cetindamar Karaomerlioglu and Bo Carlsson, "Manufacturing in Decline? A Matter of Definition," Economics of Innovation & New Technology 8, no. 3 (June 1999): 190.

[24] Ibid., 191.

[25] Ibid.

[26] Ibid.

[27] Ibid. Producer Services in the Study Include: Transportation and Communications SIC 4; wholesale trade SIC 50 51; Finance, Insurance and Real-estate SIC 6; Business, Legal, & Engineering Service SIC 73, 81, 87.

[28] Ibid., 184.

[29] Ibid.

[30] Ibid.

[31] Ibid.,185.

[32] U.S. Department of Labor, Bureau of Labor and Statistics, "Employees on Non-farm Payrolls by Major Industry sector, 1961 to date."

[33] Mark J. Perry, "The Truth about U.S. Manufacturing," Wall Street Journal, February 25, 2011. (http://www.aei.org/article/103226).

[34] Ibid.

[35] Ibid.

[36] Woods, "Industry output and employment projections," 55.

[37] Board of Governors of the Federal Reserve System, Data Download Program.

[38] Ibid.

[39] Ibid.

[40] Robert Forrant, *Goods Jobs and the Cutting Edge: The U.S. Machine Tool Industry and Sustainable Prosperity* (University of Massachusetts Lowell: Department of Regional Economic and Social Development, and Center for Industrial Competiveness, 1997).

[41] Joel S. Yudken, *Manufacturing Insecurity: America's Manufacturing Crisis and the Erosion of the U.S. Defense Industrial Base*, (Arlington, VA: High Road Strategies, 2010), www.highroadstrategies.com.

[42] Gardner Publications Inc, "2011 World Machine Tool Output and Consumption Survey," Gardner Publications Inc, www.gardnerweb.com/consump/survey.html (accessed March 3, 2011).

[43] Ibid.

[44] David Finegold, *The Decline of the U.S. Machine-Tool Industry and Prospects for its Sustainable Recovery* (Santa Monica, CA: Rand Critical Technologies Institute, 1994).

[45] U.S. Department of Labor, Bureau of Labor and Statistics, "Databases, Tables, & Calculators by Subject: Durable Goods - Machinery," U.S. Department of Labor, data.bls.gov (accessed March 10, 2011).

[46] Richard McCormack, "The Plight of American Manufacturing," The American Prospect, December 21, 2009 (http://www.prospect.org).

[47] Rob Dobson, "Global Manufacturing PMI at Near-Record High in February," JPMorgan & Markit, 2011 (http://www.markiteconomics.com/MarkitFiles/Pages/ViewPressRelease.aspx?ID=7742).

[48] U.S. Department of Labor, Bureau of Labor and Statistics, "Databases, Tables, & Calculators by Subject: Durable Goods – Machinery."

[49] Tony Hamilton, *IBISWorld Industry Report 33351: Metalworking Machinery Manufacturing in the US,* IBISWorld, December, 2010, (www.ibisworld.com).

[50] Matthew Christy, *Industry Surveys: Industrial Machinery,* Standard & Poor's, September 16, 2010, www.standardandpoors.com (accessed March 8, 2011).

[51] Christopher H. Hanna, "Corporate Tax Reform: Listening to Corporate America." Journal of Corporate Law. 35.2 (2009): 294.

[52] Alan J. Auerbach, "A Modern Corporate Tax," Brookings Institution, Center for American Progress: 1-2. (http://www.brookings.edu/papers/2010/12_corporate_tax_auerbach.aspx).

[53] John D. McKinnon, "Tax Plan Aims for 25% Cap," *The Wall Street Journal: Business News & Financial News*, March 18, 2011, (http://online.wsj.com/article/SB10001424052748703899704576204971305258778.html).

[54] William T. Evans, Brian F. O'Neil and William J. Stevenson, "Revitalizing U.S. Manufacturing: The Role of Tax Policy," *CPA Journal* (June, 2010): 52.

[55] Robert D. Atkinson, "Effective Corporate Tax Reform in the Global Innovation Economy," The Information Technology and Innovation Foundation, July, 2009,

http://www.itif.org/publications/effective-corporate-tax-reform-global-innovation-economy (accessed March 10, 2011): 12-14.

[56] Chuck Marr and Brian Highsmith, "Six Tests for Corporate Tax Reform," Center on Budget and Policy Priorities, February 28, 2011 (http://www.cbpp.org/cms/index.cfm?fa=view&id =3411).

[57] U.S. Department of the Treasury, "Approaches to Improve the Competitiveness of the U.S. Business Tax System for the 21st Century," http://www.treasury.gov/press-center/press-release/pages/hp749.aspx (accessed March 2, 2011): 9.

[58] While conducting research, the MISG received numerous briefs from active participants in the manufacturing industry and associated government agencies. These briefings fall under the non-attribution policy observed at the Industrial College of the Armed Forces and direct quoting is prohibited.

[59] Robert D. Atkinson and Merrilea Mayo, "Refueling the U.S. Innovation Economy: Fresh Approaches to Science, Technology, Engineering and Mathematics Education," The Information Technology and Innovation Foundation, December 7, 2010 (http://www.itif.org/publications/refueling-us-innovation-economy-fresh-approaches-stem-education).

[60] Ibid.

[61] R. Glen Hubbard, and Anthony P. O'Brien, *Economics*, 3rd Edition, (New York: Prentice Hall, 2010): 242.

[62] Eric Lotke, "What Chinese Currency Manipulation Looks Like," Huffington Post Business Blog, posted on November 13, 2009, (http://www.huffingtonpost.com/eric-lotke/what-chinese-currency-man_b_355679.html).

[63] Encyclopedia of the Nations, "Brazil - Customs and Duties," http://www.nationsencyclopedia.com/Americas/Brazil-CUSTOMS-AND-DUTIES.html (accessed on April 21, 2011).

[64] Steven Bipes and others, "Policy, Trade, Economy," Brazil-U.S. Business Council, http://www.brazilcouncil.org/information-brazil/policy-trade-economy (accessed April 20, 2011).

[65] James Manyika, David Hunt and Scott Nyquist, "Growth and Renewal in the United States: Retooling America's Economic Engine," McKinsey Global Institute, February 2011, (http://www.mckinsey.com/mgi/publications/growth_and_renewal_in_the_us/pdfs/MGI_growth_and_renewal_in_the_us_full_report.pdf):13.

[66] Scott Shane, "Small Business's Problem with Government Regulation," Small Business Trends Blog, posted on January 13, 2011 (http://smallbiztrends.com/2011/01/small-business%e2%80%99s-problem-with-government-regulation.html).

[67] Ibid.

[68] Testimony of Michael Fredrich, President of Manitowoc Custom Molding (MCM) Composites, on February 10, 2011 to the Committee on Oversight and Government Reform addressing the topic of Regulatory Impediments to Job Creation (http://oversight.house.gov/index.php?option=com_content&view=article&id=1109%253A2-10-11-qregulatory-impediments-to-job-creationq&catid=12&Itemid=1).

[69] Ibid.

[70] Shane, "Small Business's Problem."

[71] Doug Palmer, "Obama Export Control Reform Plan Faces some Bumps," *Reuters*, July 16 , 2010, (http://www.reuters.com/article/2010/07/16/us-usa-exports-security-idUSTRE66F5HZ20100716).

[72] Phil Stewart and Doug Palmer, "U.S. to Revamp Export Controls," *Reuters*, April 20, 2010, (http:// us.mobile.reuters.com/article/politicsNews/idUSTRE63J4QG20100420?irpc=932).

[73] Richard Van Atta and others, "Export Controls and the U.S. Defense Industrial Base," Institute for Defense Analyses, January 2007, (http://www.acq.osd.mil/mibp/docs/ida_study-export_controls_%20us_def_ib.pdf): 394.

[74] Ibid., 39.

[75] Barack Obama, "Toward a 21st-Century Regulatory System," *Wall Street Journal*, Opinion Page, January 18, 2011 (http://online.wsj.com/article/SB10001424052748703396604576088272112103698.html).

[76] Woods, "Industry output and employment projections," 55.

[77] Ibid., 52-53. Table reconstructed to show statistical numbers.

	Thousands of jobs		
	1998	2008	2018
Total Employment	140,563.9	150,931.7	166,205.6
Manufacturing	17,559.5	13,431.2	12,225.2
% of Total	12.49%	8.90%	7.36%
Service Producers	29,239.7	31,874.0	35,196.3
% of Total	20.80%	21.12%	21.18%
Transportation and warehousing	4,168.1	4,504.9	4,950.4
Utilities	613.4	559.5	500.5
Wholesale trade	5,795.2	5,963.9	6,219.8
Architectural, engineering, and related services	1,114.7	1,444.7	6,336.9
Finance and insurance	5,528.7	6,015.3	1,677.2
Real estate	1,277.7	1,481.1	1,416.8
Legal services	1,021.1	1,163.7	1,844.1
Management, scientific, and technical consulting services	590.4	1,008.9	778.9
Scientific research and development services	486.0	621.7	9,033.8
Administrative and support services	7,098.9	7,693.6	931.9
Telecommunications	1,167.4	1,021.5	931.9
Data processing, hosting, related services, and other information services	378.1	395.2	574.1
Manufacturing & Service Producers	46,799.2	45,305.2	47,421.5
% of Total	33.29%	30.02%	28.53%

Note: This table includes mining and utilities in the total manufacturing output.

[78] Ibid., 68.

[79] Ibid., 55.

[80] Executive Office of the President, "A Framework for Revitalizing American Manufacturing," Washington, DC, December 2009, (http://www.whitehouse.gov/sites/default/files/microsites/20091216-maunfacturing-framework.pdf): 15.

[81] America COMPETES Reauthorization Act of 2010, Sec 904, Public Law 111-358, Section 904, (http://www.govtrack.us/congress/bill.xpd?bill=h111-5116&tab=summary).

[82] Curtis S. Dubay, "How to Fix the Tax Code: 5 Pro Growth Policies for Congress," The Heritage Foundation: Conservative Policy Research and Analysis, December 14, 2010, (http://www.heritage.org/Research/Reports/2010/12/How-to-Fix-the-Tax-Code-Five-Pro-Growth-Policies-for-Congress).

[83] Robert D. Atkinson and Scott Andes, "17 Is Not Enough: The Case for a More Robust R&D Tax Credit," The Information Technology & Innovation Foundation, February 8, 2011, (http://www.itif.org/publications/17-not-enough-case-more-robU.S.t-rd-tax-credit).

[84] Dubay, "How to Fix the Tax Code," 6.

[85] Ibid.

[86] Barack Obama, "Remarks by the President to the Chamber of Commerce," February 7, 2011 (http://www.whitehouse.gov/the-press-office/2011/02/07/remarks-president-chamber-commerce).

[87] Atkinson and Mayo, "Refueling the U.S. Innovation Economy," 150-154.

[88] While conducting research, the MISG received numerous briefs from active participants in the manufacturing industry and associated government agencies. These briefings fall under the non-attribution policy observed at the Industrial College of the Armed Forces and direct quoting is prohibited.

[89] Obama, "Remarks by the President."

[90] Atkinson and Mayo, "Refueling the U.S. Innovation Economy," 135.

[91] Ibid., 153.

[92] National Association of Manufacturer, "ManuFACTS: Immigration Reform Increase Competitiveness Through a Legal, Skilled Workforce," National Association of Manufacturers, http://www.nam.org/~/media/9909BC7AA7C748EF8E08ABC8643422B2.ashx (accessed March 11, 2011).

[93] Ibid.

[94] Testimony of Jerry Ellig submitted on February 11, 2011 to the Committee on Oversight and Government Reform, United States House of Representatives Hearing on Regulatory Impediments to Job Creation. (http://mercatus.org/sites/default/files/publication/Ellig%20Reg%20Exec%20Order%20Testimony%20Final%20Feb%208%202011%20PRINT.pdf).

[95] Scott Beardsley, Luis Enriquez and Robin Nuttall, "Managing Regulation in a New Era," *McKinsey Quarterly* 1 (2009), 90-97.

[96] Testimony of Jerry Ellig on Regulatory Impediments to Job Creation.

[97] Gary Locke, "U.S. Commerce Secretary Gary Locke Kicks Off "Compete to Win" Address Series at Columbus. Chamber of Commerce," U.S. Department of Commerce: Documents and Publications, February 23, 2011.

[98] Ibid.

[99] Ibid.

[100] Blue Green Alliance, "Building the Clean Energy Assembly Line", November 4, 2009 (http://www.bluegreenalliance.org/press_room/private_publications?id=0019): 11.

[101] Fred Sissine, "CRS Report for Congress: Energy Independence and Security Act of 2007: A Summary of Major Provisions," Washington, DC, Congressional Research Service, December 21, 2007: 13.

[102] America COMPETES Reauthorization Act of 2010, Sec 904.

[103] Stephen Martin and John T. Scott, "The Nature of Innovation Market Failure and the Design of Public Support for Private Innovation," *Research Policy*, Elsevier, Vol 29, no. 4,5 (April 2000): 437.

[104] Blue Green Alliance, "Building the Clean Energy Assembly Line," 14.

[105] Rob Atkinson and others, "Rising Tigers, Sleeping Giant: Asian Nations Set to Dominate the Clean-Energy Race by Out Investing the United States," Breakthrough Institute, Information Technology and Innovation Foundation, November 2009, 11.

[106] Rob Atkinson and others, "Strengthening Clean Energy Competitiveness," Breakthrough Institute, Information Technology and Innovation Foundation, and The Brookings Metropolitan Policy Program, June 2010, 3.

[107] Sissine, "Energy Independence and Security Act of 2007," 13.

[108] Steven Pearlstein, "Key to job growth, equality is boosting tradable sector of economy," The Washington Post, March 13, 2011 (http://www.washingtonpost.com/wp-dyn/content/article/2011/03/11/AR2011031107726.html).

[109] Robert D. Atkinson and Julie A. Hedlund, "The Rise of the New Mercantilists: Unfair Trade Practices in the Innovation Economy," The Information Technology and Innovation Foundation, June 2007: 2.

[110] On 29 April 2011, WTO ambassadors endorsed Director General Pascal Lamy's plan to confront the deadlock in the Doha Round of negotiations. The U.S. has to be willing to give ground in some areas, (e.g., agricultural subsidies), to create gains in the manufacturing sector.

[111] William H. Cooper, Mark E. Manyin, Remy Jurenas, Michaela D. Platzer, "The Proposed U.S.-South Korea Free Trade Agreement (KORUS FTA): Provisions and Implications," Congressional Research Service, Washington D.C., (March 24, 2011): 46.

[112] The Association for Manufacturing Technology, "The Manufacturing Mandate - A National Manufacturing Strategy to Help Rebuild and Strengthen the U.S. Manufacturing Sector," AMT, (http://www.amtonline.org/article_display.cfm?article_id=161486&section_id=100).

[113] European Committee for the Cooperation of the Machine Tools Industries, "CECIMO: Where Manufacturing Begins," www.cecimo.eu (accessed March 10, 2011).

[114] Ibid.

[115] Hiroyuki Chuma, "Sources of Machine-Tool Industry Leadership in the 1990s: Overlooked Intrafirm Factors," Yale University - Hitotsubashi University, October 2001, (www.econ.yale.edu/growth_pdf/cdp837.pdf).

[116] U.S. Department of Labor, Bureau of Labor and Statistics, "Employees on Non-farm Payrolls."

[117] Federal Ministry of Education and Research (BMBF) Innovation Policy Framework Division, *Ideas. Innovation. Prosperity. High-Tech Strategy 2020 for Germany*, Federal Republic of Germany, April, 2007 (www.bmbf.de/pub/hts_2020_en.pdf).

[118] European Commission, *Europe 2020: A European Strategy for Smart, Sustainable, and Inclusive Growth*, March, 2010 (ec.europa.eu/europe2020/index_en.htm).

[119] HM Government, *UK's Innovation Strategy -- Blueprint for Technology*, November, 2010, (www.bis.gov.uk/assets/biscore/innovation/docs/b/10-1234-blueprint-for-technology.pdf).

[120] APCO Worldwide Inc, *China's 12th Five-Year Plan*, 2010, (http://apcoworldwide.net/content/PDFs/Chinas_12th_Five-Year_Plan.pdf).

Bibliography

APCO Worldwide Inc. *China's 12th Five-Year Plan*, 2010.

America COMPETES Reauthorization Act of 2010, Public Law Public Law 111-358, 2011.

Association for Manufacturing Technology. "The Manufacturing Mandate - A National Manufacturing Strategy to Help Rebuild and Strengthen the U.S. Manufacturing Sector." AMT. (www.amtonline.org)

Atkinson, Robert D. "Effective Corporate Tax Reform in the Global Innovation Economy." The Information Technology & Innovation Foundation, July, 2009.

Atkinson, Robert D. and Scott Andes, "17 Is Not Enough: the Case for a More Robust R&D Tax Credit," The Information Technology & Innovation Foundation, February 8, 2011,

Atkinson, Robert D. and Julie A. Hedlund. "The Rise of the New Mercantilists: Unfair Trade Practices in the Innovation Economy," The Information Technology and Innovation Foundation, June 2007.

Atkinson, Robert D. and Merrilea Mayo. "Refueling the U.S. Innovation Economy: Fresh Approaches to Science, Technology, Engineering and Mathmatics (STEM) Education." The Information Technology and Innovation Foundation, December 7, 2010.

Atkinson, Rob and others. "Rising Tigers, Sleeping Giant: Asian Nations Set to Dominate the Clean-Energy Race by Out Investing the United States." Breakthrough Institute and Information Technology and Innovation Foundation, November, 2009.

Atkinson, Roband others. "Strengthening Clean Energy Competitiveness." Breakthrough Institute, Information Technology and Innovation Foundation, and The Brookings Metropolitan Policy Program. June, 2010.

Atta, Richard Van and others, "Export Controls and the U.S. Defense Industrial Base." Institute for Defense Analyses, January 2007, 394.

Auerbach, Alan J. "A Modern Corporate Tax," Brookings Institution, Center for American Progress: 1-2. (http://www.brookings.edu/papers/2010/12_corporate_tax_auerbach.aspx).

Baugh, Robert. "Testimony of Robert Baugh, Executive Director AFL-CIO Industrial Union Council, Before the Committee on Workforce and Economic Development," January 19, 2007.

Beardsley, Scott, Luis Enriquez, and Robin Nuttall. “Managing Regulation in a New Era.” *McKinsey Quarterly* 1, (2009): 90-97.

Bipes, Steven, and others. “Policy, Trade, Economy.” Brazil-U.S. Business Council. (www.brazilcouncil.org/information-brazil/policy-trade-economy).

Blue Green Alliance. “Building the Clean Energy Assembly Line: How Renewable Energy Can Revitalize U.S. Manufacturing and the American Middle Class.” November, 2009.

Board of Governors of teh Federal Reserve System, “Economic and Research Data.” (http://www.federalreserve.gov).

Christy, Matthew. *Industry Surveys: Industrial Machinery*. *Standard & Poor's*, September 16, 2010.

Chuma, Hiroyuki. “Sources of Machine-Tool Industry Leadership in the 1990s: Overlooked Intrafirm Factors.”Yale University - Hitotsubashi University, Octoiber, 2001.

Cooper, William H., Mark E. Manyin, Remy Jurenas, Michaela D. Platzer, “The Proposed U.S.-South Korea Free Trade Agreement (KORUS FTA): Provisions and Implications,” *Congressional Research Service*, Washington D.C., March 24, 2011.

DeRocco, Emily Stover, Thomas J. Duesterberg, and Roger D. Kilmer. *The Facts about Modern Manufacturin*g: The Manufacturing Institute, 2009 (www.nam.org/Resource-Center/Facts-About-Manufacturing/~/media/0F91A0FBEA1847D087E719EAAB4D4AD8.ashx).

Dobson, Rob. “Global Manufacturing PMI at Near-Record High in February.” JPMorgan & Markit, 2011 (http://markiteconomics.com).

Dubay, Curtis S. "How to Fix the Tax Code: 5 Pro Growth Policies for Congress.” The Heritage Foundation: Conservative Policy Research and Analysis, December 14, 2010.

Ellig, Jerry. “Testimony of Jerry Ellig submitted to the Committee on Oversight and Government Reform, United States House of Representatives Hearing on Regulatory Impediments to Job Creation.” February 11, 2011.

Encyclopedia of the Nations. “Brazil - Customs and Duties.” (www.nationsencyclopedia.com/Americas/Brazil-CUSTOMS-AND-DUTIES.html).

Evans, William T., Brian F. O’Neil and William J. Stevenson, “Revitalizing U.S. Manufacturing: The Role of Tax Policy,” *CPA Journal* (June, 2010), 52.

Executive Office of the President, “A Framework for Revitalizing American Manufacturing,” Washington, DC, December 2009,

European Commission. “Europe 2020: A European Strategy for Smart, Sustainable, and Inclusive Growth.” March, 2010.

European Committee for the Cooperation of the Machine Tools Industries. “CECIMO: Where Manufacturing Begins.” (www.cecimo.eu).

Federal Ministry of Education and Research (BMBF) Innovation Policy Framework Division. *Ideas. Innovation. Prosperity. High-Tech Strategy 2020 for Germany*. (Bonn, Germany: Federal Republic of Germany), April, 2007.

Finegold, David. *The Decline of the U.S. Machine-Tool Industry and Prospects for its Sustainable Recover*y. (Santa Monica, CA: Rand Critical Technologies Institute, 1994).

Forrant, Robert. *Goods Jobs and the Cutting Edge: The U.S. Machine Tool Industry and Sustainable Prosperit*y. University of Massachusetts Lowell: Department of Regional Economic and Social Development, and Center for Industrial Competiveness, 1997.

Fredrich, Michael, “Testimony of Michael Fredrich, President of Manitowoc Custom Molding (MCM) Composites, to the Committee on Oversight and Government Reform.” February 10, 2011.”

Gardner Publications Inc, “2011 World Machine Tool Output and Consumption Survey,” http://www.gardnerweb.com/consump/survey.html (accessed March 3, 2011).

Hamilton, Tony. *IBISWorld Industry Report 33351: Metalworking Machinery Manufacturing in the US.* IBISWorld, December, 2010.

Hanna, Christopher H. “Corporate Tax Reform: Listening to Corporate America.” *Journal of Corporation Law* 35.2 (2009): 283-326.

Hersh, Adam and Christian Weller. “Does Manufacturing Matter?” *Challenge*, Issue 46, no. 2 (March 2003): 61.

HM Government. *UK's Innovation Strategy -- Blueprint for Technology*, (London, England: Department for Business Innovation and Skills) November, 2010.

Hindery, Leo, Jr. “Now it's all about Results, Not Theories and More Promises.” The Huffington Post, February 2, 2011 (www.huffingtonpost.com).

Hubbard, R. Glen and Anthony P. O'Brien, *Economics, 3rd Edition*, (New York: Prentice Hall), 2010.

ICAF 2010 Manufacturing Industry Study Group. *Final Report: Manufacturing Industry*. Washington, DC: Industrial College of the Armed Forces, 2010.

Johnson, Dana. "Manufacturing leading the way back." *ABA Banking Journal* 102, no. 5 (May 2010): 10.

Karaomerlioglu, Dilek Cetindamar and Bo Carlsson, "Manufacturing in Decline? A Matter of Definition," Economics of Innovation & New Technology 8, no. 3 (June 1999).

Gary Locke, Gary. "Commerce Secretary Gary Locke Kicks Off "Compete to Win" Address Series at Columbus. Chamber of Commerce," U.S. Department of Commerce: Documents and Publications, February 23, 2011.

Lotke, Eric. "What Chinese Currency Manipulation Looks Like." Huffington Business Post Blog, Novemeber 13, 2009.

Manyika, James, David Hunt, and Scott Nyquist. "Growth and Renewal in the United States: Retooling America's Economic Engine." Mckinsey Global Institute, February, 2011.

Marr, Chuck and Brian Highsmith. "Six Tests for Corporate Tax Reform," Center on Budget and Policy Priorities, February 28, 2011 (http://www.cbpp.org/cms/index.cfm?fa=view&id=3411).

Martin, Stephen and John T. Scott, "The Nature of Innovation Market Failure and the Design of Public Support for Private Innovation," *Research Policy*, Elsevier, Vol 29, no. 4,5 (April 2000): 437.

McCormack, Richard. "The Plight of American Manufacturing." *The American Prospect*, December 21, 2009.

McKinnon, John D. "Tax Plan Aims for 25% Cap," *The Wall Street Journal: Business News & Financial News*, March 18, 2011.

National Association of Manufacturers. "ManuFACTS: Immigration Reform: Increase Competitiveness through a Legal, Skilled Workforce." 2011 (http://www.nam.org).

Obama, Barack. "Toward a 21st-Century Regulatory System." Wall Street Journal, Opinion Page, January 18, 2011.

Obama, Barack. "Remarks by the President to the Chamber of Commerce." February 7, 2011.

Palmer, Doug. "Obama Export Control Reform Plan Faces some Bumps." *Reuters*, July 16 , 2010.

Palmer, Doug and Phil Stewart. "U.S. to Revamp Export Controls." *Reuters,* April 20, 2010,

Pearlstein, Steven. "Key to job growth, equality is boosting tradable sector of economy," *The Washington Post*, March 13, 2011.

Perry, Mark J. "The Truth about U.S. Manufacturing," The Wall Street Journal, February 25, 2011.

Peterson, Merrill D. Thomas Jefferson Writings: Autobiography / Notes on the State of Virginia / Public and Private Papers / Addresses / Letters. First ed. New York: Library of America, 1984, 1370-1372

Sargeant, John F., Jr. "Congress and the Challenges Facing US Manufacturing." Presentation to Industrial College of the Armed Forces, March 2011.

Shane, Scott. "Small Business's Problem with Government Regulation." Small Business Trend Blog, January 13, 2011.

Sissine, Fred. "CRS Report for Congress: Energy Independence and Security Act of 2007: A Summary of Major Provisions." *Congressional Research Service*. December 21, 2007.

Tao, Zhigang, and Y. C. Richard Wong. "Hong Kong: From an Industrialized City to a Centre of Manufacturing-related Services." Urban Studies (Routledge) 39, no. 12 (November 2002): 2345-2358.

U.S. Department of Commerce, Bureau of Economic Analysis. "GDP by Industry," (http://www.bea.gov/industry.xls/GDPbyInd_VA_NAICS_1998-2009.xls).

U.S. Department of Labor, Bureau of Labor and Statistics. "B-1. Employees on Nonfarm Payrolls by Major Industry Sector, 1961 to Date," (ftp://ftp.bls.gov/pub/suppl/empsit.ceseeb1.txt).

U.S. Department of Labor, Bureau of Labor and Statistics. "Industries at a Glance: NAICS 31-33," (http://www.bls.gov/iag/tgs/iag31-33.htm).

U.S. Department of Labor, Bureau of Labor and Statistics, "Databases, Tables, & Calculators by Subject: Durable Goods - Machinery," (data.bls.gov).

U.S. Department of the Treasury, "Approaches to Improve the Competitiveness of the U.S. Business Tax System for the 21st Century," (http://www.treasury.gov/press-center/press-release/pages/hp749.aspx), 9.

Welch, Joseph L. "Power Boost," Electric Perspectives, (May/June 2010): 26.

Woods, Rose A. "Industry Output and Employment Projections to 2018." *Monthly Labor Revie*w 132, no. 11 (November, 2009).

Yudken, Joel S. Manufacturing Insecurity: America's Manufacturing Crisis and the Erosion of the U.S. Defense Industrial Base, (Arlington, VA: High Road Strategies, 2010).