Manufacturing: The Force Behind the Economy

Throughout the 1990s, manufacturing's contribution to economic growth was strong and robust, on par with the financial sector. Through the invention and application of technology, manufacturers raised productivity higher than ever before and were largely responsible for the low-inflation prosperity of that decade.

The recession that began in manufacturing in the summer of 2000 has had a deep impact on the industry and the nation's overall growth. Manufacturing has lost more than 2.7 million jobs and has seen the slowest recovery since the Federal Reserve began keeping records in 1919. The recession in manufacturing was prompted by a number of factors, including high interest rates, a sudden spike in natural gas prices and a strong U.S. dollar that undercut U.S. exports.

Clearly the current sluggishness in the overall economy will change only when policies are in place to reinvigorate manufacturing. This section describes several fundamental facts about manufacturing's role in economic growth, including:

- its seminal role in promoting technology and innovation, which lead to a higher standard of living;
- its disproportionately large contribution to productivity, more than twice the rate of the overall economy;
- the business and jobs multiplier effects, which create more business activity and jobs in other sectors than any other industry, including construction, finance and wholesaling; and
- the high wages paid to manufacturing workers, nearly 20 percent higher than in other sectors.

When the right government policies are in place, 21st-century manufacturing will drive a prosperous economy.

The Changing Face Of Manufacturing

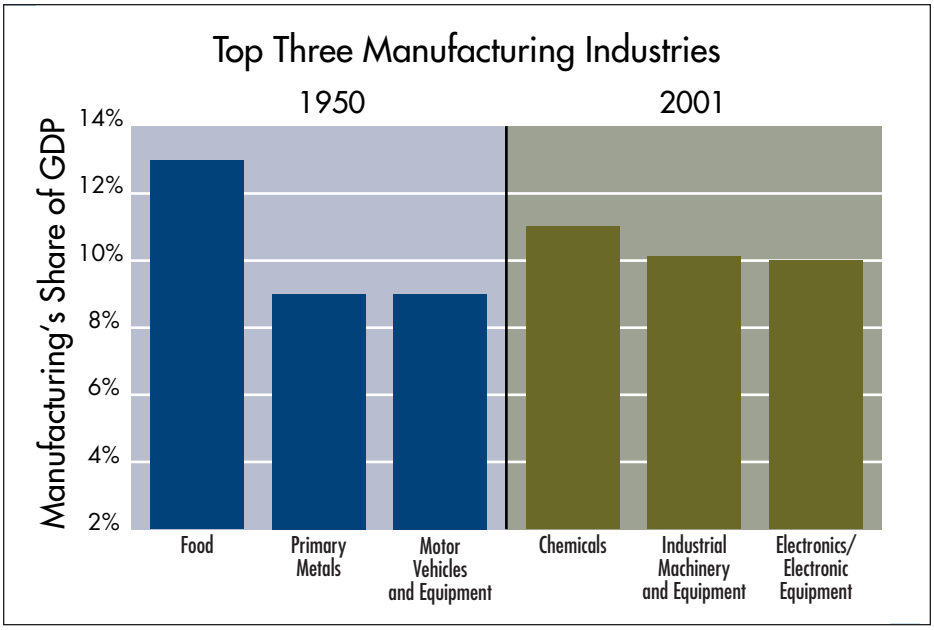
Albemarle Corporation

Founded in 1887, Albemarle Paper Manufacturing Company has grown from a simple producer of blotting paper to a leader in the specialty chemicals industry. This small, energetic company was already thriving when Ethyl Corporation, a venture of General Motors and Standard Oil of New Jersey, hit its stride selling lead antiknock compounds to improve fuels.

In 1962, seeing the end of the blotting paper business and looking for ways to diversify, Albemarle borrowed $200 million to purchase Ethyl Corporation, taking the Ethyl name in one of the first significant buyouts of a big company by a much smaller one (Ethyl had 13 times the earnings of Albemarle). Ethyl's management immediately began using the technology base in metallic compounds to continue making discoveries in many chemical arenas.

By 1994, the booming specialty chemical business was spun off to Ethyl shareholders as a new company. It was publicly traded on the New York Stock Exchange as Albemarle Corporation (ALB), harking back to its 1887 heritage. Through internal growth, new products, acquisitions and alliances, Albemarle now has production facilities in the United States, the Asia-Pacific region, Jordan and throughout Europe.

Today, the company continues to grow and reward its shareholders, providing products to industries, such as electronics, construction, pharmaceutical, transportation, paper, home care, agricultural, packaging and many others.



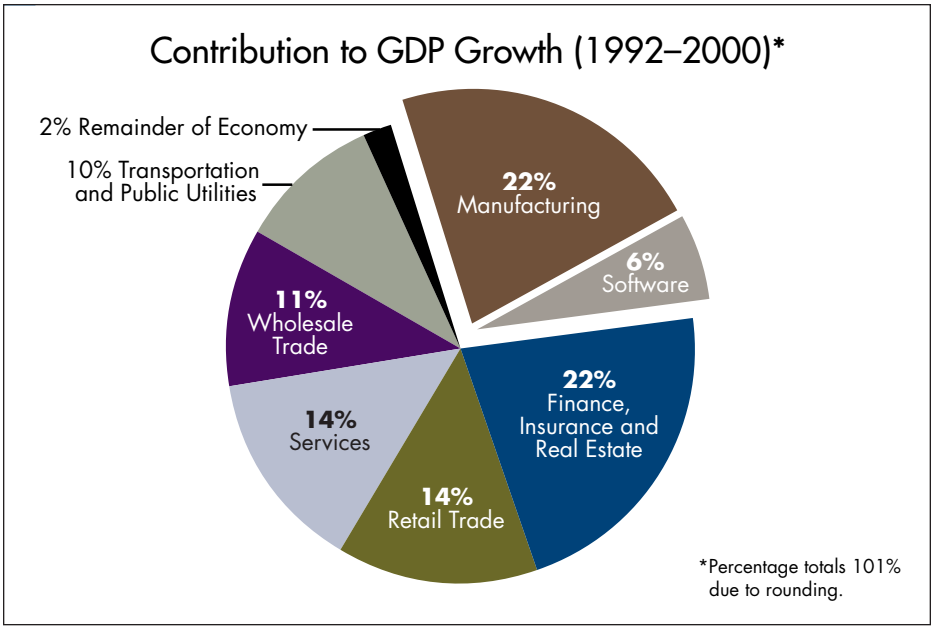
Source: U.S. Department of Commerce

While manufacturing has grown slightly faster than the overall economy over the past half century, the composition of American manufacturing changed because of technological breakthroughs, shifting demand patterns and international competition.

The three largest manufacturing industries today—chemicals; industrial machinery and equipment; and electronics—account for a third of manufacturing gross domestic product (GDP), while 50 years ago these sectors made up only 20 percent of the manufacturing sector.

By comparison, in 1950, the three largest manufacturing sectors were food, primary metals and motor vehicles. These industries continue to contribute significantly to manufacturing, with food and motor vehicles currently ranked the fourth- and fifth-largest manufacturing industries.

Manufacturing Is The Largest Contributor To Economic Growth



Source: NAM calculations from U.S. Commerce Department data

Manufacturing contributed 22 percent of economic growth (real GDP adjusted for inflation) between1992 and 2000. When software production is added, industry's contribution to real GDP growth increases to 28 percent—the largest of any sector. By comparison, services contributed 14 percent, and transportation and utilities contributed 10 percent.

While U.S. economic growth increased at an average annual rate of 3.6 percent between 1992 and 2000, manufacturing's share grew 4.5 percent per year. It has been generally underreported that manufacturing achieved rapid growth during the 1990s and was responsible for the country's longest economic expansion.

During the 2001 recession, manufacturing output contracted faster than the remainder of the economy, by dropping 7 percent while overall GDP edged up 0.3 percent. Rebuilding manufacturing after this recent severe recession will be an important part of revitalizing the whole economy.

American Axle & Manufacturing

Detroit-based American Axle & Manufacturing (AAM) is a world leader in the manufacture, design, engineering and validation of drive-line systems and related components and modules, chassis systems and forged products for trucks, SUVs and passenger cars.

Founded in 1994, AAM was formed through a purchase asset acquisition of the five axle and forging facilities previously owned by General Motors. The assets purchased at the time were nearly 100 years old, dreary and low tech. Productivity and quality were not up to par. Co-founder, Chairman and CEO Richard E. Dauch, the auto industry veteran who took the risk in purchasing these assets, said, "We first focused and invested in our people to build a world-class workforce. We invested in the right technology. We steadily increased our investment in R&D—minimally, 10 percent more dollars each year. These are the ways manufacturers grow their businesses and the economy at the same time."

As a result of the billions of dollars of investment in the plants and their associates, AAM now has 23 facilities on four continents and nearly 80 percent of its sales derive from new, high technology products introduced since 1998. AAM has created a flexible, well-paid and well-trained workforce of more than 12,000. Every year it has turned a profit and paid profit-sharing to its associates.

EDS

When manufacturing thrives, so do other sectors. EDS helps manufacturers compete effectively through its industry leading services and product life-cycle management (PLM) software. As one example, Palm, Inc.—the world leader in hand-held computing—cut engineering expenditures in half by developing the Palm™ i705 handheld using EDS software.

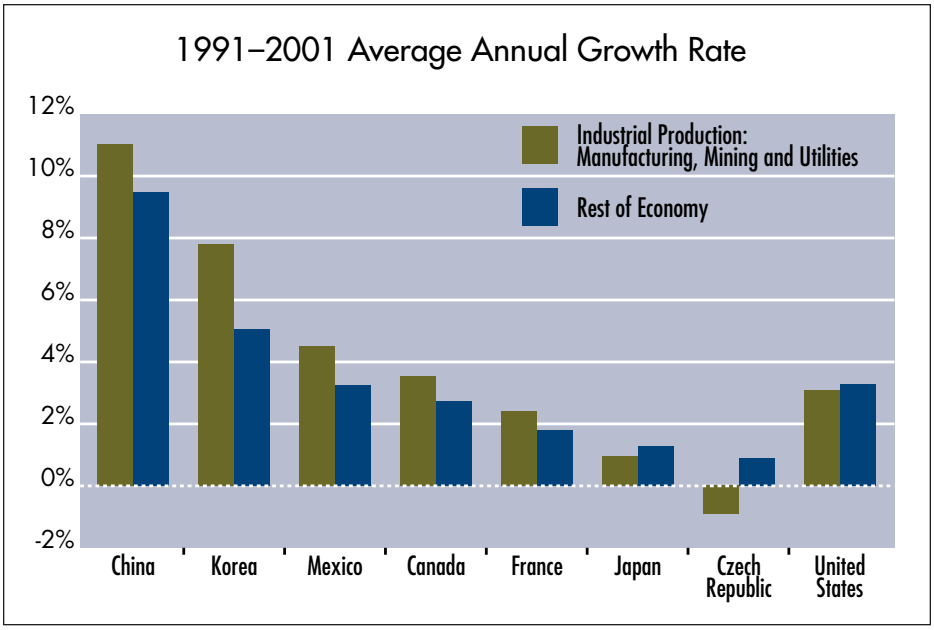
The Palm i705 is Palm's first model to deliver always-on push e-mail. It includes up to eight e-mail accounts; firewall-protected e-mail for corporate users; Web browsing via Google or URL entry; plus classic Palm hand-held features such as Date Book and Address Book—in a sleek, silver one-piece package.

Like all Palm hand-helds, the design of the i705 was unique, requiring substantial engineering. To create a great product while minimizing development costs, Palm took a new approach, adopting EDS's Unigraphics® NX product-development software to create and maintain all product data throughout engineering and manufacturing.

Palm engineering used the EDS software to create the product definition and then shared the digital geometry data files with their tooling vendor and manufacturer. They even used EDS's software to create photo-realistic images of the i705 for marketing.

The result: a 50-percent reduction in engineering costs compared with previous Palm projects.

In All Countries, More Manufacturing Means More Growth for Everyone



Source: OECD and Asian Development Bank

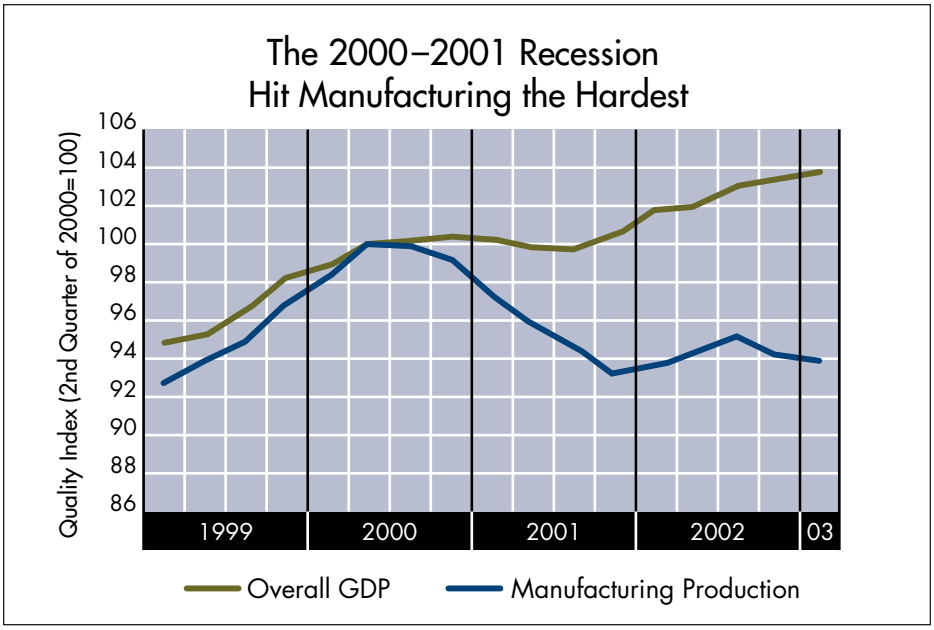
Manufacturing drives economic growth and higher living standards within countries. As the chart shows, faster growth in industrial production means faster growth in other sectors of every economy.* Where manufacturing is strong and growing, services, retail, construction and other industries will have strong growth paths as well.

A study of manufacturing's relationship with other sectors across a broader range of 41 nations shows economies that have no growth in manufacturing experience economic growth of less than 1.5 percent per year. This conclusion is based on an analysis of economies within the Organization for Economic Cooperation and Development and the Asian Development Bank by Joel Popkin, PhD., former senior staff economist at the President's Council of Economic Advisers. His report, "Securing America's Future: The Case for a Strong Manufacturing Base," was completed in 2003.

In his report, Popkin notes that "during the 1990s, the U. S. economy grew at an enviable 3.2 percent per year, on average, very similar to its average rate of growth over the past 50 years. A drop to a 1.5 percent GDP growth rate, less than half of what the United States has recently experienced, would have many adverse consequences on America's prosperity."

* Industrial production includes manufacturing, mining and utilities.

Recession Takes Its Toll On Manufacturing

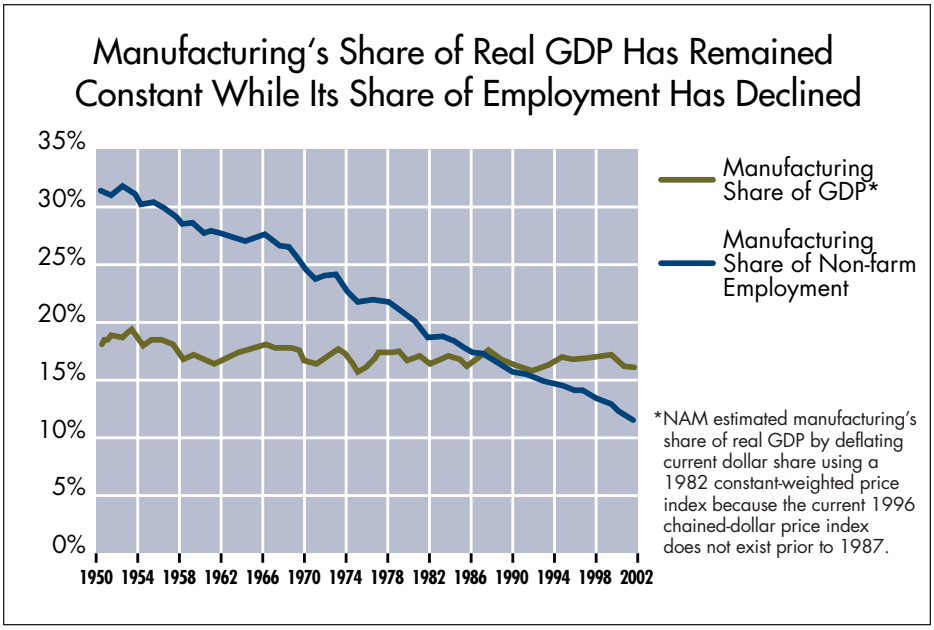


Source: U.S. Department of Commerce and Federal Reserve

The 2001 recession hit manufacturing much harder than it did the overall economy. While overall GDP edged up by 0.3 percent in 2001, manufacturing production fell sharply, by 7 percent.

The recovery that followed the recession was the shallowest in decades. Unlike the previous five recoveries, when manufacturing production bounced back and grew by 14 percent in the first year-and-a-half of an expansion, from the beginning of 2002 through June 2003, manufacturing output grew by less than 0.1 percent.

Manufacturing's Impact On GDP and Employment



Source: U.S. Department of Labor and NAM calculations from U.S. Commerce Department data

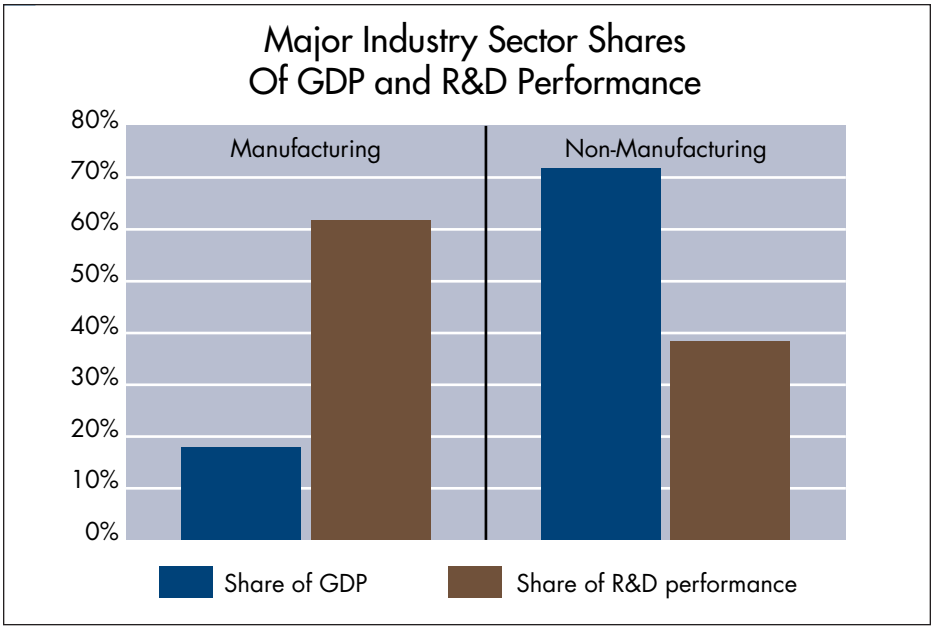
Notwithstanding the recent 2001 recession that hit industry particularly hard, manufacturing's share of the U.S. economy, measured by real gross domestic product (GDP), has been stable since the 1940s. During this time, the ratio of manufacturing output to GDP has ranged from 16 to 19 percent.

As of 2002, manufacturing's share of GDP was 16 percent. During expansions, manufacturing grows more rapidly than the rest of the economy; during recessions it contracts more rapidly. However, the overall share remains the same throughout the business cycle.

During this same 50-year time span of alternating recessions and prosperity—including the recent downturn when manufacturing employment fell to 14.8 million—the number of manufacturing employees has remained fairly constant, oscillating at around 16.5 million.

Manufacturing has sustained its share of a growing economy with the same number of workers mainly due to faster productivity growth. As the overall economy has grown, manufacturing's share of non-farm employment has decreased from 32 percent in 1947 to 11.5 percent in 2002.

Manufacturers Perform The Largest Share of R&D



Source: Commerce Department and National Science Foundation, 2000

Manufacturing plays a key role in inventing new products and processes that make the U.S. economy more productive.

Investment in research and development (R&D) is the single most important source of technological advance that leads to higher productivity and increases living standards for all Americans. While the manufacturing sector made up 17 percent of the economy in 2000, it accounts for fully 62 percent of the R&D performed in the United States.

The new technologies developed by manufacturers often spill over into other sectors of the economy. For example, the technology in automated teller machines originated with equipment used on factory floors, while antibiotics and vaccines developed by pharmaceutical manufacturers have been used by the health-care service sector—physicians and hospitals—to nearly eradicate diseases such as pneumonia, measles and polio.

As important as R&D is to the economy's health, the National Science Foundation reports that manufacturing's share of R&D has fallen steadily from more than 90 percent of all R&D in 1980 to 62 percent currently.

Dana Corporation

Dana Corporation designs, engineers and manufactures value-added products and systems for automotive, commercial and off-highway vehicle manufacturers. For nearly a century, it has created innovations in product and service technology and developed advanced products and customer-focused solutions.

For the past five years, Dana has emphasized innovation and technology, as combined invention records, patent applications and patents awarded contributed to an impressive five-year growth trend. This innovation is feeding the development of performance-enhancing traction technologies, electronic vehicle-control systems, intelligent cooling systems and many more new technologies. In all, Dana spends upward of $250 million annually on R&D.

Dana's role in the R&D of fuel-cell technology has grown through its establishment of fuel-cell support centers in Canada, Germany and the United States. Dana engineers are working to develop technology and high-volume production methods for numerous components and subsystems. The company's first steps toward becoming a supplier of systems to the fuel-cell industry will be in the residential and industrial markets. Fuel-cell-based home heating systems are expected to reach relatively widespread production within the next several years. Automotive applications should follow during the latter part of this decade.

Snap-on

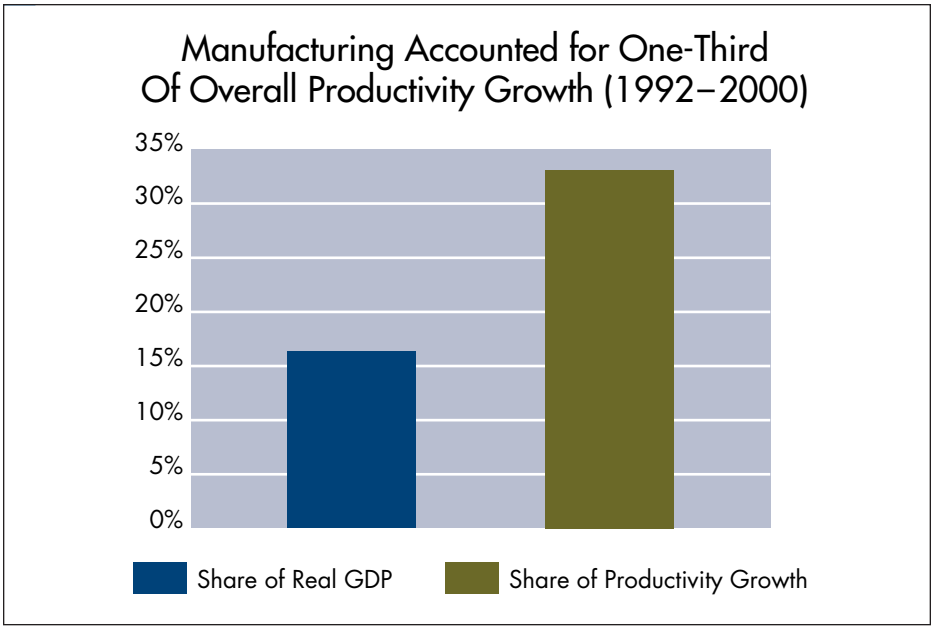
Snap-on Incorporated, based in Kenosha, Wis., is a leading global developer and manufacturer of tool and equipment solutions for professional tool users. For more than 80 years, Snap-on has focused on delivering the most value to the marketplace, and providing the best service and products to its customers.

To compete in today's global marketplace, Snap-on's continuous improvement (CI) mindset reigns throughout the organization. On the manufacturing floor, CI is applied in the form of "blitzes." The week-long focus of a blitz is on action. On the first day, employees join specific teams and are trained in the tools of the blitz process. Over the next three days, employees are empowered to use their expertise to generate ideas for improvement, implement the changes needed and measure results. On the fifth day, results are reported and follow-up suggestions are submitted.

Since 1998, Snap-on completed 312 blitz team projects, involving 1,430 participants at 18 sites. Activities to implement lean business practices coincide with corporate goals of improving operating income, reducing working investment and increasing sales.

Through the application of these lean principles and value-stream mapping, Snap-on has realized significant improvements that positively affect lead time, inventory and productivity.

Productivity Growth Is Disproportionately Large



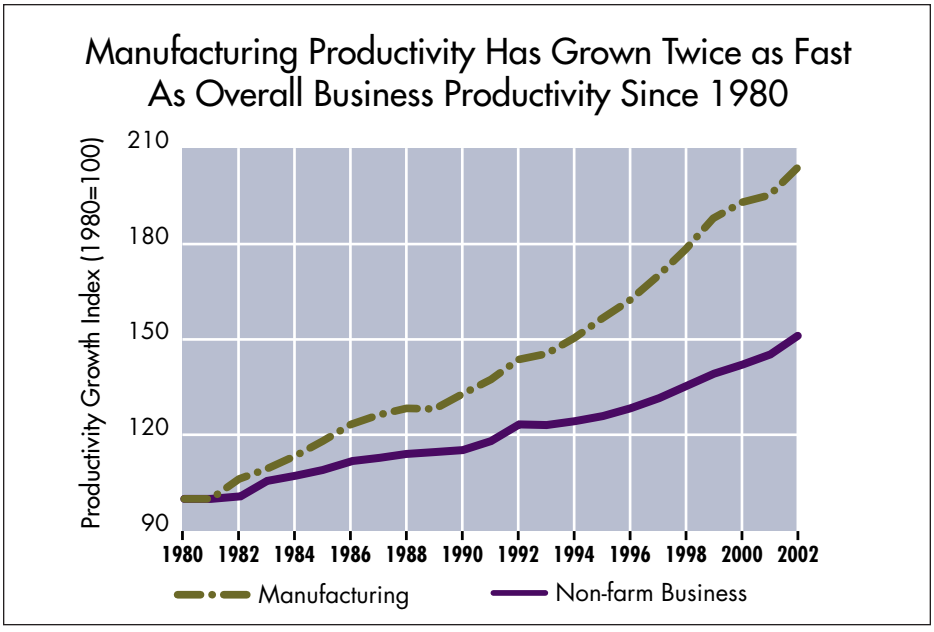
Source: U.S. Department of Commerce and NAM calculations from Commerce and Labor Department data

Long-term sustainable economic growth is determined by productivity growth and changes in the economy's labor force. Between 1992 and 2000, productivity growth averaged 2.1 percent per year while the labor force grew by 1.4 percent. Combined, this equals a sustainable growth rate of about 3.5 percent.

Although manufacturing constituted 17 percent of real GDP during these years, it was responsible for fully one-third of the economy's productivity growth. In other words, excluding manufacturing, other business productivity grew by just 1.5 percent during this time. Without advances in manufacturing productivity, the economy's growth potential would have been just 2.9 percent. During the 2001 recession, manufacturing productivity continued its unprecedented productivity growth, rising by 4.5 percent.

Between 2000 and 2010, the labor force is expected to grow at an annual rate of just 1.1 percent, which means any economic growth beyond this will have to come from productivity. This is why a thriving manufacturing sector is so critically important to the health of both the current and future overall economy.

Manufacturing Productivity Growth Significantly Outpaces Other Sectors



Source: U.S. Department of Labor

Productivity growth in manufacturing has been consistently stronger than productivity in the overall non-farm business sector for the past two decades. Manufacturing productivity growth averaged 2.6 percent in the 1980s and then accelerated to 3.7 percent growth per year during the 1990s. Overall, manufacturing productivity grew at double the pace of overall productivity growth during the entire period.

Fortunately, there has been a dramatic acceleration in non-farm productivity, which includes manufacturing. From 1996 to 2002, productivity has grown by 2.6 percent per year, remaining unusually strong during the recent recession. By comparison, non-farm business productivity stagnated from 1977 to 1995, growing by only 1.3 percent per year.

This increase in productivity has enabled the economy to grow faster without inflation and has been passed through to workers in the form of higher real wages.

The Timken Company

The Timken Company, a leading global manufacturer of highly engineered bearings and alloy steels based in Canton, Ohio, is implementing plans for growth and expansion despite the prolonged downturn in the manufacturing sector. A solid record of achieving productivity gains sits at the foundation of the company's confidence.

Timken consistently looks for opportunities to enhance its product and service lines and it learned over the years that driving productivity often leads to to success. In early 2003, the company bought Torrington, another major bearings maker, for $840 million—an acquisition that will boost revenues, facilities, workforce and R&D capabilities by nearly 50 percent.

The 104-year-old company undertook a similar capital investment strategy in 1985 when it opened a large state-of-the-art alloy steel plant, the first one built in this country since World War II. The new plant's $500 million price tag represented nearly two-thirds of the company's total equity at the time. For CEO Jim Griffith, these investments worked for Timken: "We apply state-of-the-art manufacturing and control processes to good human resources practices and drive, drive, drive productivity. Just after that [1985 alloy steel] plant opened, there were seven hours of labor in each shipped ingot. Today it is less than one. When you apply that sort of technology and productivity, you can manufacture anywhere."

Higher Productivity Leads To Higher Compensation

Nucor

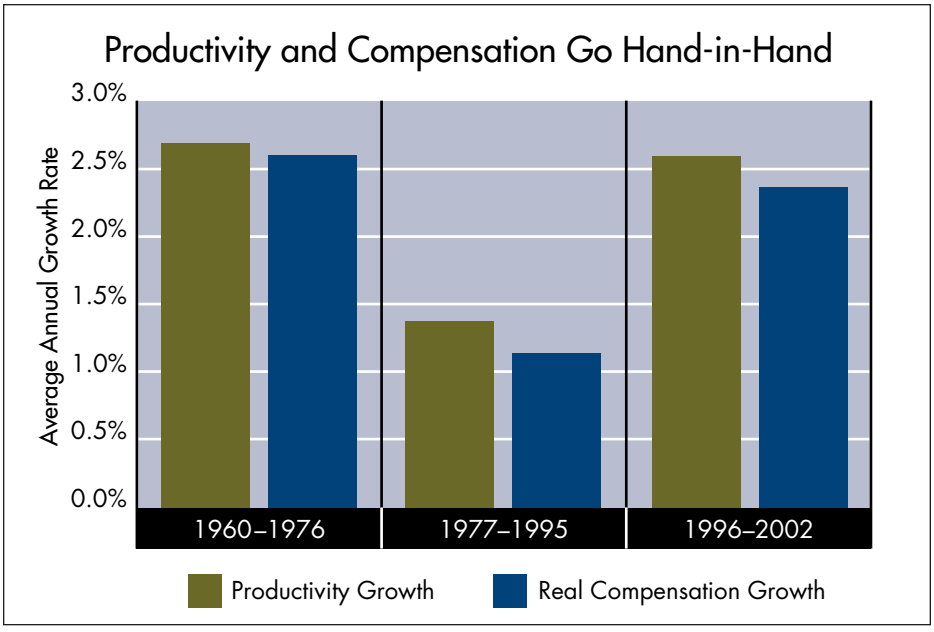
One company that has tied its compensation program to the productivity growth of its 9,800 employees is Nucor Corp. Headquartered in Charlotte, N.C., Nucor is renowned for its modern manufacturing techniques that produce globally competitive steel.

Nucor has been able to remain a growing, profitable steel and steel-products producer because of its performance-related compensation program, in which employees involved directly in manufacturing are paid weekly bonuses on the basis of the production of their work groups.

The bonuses average 90 percent to 170 percent of the base wage. Total average annual compensation for mill workers is $60,000. The plan creates incentives for each individual to perform well. Employees maintain equipment in top condition because no bonus is paid if the machines are not operating.

To foster an environment of equity, senior officers receive no profit-sharing or pension. A significant share of their compensation is based on Nucor's return on stockholder equity.

All employees are eligible for an extra bonus when the company does extremely well; these bonuses have been as high as $800 per employee.



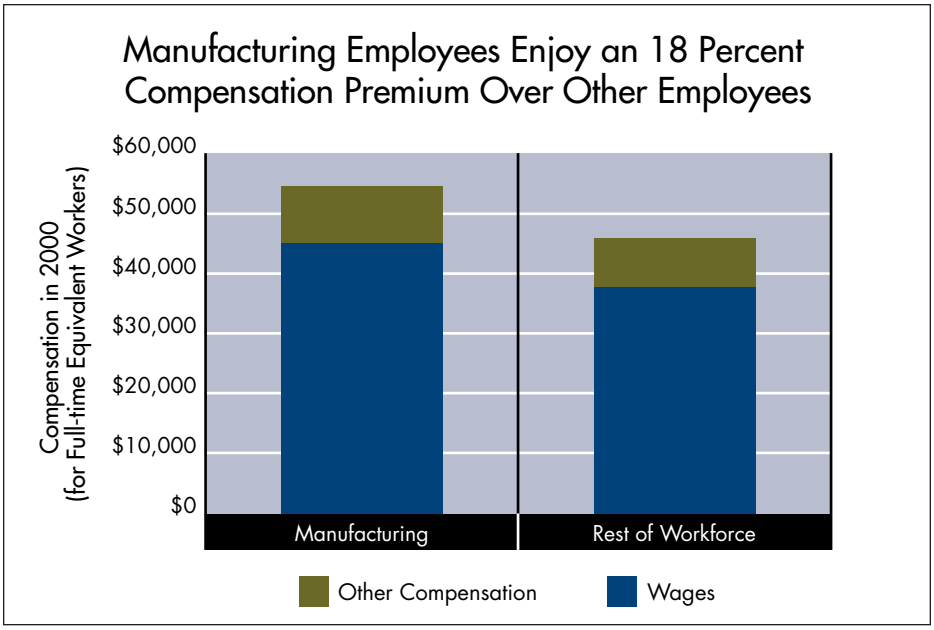
Source: NAM calculations from Commerce and Labor Department data

In a market economy, employee pay and productivity are closely related: When employees become more productive, they earn higher compensation.

American productivity experienced two periods of strong growth over the past 40 years: from 1960 to 1976 and from 1996 to the present. From 1960 to 1976, non-farm productivity growth averaged 2.7 percent and real hourly pay of workers increased by a nearly identical 2.6 percent per year. Since 1996, productivity growth has averaged 2.6 percent, and hourly pay has risen 2.4 percent annually, largely because of technological progress, process innovations and increased training.

These two periods of high productivity and real wage growth—and corresponding economic growth—were interrupted as worker productivity slowed from 1977 to 1995, averaging an anemic 1.3 percent. As a consequence, compensation rose on average of just 1.1 percent during that period. Clearly, the key to higher real incomes and higher standards of living for working Americans is faster productivity growth.

Manufacturing Employees Receive Better Compensation



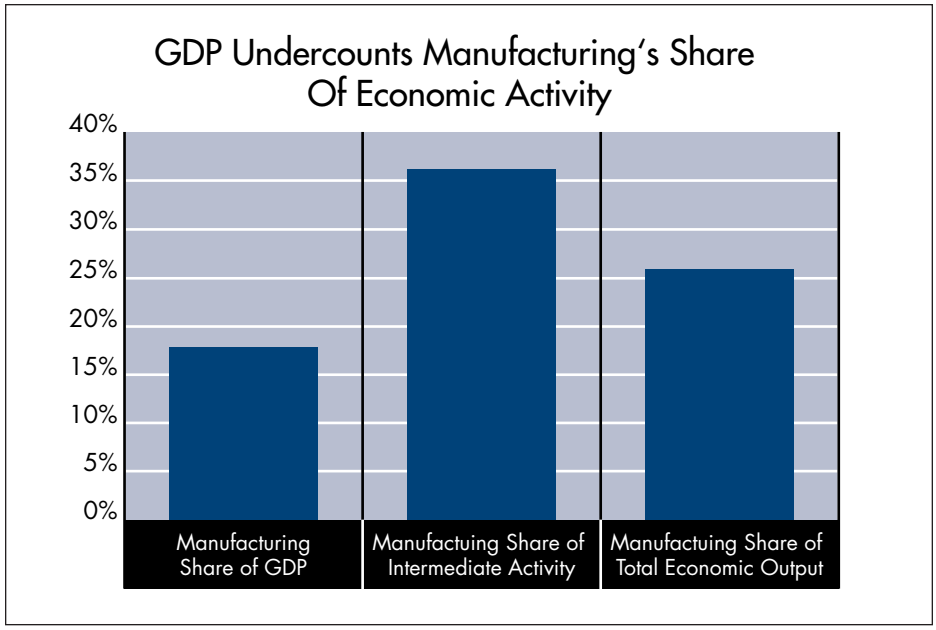
Source: U.S. Department of Commerce

Today's manufacturing employees are earning higher wages and more generous benefits than those received by many other Americans.

In 2001, average manufacturing employees earned $46,000 a year in wages, while their average total compensation (salary plus benefits, bonuses and Social Security contributions) was $54,000. Average U.S. employees in the remainder of the economy earned $39,000 a year, with total compensation of just $46,000.

While some other occupations have higher salaries, manufacturing provides millions of well-paying jobs, enhancing the well-being of families and communities. Overall, manufacturing offers higher pay than the construction, services and retail trade sectors.

Intermediate Production Contributes Significantly To Total Economic Output



Source: U.S. Department of Commerce, 1998

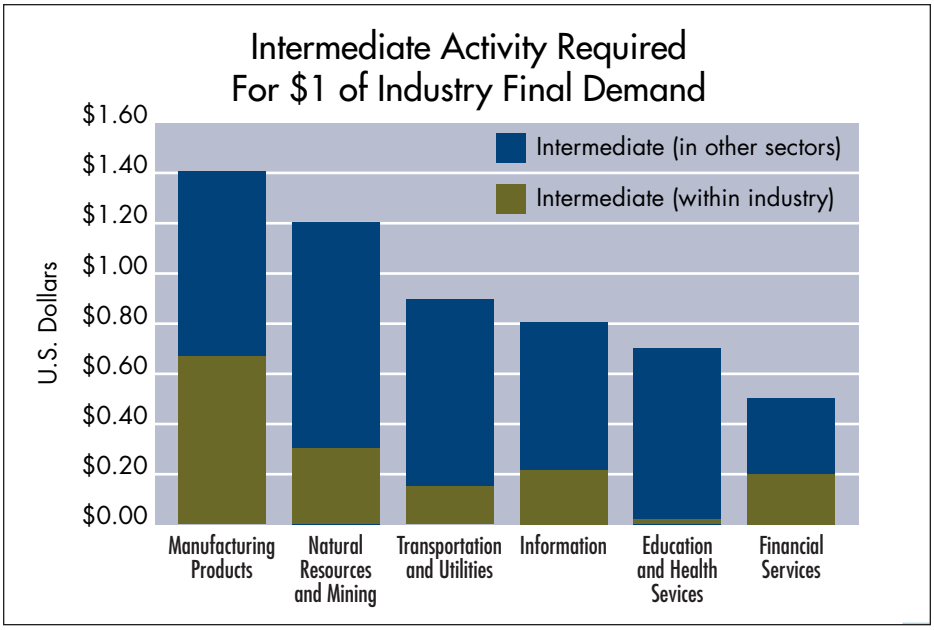
Gross domestic product (GDP) is based on final sales. However, 43 percent of the nation's economic activity is not counted in GDP. This intermediate activity is the production of goods and services that goes into making up the final sales. Examples of intermediate activity are raw materials, components and many types of services, ranging from business consulting to factory maintenance.

Sixty percent of the roughly $4 trillion in total manufacturing activity takes place at the intermediate level. Included are such industries as primary metals and semi-finished products, as well as goods that are used to make other products, such as car engines.

Manufacturing's share of total intermediate activity was 36 percent in 1998. Its share of GDP was 17.8 percent. When the two are combined, manufacturing's share of total output rose to more than 25 percent.

Because total manufacturing output is larger than final sales of manufactured goods, manufacturing's contribution to job and business growth in other sectors is also larger.

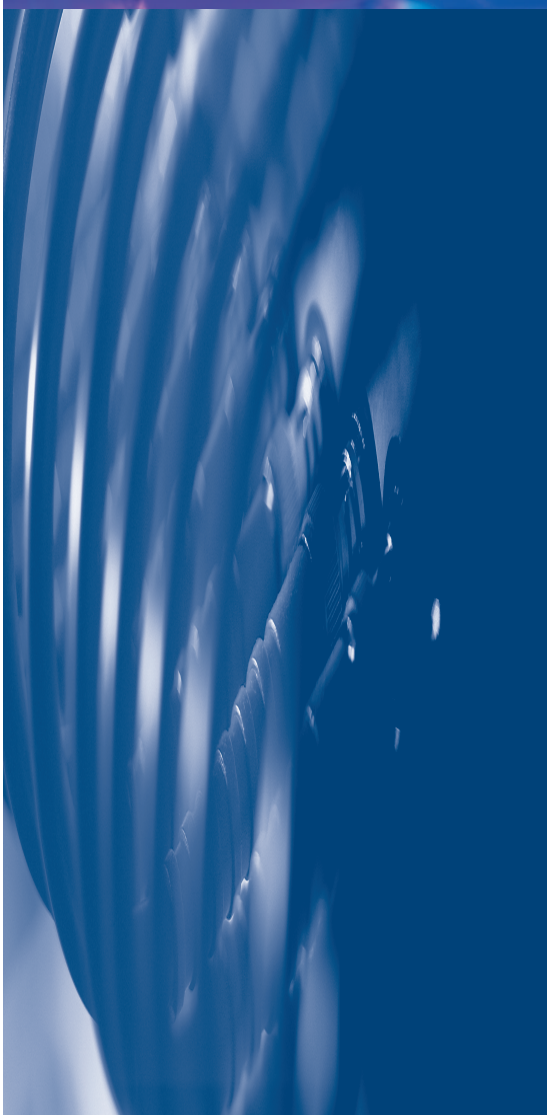
Manufacturing's Multiplier Effect Is Stronger Than Other Sectors



Source: U.S. Department of Commerce

Manufacturing's use of intermediate goods and services in its production process means that it generates substantial economic activity at the intermediate level. This is called the multiplier effect, and it turns out that manufacturing's multiplier effect is stronger than other sectors.

Specifically, every $1 of a manufacturing product sold to a final user generates an additional $1.43 of intermediate economic output, more than half in sectors outside manufacturing. Manufacturing's multiplier effect is greater than any other sector and far greater than that of the service sector, which generates only 71 cents of intermediate activity for $1 of final sales—half of the additional intermediate output generated by $1 of manufacturing final sales.



SBC

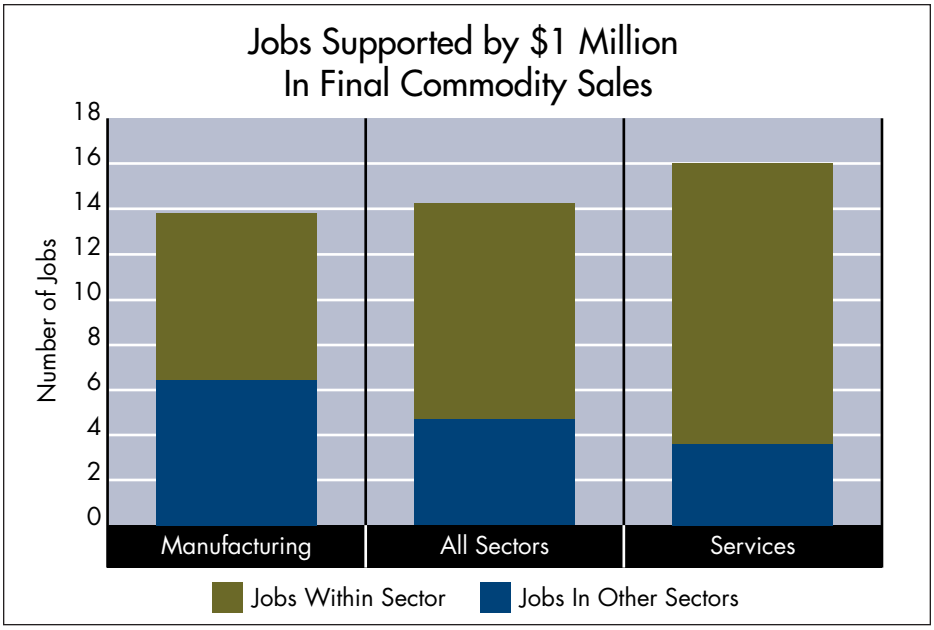
Today's manufacturers have complex needs, with customers scattered around the globe, suppliers based in different time zones and employees at work in dozens of states. Manufacturers need a high-tech communications network and data system to link their sites and customers.

SBC, one of the world's leading data, voice and Internet service providers, offers networking and e-business services to individuals and businesses. As America's leading provider of high-speed DSL Internet service, a large segment of SBC's customers are manufacturers—about 35 percent of all of SBC's land-line business is with corporate customers.

This is a highly interdependent relationship. SBC's capital investment directly benefits its suppliers and customers. At the same time, SBC's networks and systems are driven by the excellent products created by leading manufacturers such as Alcatel, Nortel, Lucent, Corning and Cisco.

Telecommunications depends on quality products: 7.6 million miles of fiber strands; nearly 10,000 SONET rings; 950 frame-relay nodes; more than 300 ATM-switching elements; thousands of routers and hundreds of remote access servers. SBC is a good customer for manufacturers. It is also a good provider of telecommunications services that meet the needs of manufacturers. SBC and its telecom supplier will invest and deploy new products when current, economically harmful regulations are removed.

Manufacturing Generates More Employment in Other Industry Sectors



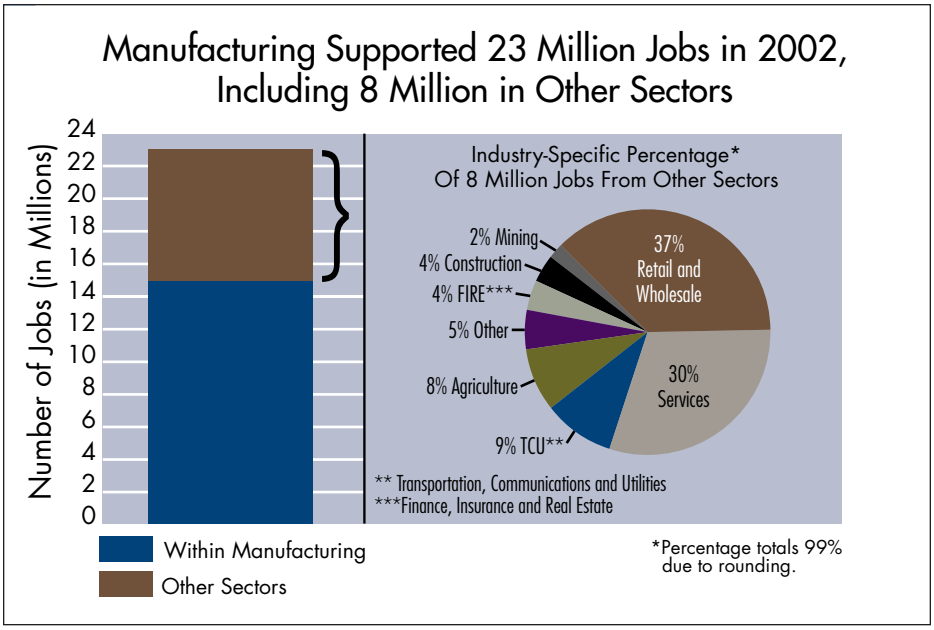
Source: NAM calculations from Commerce Department data

Through the multiplier effect, manufacturing stimulates employment in other sectors of the economy at a greater pace than other industries.

Specifically, every $1 million in final sales of manufactured products supports eight jobs in the manufacturing sector and an additional six jobs in other such sectors as services, construction and agriculture.

By comparison, because the service sector is more labor-intensive than the manufacturing sector, $1 million in final sales supports 13 jobs in the service sector. However, because the service sector has a smaller multiplier effect on the rest of the economy, $1 million in its final sales supports only 3.5 jobs in sectors outside its own.

Manufacturing Supports Millions of U.S. Jobs In Other Sectors



Source: NAM calculations from U.S. departments of Commerce and Labor

More than one out of every six jobs depends on America's manufacturing base. This is because the manufacturing sector supports millions of workers who make things in America, and nearly an equal number of workers in other sectors of the economy through the multiplier effect.

Specifically, manufacturing supported 23 million jobs in the United States in 2002: 15 million jobs within manufacturing and another 8 million jobs in sectors outside of manufacturing through the multiplier effect.

Chubb

As one of the largest writers of package policies in the United States, the Chubb Group of Insurance Companies (Chubb), provides insurance programs and services for manufacturers, including companies in the pharmaceutical, medical device, metalworking, food processing, plastics and electronics industries.

Manufacturing is an important component of New Jersey-based Chubb's business, and helps to fuel its growth. Chubb handles property and casualty insurance for more than 40 percent of leading technology-focused organizations, including electronics manufacturers and assemblers.

"Chubb has built up a large part of its commercial operations around the manufacturing sector," explains Paul J. Krump, managing director, Chubb & Son, and chief operating officer, Chubb Commercial Insurance. "By focusing on manufacturing, we've been able to gain valuable insight about the manufacturers' concerns and needs and how to address them. Typically, Chubb's insurance products include enhancements and specific coverage to help protect manufacturers from exposures and issues that conventional insurance simply doesn't address."

Chubb's insurance products and services help protect facilities and employees, including personal property protection for patterns, molds or dies used by metalworking manufacturers and human clinical trials insurance for pharmaceutical manufacturers.

Remington Products

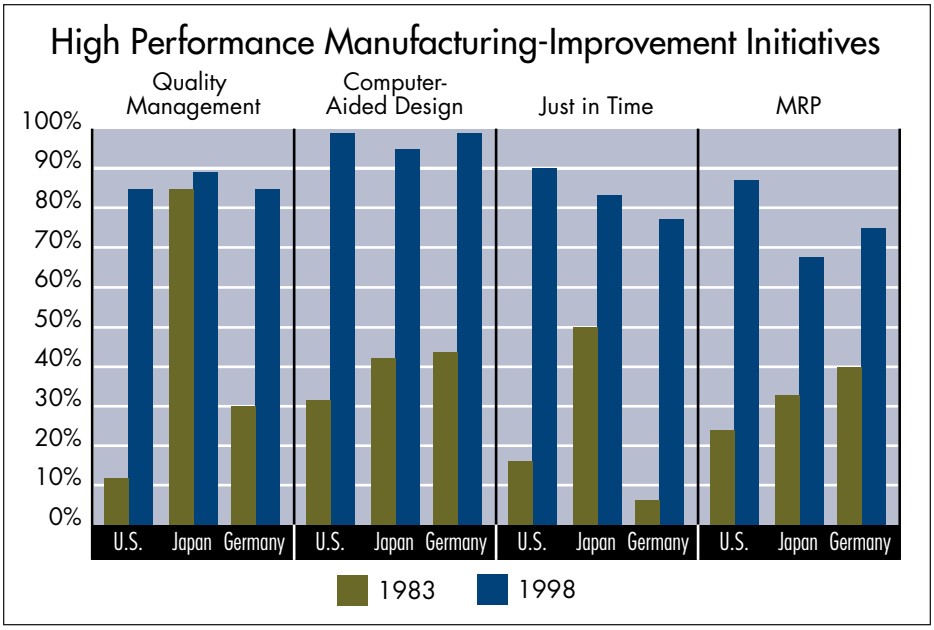
Manufacturers are always seeking new technologies to spur innovation and reduce costs. Increasingly, Web-based technologies are coming into play as one of the newest applications.

Remington Products Company, LLC, is a leading consumer products company focused on the development and marketing of personal-care products. Connecticut-based Remington designs and distributes electric shavers and accessories, grooming products, hair-care appliances and other small electrical products sold worldwide.

In a competitive market, new products provide the lifeblood of the company. To meet increasing demand for product innovation and ever decreasing product lifecycles, Remington established cross-functional, international new product teams.

To ensure smooth project collaboration with its 900 employees across geographies and organizational structures, Remington has implemented a Web-based project management system, Windchill® ProjectLink™ from PTC Corporation, which allows more effective decision-making and collaboration throughout product development. Team members worldwide can easily create and share critical project documents and monitor program status, reducing inefficiencies and decreasing time-to-market for new products.

U.S. Manufacturers Lead the Way In Technology Use



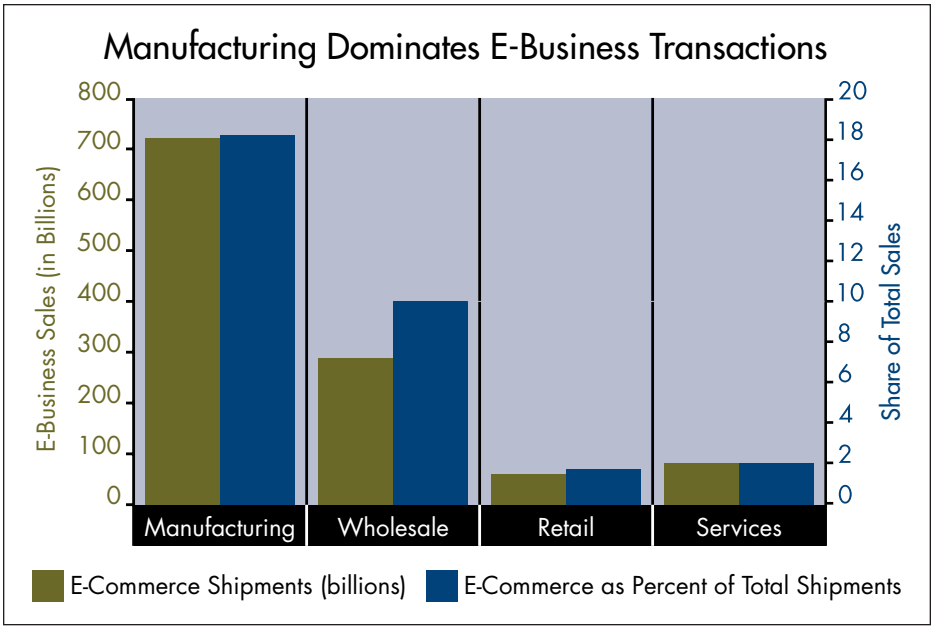
Source: Robert Filippini, Andrea Vinelli and Chris Voss, "Paths of Improvement in Plant Operations," High Performance Manufacturing, *Roger G. Schroeder and Barbara B. Flynn, editors, John Wiley and Sons, 2001*

The increased use of the Internet, lower transportation costs, falling tariffs and other trade barriers are combining to make local differences in manufacturing less important. In light of these and other macroeconomic changes, the role of technology in manufacturing is accelerating as it is increasingly applied to manufacturing operations anywhere in the world.

Over the past 25 years, technology has spread among countries regardless of its origin. Whereas Japan once held a near monopoly on the use of quality management, the United States, Germany and other major industrial countries learned how to apply quality principles and caught up with Japan. In business software, such as material requirements planning (MRP), the United States, Japan and Germany all started at about the same time, but the technology application is now used most extensively in U.S. manufacturing.

This decade will see more prolific use of technologies, including Web-based applications, online collaboration tools and wireless telematics that transform manufacturing with greater interaction between customers and suppliers, and between the front office and the factory floor.

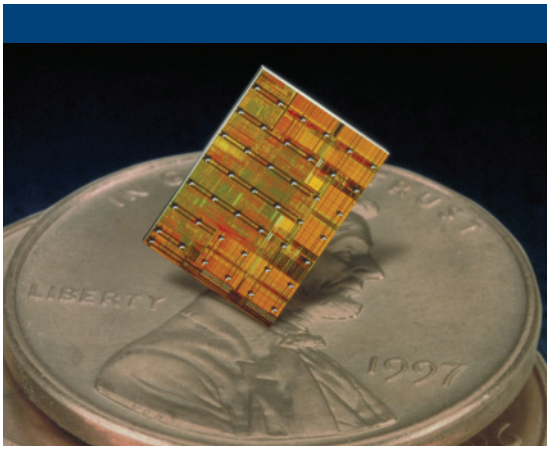
Manufacturers Have Adapted Quickly to E-Business



Source: U.S. Department of Commerce, 2001

E-business emerged as a new manufacturing tool in the late 1990s. While often associated with dot-coms and retail sales, the main beneficiary of the e-business revolution has been manufacturing. In 2001, nearly one-fifth—18 percent—of manufacturing shipments were e-business transactions. Other sectors have adapted less quickly: Only 10 percent of wholesale activity and just 1 percent of retail sales go through e-business.

In addition, manufacturers are also the largest users of e-business. In 2001, manufacturing e-commerce shipments totaled $725 billion and accounted for 68 percent of all e-business shipments in the U.S. economy. By contrast, e-retail sales of $34 billion made up just 3 percent of e-business activity that year. After surviving its first recession in 2001, e-business has demonstrated that it is embedded in manufacturing sales, procurement and human resource management and training.



IBM

IBM has learned that harnessing e-business is one of the best ways to make it easier for customers to do business with the company. IBM invested nearly $5 billion over the past 10 years to align technology with core business processes.

This leaner, more customer-focused IBM has seen a $14.5 billion return on its e-business investments. The company reconfigured work flows around a set of value chains to streamline and integrate processes for similar product lines—hardware, software and services—greatly simplifying how customers and suppliers do business with IBM. Backroom operations such as ordering and fulfillment are now handled with less personnel, and networks keep research operations going on a global 24/7 cycle rather than experiencing down time from 5 p.m. until the next business day.

IBM's business transformation has dramatically streamlined many other company operations. For instance:

- a decade ago, IBM operated 155 internal data centers worldwide; today, there are 12;
- a decade ago, IBM ran 31 separate internal networks; today, one global, integrated and outsourced network does it all; and
- Web-based sales have been enhanced to the point where 70 percent of PC sales now take place without human interaction.