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The Manufacturing Institute and the National Association of Manufacturers (NAM) have regularly issued *The Facts About Modern Manufacturing* for well over a decade. The seventh edition covers a significant transition period for U.S. manufacturing, with a growing economy and soaring productivity but with major overseas competitors on the rise.

Many people made this publication possible. First, we thank NAM President John Engler, Institute President Jerry Jasinowski and Institute Chairman Joe Loughrey for their steadfast advocacy for manufacturers and their encouragement to distribute the material in this book as far and wide as possible. We are grateful to Toyota for underwriting the publication and distribution costs. We also thank the many companies that provided the invaluable sidebars that illustrate so many of the pages.

NAM Chief Economist David Huether and Economist Chi Nguyen provided most of the data and much of the analysis underlying these pages and they tirelessly updated it when new information was released from U.S. government sources. Without their insights into today’s manufacturing and their familiarity with information sources, this publication would not have been possible.

Many thanks also to the many NAM policy department staff who have given us good ideas and suggestions. One new part is the Manufacturing Resources section on page 61; this is a ready link to all the NAM policy departments in case you have a question about how public policies can either strengthen or weaken manufacturing. It also directs you to other useful Web sites important to the future of manufacturing.

My colleagues at the Institute: Phyllis Eisen, Stacey Wagner and Peggy Walton were enormously helpful in developing the manufacturing workforce aspects of this report. In addition, we appreciate the thoughtful contributions of two interns, Dr. Terry Scout and Slade House, who helped research and write many of the sidebars.

Our design team was James Skelly and Irina Stepanova at the NAM; their beautiful work makes these pages come alive. Our faithful and tireless editor was Kitty Brims. They have made this not only highly readable but also highly accurate. Many thanks.
With its combination of low inflation, low unemployment, high growth and political stability, the United States drives the global economy.

That's why Toyota made a commitment to this country early in its corporate existence. Today, our nearly 50-year partnership with America has grown into a multibillion-dollar stake in the continuing health and success of the U.S. auto industry.

America realizes that a country's competitiveness and success depend on the combined creativity, capability and commitment of its people. Indeed, the quality of the U.S. workforce has allowed us to continually expand our investment and presence here while maintaining industry-leading quality.

For these reasons, we consider it vital to have a major presence in America and to be a member of the National Association of Manufacturers. And we are very proud to have the privilege of sponsoring this important report on the state of American manufacturing.

Some mistakenly believe manufacturing in the United States is in decline because of the continuing evolution of global sourcing and competition. In fact, U.S. manufacturing is vibrant, robust and contributes greatly to the dynamic American economy.

For example, in Toyota's manufacturing sector—the U.S. auto industry—total economic output and sales are as high as they ever have been. Productivity and quality are at record levels, innovative technology is being incorporated into plants and products at an accelerating pace, and population growth will drive sales to even higher levels in the near future.

We believe the United States will remain the biggest and most successful competitor in global manufacturing and we intend to help it do so by continuing to expand our manufacturing investment as we further enlarge our partnership with America.

Dennis Cuneo
Senior Vice President
Toyota Motor North America
Perception and reality often differ. The seventh edition of *The Facts About Modern Manufacturing* sets the record straight on a vitally important but misunderstood sector of our economy. By spotlighting mostly U.S. government data about today’s manufacturing, this book shows the reality of both the strengths and challenges facing our industry. We designed this as a resource for policymakers, students, educators and others interested in the future of our industry.

All too often the perception is that American manufacturing’s heyday is in the past. Nothing could be further from the truth. There are six manufacturing pillars that support today’s U.S. economy, as the data in the following pages show:

- **The reality is that the manufacturing sector, more than any other, drives the current U.S. economic recovery.** More than any other sector, manufacturing made the highest contribution to real Gross Domestic Product (GDP) growth between 2001 and today.

- **Manufacturing is the engine of American technology development and innovation,** responsible for more than 70 percent of private sector research and development (R&D) and the center for advanced technologies that also cut energy use and lead to a cleaner environment.

- **Manufacturing’s high productivity rate**—which determines real wage and benefit compensation—increased by more than 50 percent over the past decade and was far higher than services, which increased by only 18 percent during the same period.

- **Manufactured goods make up more than 60 percent of U.S. exports,** helping to pay for the U.S. appetite for imports. While agricultural exports amount to about $50 billion a year, manufacturers export that much each month. Overseas markets and exchange rate gyrations are more critical in manufacturing than in the rest of the U.S. economy.

- **Manufacturing wages and benefits are approximately 25 percent higher than in non-manufacturing jobs.**

- **Manufacturing has a greater multiplier effect on the rest of the economy** than does any other sector; each manufacturing dollar generates an additional $1.37 in economic activity.

Standing by itself, U.S. manufacturing would be the eighth largest economy in the world. Taken together, these positive contributions by manufacturing provide the American economy with the innovation, productivity and resilience to keep strong.

Even with these strengths, there are many challenges for manufacturers, especially the areas of costs, competitiveness and encouraging young people to pursue a career in manufacturing.
As baby boomers retire, there is a growing gap between the worker skills that are needed in the future and the skills that younger workers bring to the job. Eighty-one percent of respondents to the NAM’s 2005 Skills Gap survey stated that they could not find qualified workers to fill their job openings right now. Ninety percent said they could not find enough skilled production workers and 65 percent said they could not find enough scientists and engineers.

At the same time, federally supported R&D in the physical sciences that support manufacturing innovation is declining. Measured in terms of GDP, funding in these vital research areas is half the level of the 1970s.

U.S. manufacturing also faces significant levels of domestic costs that foreign competition, in many cases, does not. Unit labor costs for American manufacturers are more than 30 percent higher than for our major competitors. Cost spikes for U.S. natural gas, the primary fuel used in manufacturing, is increasingly driving some manufacturers to relocate abroad. The cost per employee of federal regulations is higher for manufacturers than for other sectors of our economy. While legal costs in the United States continue to rise, other countries decrease their corporate tax rates to levels lower than the U.S. rate.

Manufacturing in America provides great benefits to the economy and our quality of life, but it is challenged on several fronts. These challenges will only be met when policymakers and the public understand the facts and benefits associated with modern manufacturing. We hope this report helps to do that.
Importance of Manufacturing
Overview
The manufacturing economy encompasses manufacturing and other industries, which depend on a strong manufacturing base, such as finance, telecommunications, wholesaling and accounting. While U.S. manufacturing itself is the eighth largest economy in the world, its impact on the overall U.S. economy is much larger when this “multiplier effect” is taken into account.

In this section, the macroeconomic impact of manufacturing on the U.S. economy is discussed, highlighting a role that too few Americans understand. It’s often said today that “nothing is made in America anymore.” While manufacturing had become a smaller share of Gross Domestic Product (GDP), the data presented in this section show a robust picture:

- with manufacturing production at the highest point in its history;
- the U.S. share of worldwide manufacturing stable since 1982; and
- manufacturing having the strongest pull on U.S. economic growth of any business sector in the country.

Explaining this dichotomy is the purpose of this section.

During the recession that began in 2001, U.S. manufacturing was dramatically affected, losing 3 million jobs due to a large drop in exports, a steep decline in business investment, rising costs and greater import competition. The resiliency of manufacturers has turned that decline around and in recent years, manufacturing output has grown faster than the U.S. economy.

This section gives an overview of U.S. manufacturing, including:

- the top three manufacturing industries — food, computers and electronics, and motor vehicles;
- the importance of more than a 90 percent increase in manufacturing productivity growth, more than two times greater than for the rest of the economy;
- the factors behind a 23 percent premium paid in wages and benefits to manufacturing employees, outpacing the average compensation package for the rest of the workforce; and
- the reasons why manufacturing’s cost squeeze makes it nearly impossible to pass on added costs.

You will also find a state-by-state analysis of manufacturing’s economic strength and employment record that shows California and Texas as the largest U.S. manufacturing states.
If U.S. manufacturing was a country by itself, it would be the eighth largest economy in the world.

The availability of many foreign-made products on store shelves across America has given some the impression that domestic manufacturing is vanishing. This is a misperception not based on the facts of today’s manufacturing.

In 2005, the U.S. manufacturing sector, in terms of GDP, was close to $1.5 trillion. As shown later in this publication, more goods are made in the United States today than at any time in U.S. history. If U.S. manufacturing was a country by itself, it would be the eighth largest economy in the world.

Japan, Germany and China are the next largest economies in the world, but their GDP is significantly smaller than the United States’. While China’s economy is a force to be reckoned with, its manufacturing sector is smaller than U.S. manufacturing, comprising 53 percent of China’s total GDP.
Reports of the death of U.S. manufacturing are greatly exaggerated.

The United States is the world’s number one manufacturer, accounting for about a quarter of global manufacturing output in 2004. Its global share has barely dipped in the past two decades. Manufacturing in Germany, Japan and France has not fared nearly as well.

While industrialized countries’ share of manufacturing value added has fallen slightly in the past two decades, China and Korea’s share of manufacturing output has risen. Rising costs of energy, health care and other non-production factors will affect the ability of U.S. manufacturing to remain in this position. Lowering trade barriers and tariffs is important to the future of U.S. manufacturing because so much of global economic growth is taking place outside of North America.
### Manufacturing’s Contribution To State Economies

#### $ in Billions

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### Manufacturing Supports State Economies

Manufacturing as Percent of Gross State Product


Manufacturing’s geographic distribution in the United States has shifted in recent decades, with more manufacturing taking place outside of the traditional centers in the Northeast and Midwest. This broadening of the manufacturing base has raised its importance to all regional economies.

The sidebar on the left shows the five largest manufacturing states in terms of sheer dollar volume of business activity in 2004: California, Texas, Ohio, Michigan and Illinois.

Another way to look at manufacturing’s role in state economies is to understand how much of the state economy depends on the manufacturing sector. In this context, the largest manufacturing states are Indiana, Iowa and Wisconsin. Ohio, Kentucky, North Carolina and Arkansas tie for fourth place, followed by Michigan and Oregon.
Manufacturing has never been as labor intensive as the services industries and has never comprised the majority of the nation’s workforce. Manufacturing’s chief contribution to economic growth lies in its innovation, productivity and the multiplier effect of generating more business in other sectors of the economy.

The recession earlier in this decade hammered manufacturing employment more than any other sector. Nearly 3 million jobs were lost between 2000 and 2003 because of rising interest rates, a large decline in U.S. exports prompted by a rising U.S. dollar, spikes in the price of natural gas, manufacturing’s basic fuel, and rising productivity.

The manufacturing recovery has not generated a large number of new jobs because of ongoing price pressures from global competition, rising costs and high productivity levels. Still, manufacturing employs 14.3 million workers in the United States and another 6 million in related industries such as wholesaling and finance. Nearly every state has a sizeable manufacturing workforce.

The five states with the largest manufacturing workforces are: California, Texas, Ohio, Illinois and Pennsylvania. California’s manufacturing workforce of over 1.5 million is almost the size of the Texas and Illinois manufacturing workforce combined.
While manufacturing has grown slightly faster than the overall economy over the past half century, the composition of American manufacturing has changed because of technological breakthroughs, shifting demand patterns and international competition.

The three largest manufacturing industries today—food, computers and electronic products, and motor vehicles—account for about 30 percent of manufacturing GDP.

The top nine sectors (shown in the chart) account for about two-thirds of manufacturing GDP and include both durable and non-durable sectors.

Federal and state policies, as well as global markets, will affect the future shape of manufacturing. For example, the U.S. chemical sector’s future depends on implementation of new natural gas policies by state and federal governments.
Manufacturing Drives the Economic Recovery

To the surprise of many, manufacturing accounted for 15 percent of economic growth—real GDP adjusted for inflation—between 2001 and 2005. Manufacturing contributed more to growth than any other single sector. This follows a similar pattern of manufacturing economic leadership during the boom years of the 1990s.

From 2001 to 2005, manufacturing GDP growth averaged 4 percent a year, compared with 3.5 percent growth for the overall economy. It is generally underreported that manufacturing has played such an important role in the current expansion.

During the 2001 recession, manufacturing contracted faster than the remainder of the economy, dropping by nearly 6 percent while overall GDP grew by 0.8 percent. Generating policies that advance manufacturing are important steps in maintaining an overall strong economy.

Source: Bureau of Economic Analysis of the U.S. Department of Commerce.
*Includes Arts, Entertainment, Recreation, Accommodation and Food Services.

Emerson

St. Louis-based Emerson is a diversified global manufacturer that has grown through a combination of acquisitions and technology innovations.

Through a strategic growth plan, Emerson expanded its process management business in 1992 by acquiring a company with an industry-leading control valve offering and a growing control systems offering. Later, the company embedded digital intelligence technology in the transmitters, analyzers and valves, and integrated the field devices with digital automation systems and modular software.

This new integrated plant-wide digital approach—branded by Emerson as PlantWeb—is replacing legacy analog-type systems, permitting faster engineering, installation and startup of projects, and increasing operating efficiency. Because of its predictive capabilities, manufacturers have turned to PlantWeb to increase throughput, quality and uptime, while reducing operations and maintenance costs.

The strategy put in place during the 1990s quadrupled Emerson’s original billion dollar process management market position into a more than $4 billion business in 2005. Today, process management sales comprise nearly a quarter of Emerson’s revenue and the company has catapulted into the top ranks of the industry, according to independent customer surveys.
Manufacturing’s share of the economy, measured by GDP, declined to 12 percent in 2005. Eighty percent of manufacturing’s drop in GDP share has been from declines during recession years.

Manufacturing’s share of the economy, measured by GDP, declined from more than 25 percent in the 1950s to 12 percent in 2005. One reason for this decline is that economic recessions over the past 50 years have hit the manufacturing sector much harder than the rest of the economy: 80 percent of manufacturing’s drop in GDP share has been from declines during recession years.

GDP itself is a measurement of the dollars spent for products and services. As the price of a certain product or service rises, it takes up a larger share of GDP. Today, more of our country’s resources are spent on business services, health care and education, where prices have risen significantly.

As shown in the chart on page 12, manufacturing prices have been level or falling for over a decade, which is a good deal for U.S. consumers. In GDP data, however, this shows up as manufacturing accounting for a smaller share.

While manufacturing’s share of GDP has declined, this does not mean that less is being manufactured in the United States than in the past, as is shown on page 13.
The Bama Companies

When an industry remains flat for more than five years, increasing company sales seems nearly impossible. But The Bama Companies, Inc., a privately held corporation in Tulsa, Okla., increased its sales by 72 percent between 1999 and 2004.

Founded in 1937, the company has grown into a leading developer and manufacturer of frozen, ready-to-use food products served worldwide by quick service and casual dining restaurant chains such as McDonalds and Pizza Hut. Bama’s agility, its unique approach to product innovation and its pricing strategy have given it tremendous leverage in the marketplace despite its smaller size.

In a highly competitive and cost-conscious marketplace, Bama has not raised prices for its handheld pies and biscuits since 1996. It attributes its success to:

• An endless quest for improvement. Bama uses advanced strategies and tools to dramatically improve processes throughout the company;
• A strong commitment to its employees. Satisfaction and loyalty of its people is key, and the company shares its financial success with employees, keeping turnover low;
• Long-term relationships with suppliers and customers. The company meets customer requirements such as assured supply, precision manufacturing and value pricing; and
• Innovation. Developing new products is a major reason for Bama’s growing market share and sales growth rate and it helps its customers increase their own market share.

Manufacturing Lacks Pricing Power

Prices of manufactured products have increased at a much slower rate than the overall inflation rate over the past half century. Since 1947, overall inflation has risen more than two and a half times faster than manufacturing prices.

More recently — since 1995 — due to rapid advances in technology as well as stiff international competition, manufacturing prices have fallen by 9 percent while overall prices have risen by 22 percent, led by a 75 percent increase in construction and a 44 percent rise in education and health care services.

This huge difference in pricing power explains much of the reason why manufacturing has become a smaller part of the economy over the last decade. Simply put, consumers and businesses are spending less on manufacturing products and more for other goods and services.

Does this mean that U.S. manufacturers are making fewer products? No! See page 13 to learn more about this paradox.

Source: Bureau of Economic Analysis of the U.S. Department of Commerce.
Between 1947 and 2005, both manufacturing output and overall GDP rose over sixfold.

After adjusting for price changes, the quantity of manufacturing output has actually kept pace with the overall economy over the past 58 years, taking into account both recessions and expansions. It falls faster during recession and grows faster in expansions.

Between 1947 and 2005, both manufacturing output and overall GDP rose over sixfold. It is generally under-reported that U.S. manufacturing output is so strong, leaving many people with the incorrect notion that little is produced in the United States anymore. In fact, the opposite is true.
Manufacturing Drives Productivity Growth

Federal Reserve Chairman Ben Bernanke has said that productivity growth is “perhaps the single most important determinant of average living standards.”* Manufacturing productivity consistently outpaces productivity growth in other sectors. Between 1987 and 2005, manufacturing productivity grew by 94 percent, roughly two and a half times faster than the 38 percent increase in productivity in the rest of the business sector.

While manufacturing made up, on average, only 15 percent of GDP during this time, it was responsible for roughly a quarter of overall U.S. productivity growth between 1987 and 2005. Rising productivity translates into low inflation in the economy and rising wages for those in the most productive sectors.

Long-term sustainable economic growth is based on increases in the labor force and productivity. In the decade ahead, productivity growth will be the major source of economic growth, as more and more baby boomers leave the workforce. Since manufacturing is the country’s productivity powerhouse, a strong and vibrant manufacturing sector is a critical component in our country’s long-term economic future.

* Federal Reserve Chairman Ben Bernanke’s commencement address at MIT, 2006.

Solectron Corporation provides electronics manufacturing and supply chain management services to the world’s leading networking, telecommunications, computing, consumer, automotive, industrial and medical device firms.

The company’s Lean Six Sigma methodology (Solectron Production System™, or SPS) helps Original Equipment Manufacturers (OEMs) cut costs, increase flexibility and productivity and improve quality for competitive advantage. Most importantly, it enables Solectron employees on the shop floor to create greater value for customers.

For example, employees in one facility reduced the time it takes to change the factory floor layout by replacing heavy, difficult-to-move workbenches with lighter tables made from light metal tubing and added casters for easy mobility. This enabled workers to quickly change the factory floor to suit their demands. At another facility a worker invented a claw-like gadget that allows an employee to load seven components simultaneously, reducing change over time from two hours to several minutes.

While SPS is transforming supply chain performance and productivity on the shop floor, Solectron’s Supply Chain Solution Suite, a series of software tools and consulting services, helps companies optimize the supply chain. These tools allow OEMs to deliver products to end-customers when they want them, at the lowest cost and the highest quality.
**Lincoln Electric**

How is it possible to have some of the highest paid manufacturing workers in the world and yet become the global leader in the welding market? The answer: incentive performance. At Lincoln Electric there are no hourly wages for production employees. Workers get paid based upon how much they produce plus a year-end bonus.

Lincoln Electric, based in Cleveland, Ohio, was founded in 1895. With sales of more than $1.6 billion in 2005, it is the world’s largest manufacturer in the arc welding and cutting industry. The primary basis of competition in that industry is product quality.

Lincoln Electric employees are held to strict product quality standards. There are also piecework incentive rewards for all production work. Employees are paid according to how much they produce individually. Also, a profit-sharing Bonus Plan paid annually encourages employees to work as a team and drive improved financial performance. As a result, employees at Lincoln Electric are some of the highest paid manufacturing workers in the world but only if they are productive. The Incentive Performance System ties compensation directly to individual and company productivity and profitability.

Fortune 500 executives regularly visit Lincoln Electric to learn the secret of its success. The Incentive Performance System has been the subject of multiple Harvard Business School case studies over the past three decades, making it Harvard’s top-selling case study.

Employee pay and productivity are closely related: when employees are more productive, they earn higher compensation.

Since 1995, overall non-farm business productivity growth has averaged 2.9 percent per year and inflation-adjusted hourly pay has risen by a similar 2.6 percent per year, largely because of the application of new technologies, process innovations and increased employee training.

This is better than the 1970s, when annual productivity and real compensation growth averaged just under 2 percent per year and a significant improvement from the 1980-1995 period, when worker productivity slowed to under 1.5 percent per year and real compensation edged up less than 1 percent per year. Clearly, the key to higher real incomes and higher standards of living for working Americans is faster productivity growth.
Today’s manufacturing employees earn higher wages and receive more generous benefits than other working Americans.

In 2004, manufacturing employees earned an average of nearly $65,000 a year in wages and benefits, while employees in the remainder of the economy earned about $53,000. That’s a 23 percent premium for working in manufacturing.

Because manufacturers provide a higher level of health care support for their employees, the benefits portion of manufacturing compensation has been rising rapidly with the price of health care itself. Between 2000 and 2004, the rise in benefits accounted for more than half (57 percent) of the increase in manufacturing compensation. For some manufacturers, rising health care costs are making these generous benefits unsustainable.
JLG Industries

JLG Industries, Inc. is a producer of access equipment (aerial work platforms and telehandlers). JLG’s successful business model includes providing world-class after-sales service and support for its customers as well as offering equipment financing for its products. Such services also lead to new employment opportunities.

In 2001, JLG launched Access Financial Solutions, Inc. (AFS), a wholly owned subsidiary that led to the hiring of 14 employees. AFS provides a single point of contact for JLG’s customers to provide equipment finance options through a network of traditional third-party financial institutions and limited on-book financings. The employees of this financial arm are seasoned professionals experienced in credit analysis and financial services support designed to fit their customers’ unique business model.

“As part of our value-added service philosophy, we offer our customers a variety of ways in which they can own JLG equipment. Financing, arranged primarily through third parties, provides yet another solution for our customers’ needs,” said Kevin Ramsburg, managing director of Access Financial Solutions. “We want to be the one-stop shop for our customers, not only for new equipment, but also for finance, parts, service, reconditioning, used equipment and anything else that they may need.”

JLG’s total sales for the trailing 12 months ended April 30, 2006, were $2.17 billion up $606 million from the previous trailing twelve-month period.

Manufacturing’s Multiplier Effect Is Stronger Than Other Sectors

Manufacturing has direct and substantial links to other sectors of the economy. These links work both backward—to mining and construction—and forward, to the transportation, finance and wholesale trade sectors that help deliver goods to final consumers. Thus, as manufacturing grows, it requires more of these inputs from other sectors and in turn spurs the creation of jobs, investments and innovations in those non-manufacturing sectors.

This effect is known as the multiplier effect and it shows how much additional output is generated by a dollar’s worth of demand for manufactured products.

Specifically, every dollar in final sales of manufactured products supports $1.37 in other sectors of the economy. Manufacturing has the largest multiplier of all sectors, with only agriculture, forestry, fishing and hunting coming close. The wholesale and finance sectors have the lowest multipliers, by contrast, with roughly 50 cents to every dollar of economic activity they generate themselves.

Communities value the multiplier effect and its powerful impact on economic development. It is one reason that civic leaders often seek manufacturing plants as the premier investment over shopping malls, warehouses or office space.
Cummins Inc. is a Fortune 500 company and the world’s largest independent manufacturer of diesel engines and related products and technologies. While the company’s products are used in a range of applications worldwide, Cummins is perhaps best known for its heavy-duty engines that power large trucks across North America. Cummins’ primary product serving the Class 8 truck market in North America is the ISX engine, produced in Jamestown, N.Y. The plant produces approximately 300 ISX engines a day — representing nearly 70 percent of the plant’s total output.

As of July 2006, about 1,500 people worked at the Jamestown Engine Plant — 1,250 Cummins employees and another 250 full-time contract workers. A number of the components for the ISX are produced at other Cummins facilities or by outside suppliers, significantly multiplying the employment impact of the ISX.

More than one in six U.S. private-sector jobs depends on the U.S. manufacturing base. This is because the manufacturing sector supports millions of employees who make things in America, and a large number of employees in other sectors of the economy through the multiplier effect. Specifically, manufacturing supported more than 20 million jobs in the United States in 2006: 14.2 million jobs directly within manufacturing and more than 6 million jobs in sectors outside of manufacturing such as accounting, wholesaling, agriculture, transportation and F.I.R.E. (finance, insurance and real estate).

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For example, about 220 employees and contract workers at Cummins Heavy Duty Machining in Columbus, Ind., machine cylinder blocks and heads for the ISX while another 260 at Cummins Fuel Systems in Columbus work to make fuel injectors and pumps for the engine. Holset Turbochargers, a division of Cummins, employs about 75 people in Charleston, S.C., doing ISX-related work.

Outside suppliers provide components including crankshafts and cylinder linings. Altogether, more than 2,500 people work on the Cummins ISX engine.
Hialeah Metal Spinning's 15 employees make precision round and hollow metal parts at its Florida facility. Its customers are in the electronics, lighting, appliance, marine and medical industries.

Hialeah's president is a woman, a growing trend in all businesses, including manufacturing. Karla Aaron started at the company in 1989 and took over its management in 1997. She has led the company to revenue growth of more than 200 percent by diversifying the customer base, raising productivity and investing in new technology and employee training.

Aaron grew up in the Midwest, surrounded by manufacturing firms. She graduated from the University of Michigan with a Bachelor of Science degree in industrial and operations engineering. Her education and six years at Abbott Laboratories gave her the experience to know that she was interested in manufacturing.

Aaron says, “I love to work with three dimensional objects. The real satisfaction comes from creating tangible products from raw materials, which then become an integral part of a useful end product.” She sees the rise in the number of women business owners as a logical evolution of the business world. “More than 30 percent of today’s engineering students are women,” she said. “Women have the skills. The sky is the limit and women are reaching their potential now just as men have in the past.”

Women are increasingly becoming owners and managers of all types of businesses. It is estimated that there are 10.6 million firms that are owned outright or at least 50 percent-owned by women. Moreover, between 1997 and 2004, the growth rate in women-owned firms was nearly twice that of all firms.

This trend also extends to manufacturing, where the number of women-owned firms has nearly doubled in the past decade. It’s estimated that 19 percent of all manufacturing firms with employees are owned by women and another 21 percent are owned jointly between women and men. These women-owned manufacturing firms grew by 38 percent between 1997 and 2004 while all manufacturing grew by 8 percent. The Center for Women’s Business Research estimates that 16 percent of all manufacturing employees now work in women-owned firms.

Manufacturing owners and employees are often thought to be primarily men. Increasingly, however, new technologies are transforming manufacturing and a growing trend is the role of women managers, owners and employees. At some large manufacturing facilities, it is not unusual to find half the production employees to be women.
Manufacturing: Engine Of U.S. Innovation
The many wonderful products that make our lives easier and more productive did not just happen by chance. Someone invented them and someone found a way to produce them at a price most of us could afford. Overwhelmingly, these inventions are a product of U.S. innovation and the engine of that innovation is manufacturing.

This section discusses the ways in which U.S. manufacturing creates the bulk of technology and innovation in the economy and the top challenges we face in keeping the United States in the lead. Although the United States accounts for 40 percent of all research and development (R&D) spending in the industrial world, the rapid growth of overseas manufacturing is creating new global centers with the critical mass to challenge U.S. innovation leadership.

The United States is particularly vulnerable in two areas:

- **Federally supported R&D in the physical sciences.** Spending has fallen from 0.25 percent of GDP to only 0.13 percent over the past 20 years. This change is curtailing one of the sources of new products and processes that has traditionally supplemented the private sector R&D that make up the innovation foundation of manufacturing; and
- **Skills shortages of engineers, scientists and technical workers.** This shortage of qualified workers is already adversely affecting many manufacturers. More than 80 percent of manufacturers report shortages of qualified workers. This deficiency is spurred in part because too many of today’s graduates do not have the math, science and technical skills required to work in today’s manufacturing. In addition, the number of engineering degrees awarded in this country has declined by 20 percent from its peak in 1985.

These factors will determine whether the United States remains the foremost innovation leader, as it is today. There are various ways to measure that leadership. Patents are one way; the United States generates more utility patents granted per million of population than any other country. These patents are the result of extensive private sector and federally supported spending on R&D. The U.S. spends almost twice as much on R&D — over $200 billion — than the next highest spender, the European Union. Manufacturers perform U.S. industrial R&D.

Technology leadership is also measured in the ways in which technology is deployed. Manufacturers’ investments have paid off in a cleaner environment: today’s industry generates fewer metric tons of carbon dioxide than in 1980. Spurred by innovative products and processes the energy intensity in 1,000 BTUs measured in 2003 real dollars has decreased from almost 13 in 1970 to approximately eight in 2003. In other words, American manufacturers are producing more with significantly less energy.
Traditionally, innovation has been measured by the number of patents issued. In 2005, The Procter & Gamble Company (P&G) was among the top innovators with more than 600 patents to its credit that year alone.

There is nothing traditional, however, about how this large, Cincinnati, Ohio-based consumer goods company, with nearly $70 billion in annual sales, innovates. In 2000, leadership at the company could see that important innovation was being done all over the world at small and mid-size companies. The old method of doing everything in-house no longer served P&G well.

While keeping their in-house R&D facilities, the new innovation model — called “Connect and Develop” — now generates more than 35 percent of new products, up from 15 percent six years ago. This innovation model, which identifies promising ideas throughout the world, doubled P&G’s innovation success rate, enhanced R&D productivity and reduced its innovation costs.

Among its new innovative products are the successful Swiffer Duster and the Crest SpinBrush, which were developed by searching worldwide for good ideas. Also, P&G’s enhanced line of Pringles chips were enabled when the company identified a small baker in Bologna, Italy, who had invented an ink-jet method of printing on baked goods.

The American future hinges on optimizing innovation. U.S. investors are willing to take risks on new ideas; consumers welcome new products and this country protects and rewards research and innovation through intellectual property rights. Yankee ingenuity has always been America’s strength and it has generated the productivity that has accounted for half of the GDP growth over the past 50 years. U.S. innovation can be boosted in at least three ways:

- The United States is the number one destination for patent applications as well as for patent applications filed by foreigners but we need a global patent system that is simpler, faster and electronically based.
- Since World War II, federal support for research has been a key source of innovation, yielding economy-changing developments such as the laser and the Internet. But federal R&D spending is only half of its mid-1960’s peak of 2 percent of GDP. By comparison, the United States now spends 2 percent of GDP on tort claims.
- The United States will not remain the innovation leader if we do not develop the talent of more scientists, engineers and technical workers. In 2000, only 11 percent of all U.S. bachelor's degrees were in natural science or engineering, far below the world’s average of 23 percent and about one-fifth of China’s 50 percent.
In 1999, Bobcat Company, a business unit of Ingersoll-Rand, decided to build a machine for the underserved light construction and landscaping markets, which Bobcat could reach through its extensive network of dealers.

To refine its product concept, Ingersoll-Rand implemented customer-focused research to identify 10 promising niche markets, such as hospitals, resorts and parks. From its research, Bobcat also identified more than a dozen features and benefits desired by potential users that no single piece of machinery on the market could fulfill.

By the end of 2001, the company developed and began testing a prototype — named the Toolcat 5600. Over the next year, the company refined the product, and tested it repeatedly for quality and durability.

In January 2003, Bobcat launched the Toolcat to enthusiastic praise from industry experts and customers alike. Toolcat combines multiple capabilities in one machine making it more convenient for users. Aply characterized as the “Swiss Army Knife” of yard machines for its ability to perform diverse groundskeeping and light construction tasks, the Toolcat also features a number of unique operator and safety comfort features.

Since its market launch in early 2003, the Toolcat 5600 has garnered several prestigious industry awards and has contributed to Ingersoll-Rand’s strong revenue growth in recent years.

Manufacturing accounted for 71 percent of U.S. industrial R&D in 2002 (latest National Science Foundation data available). In fact, U.S. manufacturing alone performs more R&D than total industrial R&D in the European Union, as well as total industrial R&D in Japan, South Korea and Canada combined.

Nearly 30 percent of U.S. industrial R&D takes place in sectors outside of manufacturing, such as computer services, software consulting and research labs. By contrast, just 15 percent of industrial R&D is performed outside of manufacturing by our major trading partners.

The broader distribution of U.S. industrial R&D activity across multiple sectors is an economic advantage that helps drive productivity outside manufacturing.

**Ingersoll–Rand**

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PPG Industries

PPG Industries is a leading manufacturer of coatings, sealants, adhesives, flat glass, fabricated glass, continuous-strand fiber glass products and industrial and specialty chemicals. PPG has developed CeramiClear® clearcoat, the first automotive clear coat to use nanoparticle technology. The clearcoat is the final coating applied to a vehicle body, protecting the color coat while providing a durable, glossy appearance.

In the picture above, clear nanoparticles diffract light to impart color. PPG’s nanotechnology imitates nature: a peacock feather contains no pigment but a matrix of particles reflect light so color variations change depending on the angle viewed. PPG’s colorants have these same traits.

PPG uses patented nanoparticle technology to create a highly cross-linked network of molecules at the surface of the coating for superior resistance to damage caused by day-to-day use, car washes and environmental hazards, such as acid rain and tree sap.

Tests showed that after several months of weathering and passes through car washes, CeramiClear clearcoat retained more than 80 percent of its gloss appearance, while most standard clearcoats maintained a little more than 20 percent of their gloss. CeramiClear clearcoat has also outperformed most current commercial clearcoats in field testing for resistance to acid etch by as much as 50 percent. CeramiClear can reduce an automaker’s total cost by decreasing costs associated with in-plant damage, buffing and dealership touch-up.

It is often said that manufacturing equals technology because most technology is developed and then utilized in manufacturing. Robotics, computer-assisted design, Radio Frequency Identification (RFID) and Just-in-Time inventory control are among the many types of high-tech applications used to keep U.S. manufacturing competitive.

A growing measure of technology is the use of nanotechnology or, as it is sometimes called, molecular manufacturing. At the nano scale, material properties differ in fundamental ways from individual atoms and molecules. One nanometer is one-millionth of a millimeter (a single human hair is about 80,000 nanometers in width). Some current applications of nanotechnology:

- **Plastic nanocomposites** that create scratch-resistant, lightweight and rust-proof auto components, resulting in stronger, lighter and more fuel-efficient cars.
- **Nanoparticles** that make pants, shirts and ties stain-repellent.
- **Nanstructured materials** that form alloys as hard as diamonds used in drill bits, military armor and jet engines.
- **Nanoclays** used in bottles that extend the shelf-life of beer by 50 percent.

Whether it is software development, materials synthesis, biotechnology or other technology areas, more manufacturing firms are engaged in nanotechnology R&D than any other industry, according to the National Science Foundation.
When it comes to cleaning up the environment, U.S. industry leads the way. Even as U.S. industrial production has risen, mirroring overall U.S. economic output since 1980, the amount of CO₂ emissions generated by U.S. factories actually declined by 6 percent over the same timeframe. By contrast, CO₂ emissions from the transportation, residential and commercial sectors have all increased since 1980. Collectively, CO₂ emissions from these sectors rose by 38 percent.

Caterpillar

Caterpillar is the world’s leading manufacturer of construction and mining equipment, clean diesel and natural gas engines and industrial gas turbines.

Between 1990 and 2001, Caterpillar reduced greenhouse gas (GHG) emissions from its facilities by more than 500,000 tons, out of the 2 million tons of CO₂ equivalent it generates.

In 2003, Caterpillar joined Climate Leaders Program, a voluntary initiative in which the EPA works with companies to set long-term emissions reduction goals. Caterpillar has pledged to further reduce its GHG emissions 20 percent by 2010.

Caterpillar has reduced particulate emissions in on-highway clean diesel engines by 90 percent since 1988, and will reduce emissions another 90 percent by January 2007. The company’s ACERT® technology substantially reduces oxides of nitrogen (NOx), non-methane hydrocarbons (NMHC) and particulate matter (PM) by controlling the combustion cycle and integrating fuel and air system improvements to optimize “in-cylinder” combustion, raising fuel economy by as much as 23 percent.

Additionally, the company now remanufactures everything from diesel engines to railroad cars. Of the approximately 135 million pounds of material recovered in 2005, close to 70 percent was remanufactured, preserving about 85 percent of the energy expended in the original manufacturing.
The Timken Company

The Timken Company, a 107-year-old global maker of highly engineered bearings and alloy steel headquartered in Canton, Ohio, is making great strides to develop new energy-efficient applications for its bearings. One of the solutions: harness the wind.

Whenever something is moved, it requires energy—whether it is a person’s own physical exertion or energy that is generated from a machine. If a machine is being used to move something, chances are it contains an anti-friction bearing.

When two or more components come in contact with each other, the friction between them causes a force that slows them down, also slowing down the main object being moved, like a bicycle or a car. That friction requires more energy to be consumed. But, if the two surfaces can roll over each other, the friction is greatly reduced, and the amount of energy required to move an object is also reduced.

The Timken Company is using its extensive knowledge of friction and power transmission to help leading U.S. and European wind turbine manufacturers and gearbox suppliers create new energy-efficient designs to improve the reliability and efficiency of wind power. Bearing and bearing packages are used in the gearbox and main motor support of wind turbines.

Timken’s anti-friction bearings do just that—reduce friction. And anytime friction is reduced, energy is conserved.

Responding to rising energy costs and the need to protect the environment, U.S. manufacturers have introduced a variety of innovative technologies, new business processes and enlightened management techniques to encourage greater efficiency in the industrial use of energy.

Over the past three decades, the energy efficiency of industry has improved remarkably. Energy intensity, the amount of energy it takes to produce one dollar of goods, has been cut in half, from 30 thousand BTU in 1970 to 15.6 thousand in 2004.

Roughly half of the reduction in energy intensity can be attributed to energy efficiency improvements—using less energy to do the same work. The rest is the result of structural changes in the economy, such as changes in the product mix and shifting of energy intensive product manufacture to offshore locations.
 Manufacturing is a safe place to work. Safety is a high priority in America’s plants and offices. As workforces have become leaner, the loss of an employee due to injury can have an immediate impact on productivity and operations. In addition, technology has enabled routine and dangerous work to be done by robots and other equipment.

 Between 1994 and 2004 the rate of occupational injuries has been cut in half, from 12 workers per 100 workers to less than six.

 This is a faster decline than that of the overall private sector.

**Saint-Gobain**

Saint-Gobain is an international company that has invested strongly in the United States since 1967. With more than 25,000 U.S. employees at 180 manufacturing locations, the company produces a wide range of products including beer bottles, CertainTeed® roofing shingles, gamma ray spectrometers used by NASA and insulation used in more than a fifth of all U.S. homes.

With such diverse businesses, Saint-Gobain’s North American arm — Valley Forge, Pa.-based Saint-Gobain Corporation (SGC) — has made safety the cornerstone of its success. Seventeen percent of SGC’s plants have accumulated more than a million hours without a lost-time accident, while 60 percent had no lost workday injuries in 2005.

President and CEO Jean-François Phelizon says, “A plant with a poor or mediocre safety record is not a good plant. Our business is based on making strides in safety, which increases quality, productivity, employee flexibility and ultimately bottom-line profitability.”

SGC’s business is based on:

**Safety.** Improve the safety record through an emphasis on employee communication.

**Quality.** Make customer satisfaction a commitment for each employee.

**Productivity.** Achieve a 5 percent improvement each year.

**Adaptability.** Innovate and apply new ideas and techniques.

**Profitability.** Achieve increasing return on investment.
Vermeer Manufacturing

Founded in 1948, Vermeer Manufacturing is a family owned and managed business in Pella, Iowa. The company specializes in designing and producing machines and products used to build and maintain the world’s infrastructure — agricultural, construction, environmental and industrial. The company values its more than 2,000 employees, and rewards them with excellent pay and benefits, opportunities for growth and development and a share in company profits. Vermeer is an employer of choice with employee tenure averaging 11 years.

Mary Vermeer Andringa, co-CEO, will be the first to tell you that, “Our people are our greatest asset.” “People” are one of the primary areas of focus in the company’s 4P Philosophy, which also includes Principles, Product and Profit. Vermeer believes in and does all it can to nurture a high-performing workforce because, as Andringa states, “We know that employee success is essential to our success.” Vermeer depends on skilled workers for its competitiveness as a company, to be innovative and effective in all areas of the business.

It is becoming more and more difficult, however, for Vermeer and other manufacturers to get the “raw material” that they need to create a high-performing workforce. Jobs are available, yet many applicants are simply not qualified. Manufacturers recognize the need for a high-performing workforce but it is becoming more of a challenge to fulfill that need.

High Performance Workforce Is a Key Business Driver

People are a company’s greatest asset. In a 2005 survey conducted by The Manufacturing Institute, the NAM and Deloitte Consulting, 74 percent of respondents reported that a high performance workforce would be the key business driver for them over the next several years.

The other two key business drivers are new product innovation and low-cost producer status. Interestingly, it is the high performance workforce that drives product innovation and the ability to produce high quality products at low cost. So the shortage of skilled workers in manufacturing poses a triple threat unless we find ways to fill the skills gap and build a better pipeline of new, skilled workers.

The common perception that being the low-cost producer is the only factor that leads to business success does not match today’s reality: It’s the performance of the workforce that provides America’s competitive edge.
The shortage of skilled engineers and scientists is a reality for most manufacturers. Della Williams is president and CEO of Williams-Pyro, a Fort Worth, Texas-based manufacturer of equipment used to monitor industrial machinery, test electronics and weapon systems and suppress fires. For her 43-year-old company and its 98 employees, engineering new solutions for industrial and military applications lies at the core of its business plan. Yet, Williams has found it difficult to find people to develop the next generation of the company’s sophisticated products.

In 1999, at the height of the tech boom, Williams approached the University of Texas looking for graduate students willing to work at the company. Those who were interested were foreign students from Korea, India, China and Mexico. Many of these young engineers whom she recruited have worked at Williams-Pyro for six years with plans to stay permanently. But U.S. immigration laws have prevented them from obtaining the green cards that would allow them to become U.S. citizens. Williams has spent more than $115,000 unproductively on obtaining the necessary permits and she feels U.S. law should make it easier to employ such high-skilled employees, especially because fewer Americans seem attracted to these vital careers. Some engineers whom she hired have already left and returned to their native countries, leaving Williams-Pyro searching for American and foreign-born engineers.

More than 80 percent of respondents to the NAM’s 2005 Skills Gap survey stated that they could not find qualified workers to fill their job openings right now. Ninety percent said they could not find enough skilled production workers and 65 percent said they could not find enough scientists and engineers.

The skills so in demand in today’s advanced manufacturing include math and science skills and the ability to problem-solve, think analytically, communicate via written and spoken word and work in teams, as well as autonomously. Yet, too few young people take the necessary math and science in school, nor do they understand how these skills translate into their future careers. According to the U.S. Department of Education, American 12th graders fall near the bottom in mathematics and science when compared to their peers overseas.

A major reason why the United States is not producing enough skilled workers is because youth are not being provided with up-to-date career guidance and the corresponding coursework they will need for achieving their desired career outcomes.

United States Is Not Producing Enough Skilled Workers

Source: U.S. Department of Education.
In 1973, more than half of workers on the factory floor had not finished high school. But by 2001, nearly a third of production workers had some form of post-secondary education (associate/college/graduate degrees), up from just 8 percent in 1973. By comparison, those without a high school degree dropped by more than half to only a fifth of production workers. It’s clear that post-secondary education is essential to the success of men and women seeking manufacturing careers and to manufacturers looking for skilled workers.

By creating more pathways to post-secondary education, opening up funding for non-traditional students and providing flexible and customized learning and support, more individuals will receive the kind of training required for work in manufacturing.

This is a high priority for manufacturers. Sixty percent of manufacturers responding to a recent Manufacturing Institute’s Skill Gap survey said that young people with a high school degree were not prepared for an entry-level manufacturing job, but 81 percent said they were prepared if they had a certificate or degree from a post-secondary institution.
The National Science Board reports that the absolute number of engineering degrees awarded in the United States is down 20 percent from the peak year of 1985 (from 8 percent of all college degrees to 4 percent). Manufacturers face a lack of skilled workers, who drive innovation and productivity. Engineers often design the products and the processes that we marvel at today.

Twenty years ago China, Japan and the United States graduated almost the same number of engineers. Today China graduates about four times the number of engineers as the United States, although they are not all trained at the same level as U.S. engineers. Many of them are only technical workers with a lesser degree. Japan, with less than half the population of the United States, graduates about twice as many engineers. According to the National Science Board, South Korea with about one-sixth the population of the United States graduates nearly as many engineers as does America.

In order for manufacturing to remain vibrant, the number of U.S. engineering graduates should increase, including talented foreign engineers educated here and abroad.

In order for manufacturing to remain vibrant, the number of U.S. engineering graduates should increase, including talented foreign engineers educated here and abroad. The innovation advantage currently enjoyed by the United States will be quickly eroded as experienced engineers, who are in the large baby boomer generation, start to retire and there are not enough new engineers to hire.

* International Equivalent to a Bachelor Degree
Form-Cove Manufacturing

Form-Cove Manufacturing Company, a 40-year-old family owned business manufactures and installs cultured marble and laminated countertops for new and existing homes. Located outside of Albuquerque, N.M., Form-Cove has open accounts with more than 250 home builders in the area; its growth has been tied to the robust housing market of the past decade. Since 2001, the company’s sales have increased by nearly 124 percent and its workforce by 89 percent. This growth and a smaller youth workforce have caused a severe labor shortage for Form-Cove.

A job at Form-Cove is considered one of the best in the area, with competitive entry-level wages that are 54 percent higher than the average service industry jobs. The company also offers a full range of benefits, including in-house training for employees. More than half of their 126 employees have been there for more than five years and some for more than 25 years.

Too many of the applicants for these jobs are unprepared for work in modern manufacturing and do not have the minimum skills needed in today’s workplace. A large number lack the basic ability to read and write. Of those offered employment, half are disqualified due to failed drug tests. For Form-Cove and many other manufacturers, finding the right workforce remains one of the toughest jobs in managing for success.

What do you want to be when you grow up? Most ninth graders cannot answer that question. Their knowledge of the real world and where the jobs are now and in the future is very limited. Overwhelmingly the message that they receive is that to get a good job one must get a college degree.

Almost 30 percent of ninth graders indicate that they are headed for a four-year college after high school graduation. But what they do not know is that only about 20 percent of the jobs will be in areas requiring a four-year college degree.

More than 30 percent of ninth graders indicate that they will enter an associate degree program. It is estimated that approximately 65 percent of future jobs will require or need a person with an associate degree.

To bridge this gap, The Manufacturing Institute established the Dream It. Do It. (DIDI) Manufacturing Careers Campaign, which targets young men and women between the ages of 16 and 26 with youth-oriented advertising to dispel outdated notions of manufacturing. DIDI’s regional partnerships among business, political, education and civic leaders, economic developers and public workforce developers strengthen regions’ economic development using a workforce development focus. In the pilot region of Kansas City, Dream It. Do It. has raised enrollment in manufacturing-related courses at the local technical college by 35 percent. For more information, visit www.dreamit-doit.com.
R&D Investments: Fastest Growing Economies Gaining Rapidly on United States

For more than half a century, the United States has led the world in science and innovation. In today’s competitive world, the United States can no longer take its supremacy for granted. Aggregate R&D spending by six fast-growing economies (China, Ireland, Israel, Singapore, South Korea, Taiwan) is on track to exceed U.S. spending in a few years.

As a share of 2004 total world R&D, the United States increased its investment by 38 percent since 1995. China alone has tripled R&D funding during that same period.

This is a call to action for policymakers to provide more funding for federally supported R&D. Otherwise, future innovation and our economic competitiveness will be at risk.

Bison Gear & Engineering

Development of new products and processes is more important than ever to U.S. competitiveness. With 200 employees, Bison Gear and Engineering outside of Chicago is seeking major changes in electric motor designs that will enhance its future business by dramatically improving current energy use of motors. Bison’s motors, gearmotors and reducers have been produced for more than 45 years and can be found in products sold by machine tool, food processing, packaging and medical equipment manufacturers.

To stay ahead of the competition, Bison established an Industrial Design Studio in 2005 where its team of engineers and scientists can quickly bring to market prototypes of new gearmotors, drive trains and machines. The studio team works not only for Bison Gear, but also for large and small customers alike.

Building on the studio’s investment, Bison has won a National Science Foundation grant to demonstrate that it can significantly cut the energy used in operating electric motors. New motors would raise productivity of machines in which they are used, while reducing electricity consumption and operating costs.

Bison Gear Chairman and CEO Ron Bullock said, “It’s possible that these new, highly efficient motors, if widely used, could eliminate the need for dozens of U.S. fossil fuel burning plants, bringing a substantial environmental benefit to their application.”
Intel

Intel, the world’s largest chip maker, is also a leading manufacturer of computer, networking and communications products. Some of Intel’s breakthroughs have originated with federally funded research conducted at Department of Energy labs such as the Sandia and Lawrence Livermore National Laboratories. Recently, Intel along with Motorola, AMD and IBM invested more than $200 million on lithography at a consortium of national labs, called the Virtual National Laboratory (VNL). Lithography is the process by which complex circuit designs are transferred to semiconductor wafers and underlies all semiconductor manufacturing.

Intel and the other companies turned to VNL to determine how to jump massive technical hurdles as industry reduces circuits to sizes below 100 nanometers. The VNL research will engage 130 laboratory researchers, 20 U.S. suppliers and 3 universities. If a new ultraviolet lithography can be mastered, it will become the leading semiconductor lithography technology for the 21st century, benefiting both commercial and defense applications. Other countries are seeking the same advantage that this knowledge will bring.

Federal budget policy, however, has not kept up with U.S. R&D needs, and in recent years such research activity has been reduced by 10 percent, with a corresponding exodus of research talent. Better funding for research into the physical sciences is critical if the United States is to keep its lead in technology.

Federal R&D spending in the areas of engineering and physical sciences has been eroding over the past three decades. Physical sciences, which includes physics and chemistry, is vital to innovation in the manufacturing sector.

In 1970, federal spending in engineering and physical sciences amounted to a quarter of 1 percent (0.25 percent) of GDP and accounted for half of federal R&D spending. By 2003, federal spending in engineering and physical sciences fell by half to 0.13 percent of GDP and accounted for just a fourth (27 percent) of federal R&D spending.

Federal spending on R&D should be increased over the next decade to 1 percent of GDP for the United States to remain competitive.
Manufacturing in the Global Economy
The global economy is more important than ever for U.S. manufacturers. Foreign markets like China and India, are growing rapidly and offer both new business opportunities and challenges. American manufacturers have increased their competitiveness and look to new export markets for trading opportunities.

Total U.S. exports topped $900 billion in 2005, yet too few know that over 60 percent of all U.S. exports are manufactured goods, nearly double the value of U.S. goods exports just 10 years ago. By comparison, farm exports account for only 6 percent of U.S. exports. Despite this progress in exporting, the challenges that most U.S. manufacturers face place them on the front lines of the most intense global competition in history.

Exchange rates have made it difficult to raise prices here and abroad, so American manufacturers have increased their competitiveness through the innovation and productivity strides discussed in Sections 1 and 2. The pattern of trade also has shifted in the past decade, providing new opportunities for American exporters: developing nations now buy nearly half of U.S. exports.

It is sometimes incorrectly alleged that free trade agreements have caused the current large trade deficit, but only 10 percent of the deficit actually comes from countries with which the United States does not have trade agreements. The artificially pegged Chinese currency is also a source of the trade imbalance, which has helped contribute to the United States displacement as the largest manufacturing exporter in the world; Germany now holds that distinction.

Priorities for leveling the playing field for U.S. manufacturers include:

- Basing rates of major trading partners on market forces, not artificial pegs;
- Opening new markets abroad by removing barriers that limit U.S. exporters; and
- Enforcing trade and intellectual property laws and combating unfair trade practices.

With foreign investment, the United States remains the number one destination, considerably ahead of the United Kingdom and China. U.S. manufacturers continue to invest heavily in the largest markets, so it is not surprising that more than half of U.S. manufacturing investment abroad is in Europe, one of our largest trading partners.
Hutchinson Technology

Hutchinson Technology designs and manufactures suspension assemblies for hard disk drives. Without them, data and other information would not be transmitted from the disk drive. Hutchinson has succeeded in its goal to be the leader in their industry through continuous innovation and improvement while exporting nearly all of their products. Today it manufactures the majority of worldwide suspension assemblies for all sizes of disk drives at its facilities outside of Minneapolis, in Sioux Falls, S.D. and in Eau Claire, Wis.

This 41-year-old company that began in a chicken coop seeks to deliver the highest data storage capacity at the lowest cost. Since its first disk drive in 1956, disk drive capacity has increased five million times. Also, the cost per megabyte of storage has plummeted, helping introduce today’s successful high-tech economy. Hutchinson’s 5,000-plus employees have helped in this transformation and its Development Center continues to provide new products and processes.

Hutchinson knows that exporting is also important to its success. Manufacturers command higher prices around the world for their more sophisticated products. At Hutchinson, over 90 percent of revenues stem from exports to Thailand, Hong Kong, China and Japan where Hitachi, Samsung, Seagate, Toshiba and Western Digital use their products for computing, portable music players, digital photography and cell phones.

U.S. manufacturers export more than $60 billion in goods every month. Exports from the United States have increased by 57 percent over the past ten years, with manufacturing responsible for nearly two-thirds of total exports. By comparison, agricultural exports account for just 5 percent of the total.

One of the main reasons for American manufacturers’ increased global engagement is the transformation into market economies of many developing nations, which now consume nearly half of U.S. exports. Developing nations tend to import capital equipment and intermediate products, the kind of products in which U.S. manufacturers are most competitive.

A decline in exports was one of the chief reasons for the 2001 manufacturing recession. From a highpoint of $771 billion in 2000, manufactured exports fell to $681 billion in 2002. A realignment of exchange rates led to a depreciation of the U.S. dollar in 2004-2005 and has made U.S. products more price competitive, helping to boost exports to over $900 billion in 2005.
U.S. exporting firms were hit hard by the 2001 recession coupled with exchange rates, which hurt U.S. firms’ ability to compete abroad. U.S. goods were more expensive abroad and at the same time imported foreign goods were relatively affordable.

The chart above shows that the recent realigning of the dollar (orange line) had a positive effect on U.S. exports. The grey line depicts U.S. exports climbing in the past three years against the Federal Reserve price index, which measures a basket of currencies of the U.S. major trading partners. Economic slowdowns among the United States’ major trading partners also affect exports. Sluggish economies abroad dampen the demand for U.S. exports.

China, however, has pegged its currency to the U.S. dollar and it remains significantly undervalued. This is stimulating Chinese exports to the United States and limiting U.S. exports to China.
The vast bulk of global trade is — 77 percent — in the form of manufactured goods. Food and agriculture make up a mere 9 percent of global merchandise trade, followed by fuels (8 percent) and ores and minerals (3 percent).

Previously the top global exporter, as of 2004, the United States now ranks number two behind Germany. But U.S. exporters are starting to make up for lost ground now that the U.S. dollar has depreciated against the euro.

Though Germany is the number one exporter globally, the U.S. economy is healthier than that of Germany’s, which has much higher unemployment and slower growth. Simply having a trade surplus, as Germany does, is no guarantee that a country’s overall economy will grow and produce jobs. China has become the third largest exporter, overtaking Japan.

Previously the top global exporter, the United States now ranks number two behind Germany. China has become the third largest exporter, overtaking Japan.
The U.S. manufactured goods trade deficit in 2005 was more than $500 billion, twice the size of the deficit in 1999. Both export growth rates and the level of imports determine the trade balance. Imports have grown by nearly a quarter in those years while exports were primarily flat. Only in 2004 have exports finally improved, in response to exchange rates.

The types of products imported and exported from the United States are almost mirror images of each other. Trade in chemicals, non-electrical machinery, food manufacturing and printing were each in balance with near-equal amounts of exports and imports.

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Bulk of U.S. Manufacturing Trade Is in Core Industries

<table>
<thead>
<tr>
<th>Imports, $ Billions</th>
<th>Exports, $ Billions</th>
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<tr>
<td></td>
<td>U.S. Manufactured</td>
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<tr>
<td></td>
<td>Total Imports</td>
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<td></td>
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<td>-300</td>
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<tr>
<td>Computer &amp; Electronics</td>
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<td>Transportation Equipment</td>
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<td>Chemicals &amp; Pharmaceuticals</td>
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<tr>
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<td>Printing &amp; Publishing</td>
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<td>Furniture &amp; Fixtures</td>
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<tr>
<td>Leather Products</td>
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<tr>
<td>Total Exports:</td>
<td>$806 Billion</td>
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<tr>
<td>$1.347 Billion</td>
<td>$110</td>
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</table>

Source: U.S. ITC and NAM calculations based on three digit NAICS codes, 2005.
Note: Crude oil is not a manufactured product.
Employees in the most trade competitive industries earn an annual compensation package that averages about $80,000. This is 60 percent more than average compensation in the least trade competitive sectors of manufacturing.

Higher employee pay and trade intensity go hand-in-hand.

Employees in the most trade intensive industries—where combined exports and imports amount to at least 60 percent of their domestic industrial output—earn an annual compensation package that averages about $80,000. This is 60 percent more than average compensation in the least trade engaged sectors of manufacturing. Industries in this most trade-engaged category account for about one-third of U.S. manufacturing trade. The industries with the least trade engagement pay $51,000 a year and account for only 12 percent of U.S. manufacturing trade.

The premium pay of trade-engaged industries also extends to other manufacturing and service companies in the supply chain. Employers at these companies—where jobs are directly supported by exporting—also enjoy higher pay than their peers at domestic-only companies.

The middle group of trade-engaged industries pays about $58,000 a year in wages and benefits. Industries in this category account for about one-third of U.S. manufacturing trade.
According to the U.S. Department of Commerce, 97 percent of all exporting manufacturers have fewer than 500 employees (the Small Business Administration definition of a small manufacturer). While large companies are responsible for 70 percent of the value of exports, smaller companies have learned that export markets are important to their success, too.

The NAM has tracked the exporting experiences of smaller manufacturers for more than a decade. Just as exchange rates affected all U.S. exports, smaller manufacturers were affected as well, leading to a sustained drop in exporting between 1998 and 2001. The increase in exports by smaller companies, which doubled after 2001, has now exceeded the growth rate of the late 1990s.

With this kind of productivity, it’s no surprise that Power Curbers attracts customers abroad. “More than one-fifth of our production was exported in 2005 and our exports have doubled in the last three years,” said Dyke Messinger, the company’s president.

A more favorable dollar–euro exchange rate has increased Power Curbers’ exports to the European Union. But there remains a huge imbalance in tariff rates between industrialized and developing countries. U.S. and other industrial countries bound tariff rates on imports of manufactured goods are now down to an average of about 3 percent, but the average bound industrial duties in the developing countries is more than 17 percent—nearly six times as high. Messinger says, “My equipment faces duties of 15 percent in India and 8 percent in China. We could sell much more if these barriers were eliminated or reduced substantially.”
Technical Materials

Technical Materials, Inc. transforms metal through bonding, electroplating, electron beam welding and other methods for use in medical products, energy products, electronics, telecommunications, automotive products, computers, disk drives and semiconductors.

This R.I.-based manufacturer with approximately 250 employees has been exporting high-technology precious metal-plated and other material systems to stamping companies in China. The inability of the Chinese and other regional suppliers to procure these high-quality products has allowed Technical Materials to maintain a distinct advantage in U.S. production.

Despite this advantage, Technical Materials President Al Lubrano said, “Our technology and innovation have kept us ahead of the game with some of our customers, but it is not sustainable nor is it going to be enough if we don’t address the problems in our trade with China soon. As a global manufacturer we will have to pursue a manufacturing presence in the Asian region.”

With a currency undervalued by as much as 40 percent and with some of its industries benefiting from government subsidies, China has hindered some U.S. manufacturers’ ability to retain market share at home and compete globally.

Technical Materials used to sell parts to the suppliers of cell phone makers but when the cell phone production was moved to China, the suppliers moved as well.

Trade Gap Widens For Manufacturers

Since the early 1970s, manufacturing has become much more engaged in international trade. While exports have more than doubled from 8 to 20 percent of domestic manufacturing output, imports have risen much faster. By 2004, more than one-third of all manufactured products bought in the United States were imported, compared to 11 percent in 1972.

This divergence was not a continuous trend but rather was driven by two specific periods — in the mid-1980s and the late 1990s — when exchange rates made imports relatively inexpensive to U.S. consumers and had the opposite effect on U.S. exports, making them expensive in other countries.

From 1972 to 1982 imports and exports rose by similar magnitudes. Then, as the dollar climbed to an all-time high in 1985, U.S. exports stagnated while imports accelerated (see shaded area in chart). After the dollar realignment in the late 1980s, exports again began to increase and actually outpaced the rise in imports through much of the 1990s. Then, from 1997 to 2002, the dollar again surged. And again, the gap between imports and exports widened.
Metal Essence

Metal Essence, Inc. is a small precision metals and plastics fabricator located in the Orlando, Fla., area, specializing in high-quality close tolerance machining for the electronics, automotive, telecommunications, medical and aerospace industries. Their computer numerical controlled (CNC) turning and milling, and plastic molding and sheeting capabilities allow them to design and mass manufacture any part that a customer demands.

Al Stimac, president of Metal Essence, emigrated to the United States from Croatia and built his business from the ground up. He uses his knowledge of machine tool building and manufacturing processes to continually reduce the time it takes to manufacture parts. His skill and ability in reducing the product cycle time enabled his company to outbid a highly competitive Chinese company for a contract to make six million parts a year. His factory runs so well that Lockheed Martin and the Association for Operations Management have toured the plant.

Metal Essence has also experienced growth due to the North American Free Trade Agreement (NAFTA). Before NAFTA, Metal Essence only sold parts in the United States and Europe. NAFTA allowed Stimac entry into Mexico. Previously, his ability to compete was hurt by trade barriers and higher transportation costs. After NAFTA was enacted in 1993, the logistical costs were reduced so that Metal Essence could begin selling parts in Mexico.

The U.S. trade deficit is not with those countries where the United States has a free trade agreement (FTA). Less than 10 percent of the U.S. manufactured goods trade deficit lies with our FTA partners. In fact, the bulk of the U.S. trade deficit lies with Asia (nearly 40 percent of it is with China).

Free trade agreements help level the international playing field: U.S. tariffs on imported manufactured goods averages less than 2 percent while U.S. exports face an average of about 10 percent globally. U.S. exports gain when those trade walls to U.S. goods fall. In addition, foreign exchange rates that are determined by market forces help keep trade in balance.
American exports to China should have doubled had the United States maintained its 1998 import market share in China.

According to 2005 data, the E.U.-25 bloc exports 50 percent more to this growing market than the United States. For the past few years, the European exporters have maintained a higher import market share in China than American exporters. China’s import market share of U.S. goods has been declining since 1998.

While actual U.S. exports to China have grown in the past few years, American exports to China should have doubled had the United States maintained its 1998 import market share in China.
U.S. Attracts More Investment Than Other Countries

The United States is the number one destination for foreign direct investment (FDI) because of a large and open market, dynamic, stable economy and government, enforcement of intellectual property laws and a robust financial system.

Following the United States, the United Kingdom, China and France are large recipients of FDI. The CIA estimates that China could be the number two destination of FDI by 2020.

To continue to be an attractive destination for FDI, the United States must continue to foster opportunities for foreign firms to invest. Factors critical to foreign investors: an educated workforce, a low-inflation economy and a transparent regulatory process. Production costs are also a factor in determining foreign investment. As discussed in Section 4, the United States is vulnerable because a range of structural external costs, such as energy and taxes, are making this country a less attractive location for investment.

Toyota Motor North America

Toyota’s $13.9 billion investment in its U.S. operations has created nearly 400,000 jobs across the country in its plants, with its suppliers and at its dealerships. Toyota’s U.S. investment has also benefited companies well beyond the auto industry through its innovative manufacturing system.

Toyota Production System’s (TPS) lean production methods focus on quality, continuous improvement, waste elimination and employee empowerment in problem-solving and workplace and process improvements. TPS started on the shop floor, but it also applies to engineering, marketing and administrative operations.

TPS’s success has inspired other automakers, parts suppliers and manufacturers in other industries to adopt these lean production principles to further their own competitiveness. In a recent study, the Michigan-based Center for Automotive Research (CAR) found that many non-automotive U.S. manufacturers have also embraced these production methods. The CAR study reveals that adoption of TPS increases productivity, time- and cost-savings and product quality. Within the aerospace and defense industry, application of TPS has:

- Reduced scrap by up to 69 percent;
- Raised quality by 60 percent through reduction in defects;
- Reduced assembly and production time by an average of 59 percent; and
- Improved productivity by up to 82 percent.

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- Improved productivity by up to 82 percent.
Another term for foreign investment in this country is “insourcing.” Foreign capital creates wealth and jobs in the U.S., rather than abroad. Thanks to net foreign investment, about one in twelve American manufacturing workers are now employed by a foreign-owned firm. Toyota recently invested $800 million in a new plant in San Antonio, Texas, that will employ 2,000 workers.

Texas Instruments (TI) is a world leader in digital signal processing and analog technologies, the semiconductor engines of the Internet age. This U.S. company was founded in 1930 as a seismic exploration company.

TI is committed to being close to its customers worldwide. Because it builds local partnerships with its international customers, its network is a competitive advantage. And when the company invests in overseas markets, it also invests in highly trained, high-wage employees.

TI employs approximately 30,000 people worldwide on revenue of more than $13 billion. It derives approximately four-fifths of sales from customers outside the United States. About two-thirds of its employees are in the Americas and about 10 percent in Europe. TI operations in Europe started in 1958 in the UK and today include 27 sites in 16 countries. Recent investments have been in Denmark, Germany, France and Norway.

All of TI’s businesses are represented in Europe. With wireless, for example, TI was the first single chip processor for Finnish-brand Nokia cellular phones in 1995 and today Nokia is a major TI customer. More than half the wireless phones sold worldwide contain TI’s Digital Signal Processing (DSPs), found also in many consumer electronic devices such as digital cameras, iPods and TI’s DLP® Technology used in today’s best HDTVs, projectors and digital cinemas around the world.
The domestic environment for manufacturers is dominated by concerns about rising external costs that make manufacturing from a U.S. base difficult. These costs for corporate taxes, health care and pensions, regulation, natural gas and tort litigation add more than 30 percent to manufacturers’ costs.

Because of these escalating costs:
- this country’s manufacturing sector has become less competitive;
- more jobs were lost during the last recession;
- fewer jobs have been created in the recovery; some of the external costs—especially health care—make every new job more expensive;
- profits are lower, spurring cutbacks in investments in R&D and worker training; and
- outsourcing production overseas has increased.

Recent analyses by the NAM, The Manufacturing Institute and the Manufacturers Alliance/MAPI show that these external sources add a 31.7 percent cost disadvantage for U.S. manufacturers when compared with similar costs for our nine major trading partners. That is a jump of over 40 percent since a similar review was undertaken in 2003. Some of the major costs undercutting U.S. manufacturing include:

Natural Gas Prices. The price of the primary fuel used in manufacturing in the United States, rose dramatically after hurricanes Katrina and Rita. The lack of adequate U.S. supply affects all manufacturers, especially chemical manufacturers and those companies that use their products.

Regulatory Costs. The annual cost of complying with federal regulations is more than $10,000 per employee. For non-manufacturing U.S. businesses that cost is half that.

Health Care. Rising health care costs remain one of the most challenging pressures for manufacturers. According to a recent survey by the NAM, nearly half of all small and medium manufacturers cited escalating health care costs as their most pressing problem, with some companies spending more than 30 percent of their sales on health care expenses.

Taxes. To keep their industries competitive, many countries have cut their corporate tax rates significantly more than the United States. Ireland, Hungary, the United Kingdom, France, Italy and Germany all have lower corporate tax rates than the United States.

Litigation Costs. Tort costs rose from 1.82 percent of GDP in 2000 to 2.22 percent of GDP in 2002 and have remained at that high level in subsequent years. U.S. manufacturers pay far more for tort litigation than other countries; comparable costs are 1.1 percent in Germany and 0.8 percent in Canada.
While it is well known that Mexico and China have lower labor costs, it is generally not recognized that external overhead costs put U.S. manufacturers at a competitive disadvantage even with our industrialized trading partners. Compared to our nine largest trading partners, U.S. manufacturers face higher costs in the areas of taxation, employee benefits, tort claims, natural gas and government regulation. A recent study by The Manufacturing Institute, NAM and the Manufacturers Alliance/MAPI shows that these costs add 31.7 percent to the cost of doing business in the United States. The Escalating Cost Crisis documents how these costs make the United States a more expensive place to manufacture products than any of our nine major trading partners. Without this cost disadvantage, the United States would be a lower-cost place to manufacture than Germany, the UK, France and Canada, and roughly on par with South Korea. Together, these external costs have offset a large part of the 90 percent productivity growth generated by the manufacturing sector since 1990. As a result of these costs:

- manufacturers are less competitive;
- more jobs were lost in the last recession;
- fewer jobs have been created in the current recovery;
- profits are lower, spurring cutbacks in investments in R&D and worker training; and
- outsourcing production overseas has increased.

For more information on this report, visit www.nam.org/costs.
New Vista Enterprises

In 2004, when Ann and Gordon Brown started New Vista Enterprises in Golden, Colo., two things were certain. They would offer health care insurance to their 10 employees and it would be expensive. They found a consumer-driven plan that was “affordable” and adequate in coverage. They selected a Health Reimbursement Plan (HRA) that had a high deductible, a provider-funded, self-directed account and full coverage of most preventive care.

New Vista, a manufacturer of digitally printed graphics for vehicles, retail, museum and corporate customers, covers 60 percent of the premium and the employee covers the rest. The high deductible causes an employee to think twice about non-essential emergency room or doctor’s visits. New Vista offered to cover the cost of the deductible in a given year, if the employee had a catastrophic event.

New Vista focuses on the health and productivity of their employees in other ways including offering fresh fruit and purified water on-site, healthy habits reading materials and a flexible work schedule so employees can exercise.

Despite all these wellness features, New Vista’s health care premium jumped 9 percent in 2005 and was projected to rise by another 35 percent in 2006. To keep the costs flat, New Vista switched providers and reduced benefits by raising the employee-deduction level and instituting a copay for doctor office visits.

Rising health care costs are one of the biggest challenges manufacturers and their employees face. According to a 2006 NAM survey of small and medium manufacturers (SMMs), 87 percent of respondents ranked escalating health care costs as their most pressing problem. Further, more than 10 percent of SMMs surveyed spent an average of 27 percent of sales on health care expenses.

As a result of rising costs, 69 percent of those surveyed said they had to raise their employees’ share of coverage while 28 percent said that they would begin or increase Health Savings Accounts (HSA).

The United States tops other countries in terms of health care spending as a percent of GDP. While the United States has advanced technology and medical services, escalating spending is taking a toll on employers. The answer to the rising cost of health coverage lies in an aggressive two-track strategy of reducing health care costs today while experimenting with changes or alternatives to our present health care system.

Manufacturers want to continue their proud commitment to providing health benefits through affordable health coverage by creating an electronic health record to improve cost and quality of health care, preventing and managing chronic care of workers through education and encouraging consumer-directed health care options.
When it comes to changes in the price of natural gas, oil or most other energy sources, manufacturing has more at stake than any other sector of the economy. U.S. industry consumes fully one-third of all energy in the United States.

Compared to the other end-use sectors (commercial, residential and transportation), industry consumes 95 percent of coal, 70 percent of renewable fuels, 48 percent of natural gas, 29 percent of electricity and 25 percent of petroleum used in the United States.

So, whether it comes to finding new energy sources, improving efficiency or diversifying our energy supply, no-one has a larger stake than manufacturers to ensure that a dependable supply of affordable energy is available to our country.
The Dow Chemical Company, headquar-tered in Midland, Mich., is the largest U.S. chemical producer, with annual sales of $46 billion and 42,000 employees world-wide. In recent years, rising natural gas prices — particularly in the United States, where natural gas prices are among the highest in the world — have forced Dow to take steps to remain globally competitive, including:


• Shifting some production overseas where energy is more abundant and competitively priced.

• Announcing future investments outside the United States. These investment dollars could have gone into new plants and jobs in North America, but non-competitive U.S. energy and feedstock costs will force them to go to joint ventures in Oman, Kuwait and China instead.

• Forming a partnership to build a U.S. port for liquified natural gas (LNG).

• Implementing aggressive energy efficiency programs at all U.S. facilities.

• Announcing an aggressive corporate goal to further reduce the energy intensity of its global operations by an additional 25 percent from 2005 to 2015.

• Increasing the price of its products to help offset the inflated energy and feedstock costs.

Unlike oil, natural gas is not a global commodity with a single world price, so gas prices vary based on local supply and demand.

While there is plenty of natural gas in the United States, Congress has mandated that most of the Outer Continental Shelf is off-limits to energy development. New sources of clean-burning natural gas are needed; the U.S. Energy Department estimates that maintaining U.S. economic growth through 2025 will require a 40 percent increase in supplies natural gas.

This growing lack of supply puts U.S. industry which, consumes 48 percent of natural gas, at a major disadvantage vis-à-vis our competitors.

The chemical industry is one of the largest sectors in U.S. manufacturing, providing much of the nation’s R&D and technology leadership, as well as hundreds of thousands of high-wage manufacturing jobs. More than any other manufacturing segment, the chemical industry relies on stable and competitively priced natural gas as both an energy source and a critical raw material to produce thousands of chemical, plastic and agricultural products that are essential to many consumer and industrial markets. Every $1 increase in the price of natural gas adds $3.7 billion to the industry’s costs.

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Marlin Steel Wire Products

Marlin Steel Wire Products makes wire baskets, shelves, wire forms and hooks for major U.S. and foreign companies. Marlin makes all of their products, importing no finished product from foreign suppliers. President and owner Drew Greenblatt has managed to stay competitive while offering his employees a full package of benefits, including health insurance, holiday pay, 401(k) matches and full tuition reimbursement.

After losing customers to competitors in China, Greenblatt changed the business model to ensure that Marlin would survive. He moved the company from Brooklyn, N.Y., to Baltimore, Md., upgraded to a computer-assisted design (CAD) system, bought 11 labor-saving robots and implemented a new marketing strategy.

Greenblatt still must deal with costly government regulations, which hurt his ability to compete against foreign companies. For example:

- limits on truckers’ hours have resulted in higher freight rates;
- top-heavy rules on pension contributions have required him to hire a pension consultant;
- tax code rules on how equipment is expensed means Marlin must spend money on accountants to optimize depreciation strategies; and
- $50,000 a year is spent on payroll services, accounting and internal bookkeeping to satisfy government rules cost.

More than any other sector, manufacturers bear the highest share of the cost of regulation. Many regulations have positive benefits for the economy and society. Yet few understand the cost of these regulations and their impact on companies that face intense global competition with overseas firms that often do not have similar costs.

The cost of simply complying with federal regulations is steep. Manufacturers bear the highest cost—$10,000 per employee—almost twice the average for all U.S. industries.

Recent NAM/MAPI studies document external costs such as regulations, showing how such government mandates increase the unit labor costs for U.S. manufacturing. The first study, undertaken in 2003, showed a 22.4 percent cost differential compared with our nine major trading partners. By 2006, a follow-up study, The Escalating Cost Crisis, showed the disparity had widened to 31.7 percent.

These two reports show how regulatory compliance costs have continued to rise as well. The total regulatory burden on manufacturers is estimated at $162 billion. That’s a 10 percent increase just between 2000 and 2005. Environmental, economic and tax compliance regulations have grown the fastest this decade.

These and other high costs hinder the global competitiveness of manufacturers and constrain the demand for employees in U.S. facilities. Rising U.S. costs at home are further inducements to locate production abroad.

Manufacturers Hit Especially Hard by Federal Regulations
Out-of-Control Tort Costs Need To Be Reined In

While the U.S. economy has grown at a healthy pace, tort costs are increasing much faster than the economy itself. They are another impediment to manufacturing in the United States.

The United States has the most expensive tort system in the world, costing more than $250 billion a year, or 2.23 percent of GDP, compared to less than 1 percent of GDP in Japan, France, Canada and the United Kingdom. That’s more than the entire federal R&D budget. Trial lawyers rake in more than $40 billion annually, while manufacturers face ever-rising legal costs. Everyone pays as a result of runaway legal costs: health care costs rise, investment is deferred and, in some cases, plants are closed while insurance fees jump.

A case in point is asbestos tort claims against a wide range of manufacturers, most of whom never produced asbestos. With more than 70 manufacturers in bankruptcy solely because of asbestos-related lawsuits and 57 cents of every dollar in asbestos claims going to transaction costs — most of it to lawyers — it’s clear to see why legal reform is needed. The courts are inundated with lawsuits on behalf of workers exposed to asbestos, 95 percent of whom show no physical impairment, while the claims of the truly sick languish. Meanwhile, 60,000 jobs have been permanently lost because of looming uncertainty over asbestos liability.

RPM International

Ohio-based RPM International manufactures specialty coatings for both industrial and consumer markets. With nearly 9,000 employees and 75 U.S. facilities, its products include Rustoleum, a rust-preventing paint; DAP, a caulk and sealant product; and Day-Glo, fluorescent colorants.

In 1966, RPM acquired the assets and assumed the liabilities of a company that made a patch-and-repair joint compound called Bondex that contained a small amount of asbestos. “Our product was the type of product that somebody would buy at a hardware store and use once or twice,” says President and CEO Frank Sullivan. “We discontinued the product in 1977 in conjunction with OSHA requirements. From the mid-’80s to the late ’90s, our total asbestos costs were about $2 million. In just the past six years, we’ve spent more than $200 million.”

Today RPM faces more than 10,000 asbestos-related lawsuits and it has spent as much as $67 million annually in recent years on asbestos-related costs.

In 2004, RPM’s asbestos costs exceeded its dividend to shareholders as well as employee pension, 401(k) and comprehensive health care costs. Sadly, of the millions spent on asbestos costs, only $20 million went to victims. The $40 million that went for legal fees alone could have been used to hire 500 workers; double the company’s annual investment in plant and equipment; and increase the investment and dividends for stockholders and retirees.

* A tort is a harm for which one may bring civil legal action.
While many U.S. trading partners are cutting their statutory corporate tax rates, the United States’ tax rate has barely budged. The 2006 U.S. corporate tax rate is higher than the OECD’s average 28.3 percent tax rate by more than 10 percentage points. These high tax rates are a drag on competitiveness for three reasons: they constrain after-tax cash flow, discourage establishment of foreign manufacturing facilities in the United States and encourage the migration of U.S. manufacturing facilities to lower-tax jurisdictions.

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The National Association of Manufacturers (NAM) serves as the voice of U.S. manufacturing and is committed to pro-manufacturing public policies. The Manufacturing Institute is the research and education arm of the NAM. Here are a few online resources to help you take action to ensure the future of U.S. manufacturing.

To learn more about the impact of manufacturing policy issues, the NAM has created a special online one-stop shop for manufacturing data at www.manufacts.org. Information on this site is set up to prepare manufacturers — as well as members of Congress and their staff — with the necessary advocacy tools to speak informatively on issues of importance to their industry, including:

- **State Manufacturing Data** to establish the contribution that manufacturing makes to the state’s economy — in dollars and in jobs.
- **To the Point** are talking points that highlight key arguments for manufacturing issues.
- **ManuFacts** are one-page “leave behinds” on issues such as Energy, Last-In, First Out (LIFO) inventory accounting method, R&D Tax Credit, Pension Reform, Trade, Franchising Reform and Environmental Compliance Costs. Each ManuFacts has a “How Congress Can Help” section as well as supportive visuals.
- **Manufacturing Profiles** — Available for each member of Congress, which list the number of manufacturing employees per congressional district, manufacturing voting records and other important information.

**Dream It. Do It.** campaign (www.dreamit-doit.org) — Seeks to help young adults find careers that reflect their passions in manufacturing. Developed by The Manufacturing Institute and the NAM, the campaign aims to make manufacturing a preferred career choice by 2010. In the Kansas City area pilot in 2005, was successful in increasing the number of applicants at the local technical college by 35 percent. Other communities are rolling out their own Dream It. Do It. campaigns as they increasingly see a skilled workforce as one of the most important economic development tools.

**Compete America** — The Alliance for a Competitive Workforce (www.competeamerica.org) — This coalition of more than 200 corporations, universities, research institutions and trade associations is committed to assuring that U.S. employers have the ability to hire and retain the world’s best talent. It supports programs to attract and retain more students in STEM fields, and supports funding for basic research that will ensure that our universities are turning out the next generation of innovators who will drive America’s economic growth.

For more resources, visit the NAM’s award-winning Web site at www.nam.org where you’ll find more tools and information on manufacturing and policy issues. The Institute’s research and programs can be accessed at www.nam.org/institute.
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