



Facing Manufacturing Challenges

by Donald W. Havas, New York Nu '67

In spite of the much heralded claims of the decline of manufacturing in the United States and despite the recent economic turmoil, manufacturing is still a significant portion of the nation's Gross Domestic Product (GDP) and employs a significant portion of the work force.

Manufacturers are facing challenges on a number of fronts and are using a number of strategies to respond. Data shows that from a national perspective, a large majority are succeeding.

By definition, manufacturing is the use of tools and labor by an industrial operation to turn raw materials into a finished product for sale at a profit. In a free-market economy, manufacturing is usually directed toward products for sale to consumers and products used by other manufacturing and service industries. U.S. firms now compete in an international marketplace, and manufacturing output has continued to grow.

According to the Bureau of Labor Statistics, in the first quarter of 2006 there were more than 360,000 manufacturing companies operating in the U.S., accounting for 12% of the GDP. Although this percentage has declined from 27% in the mid 20th century, this decline is due more to the growth of the service sector rather than the decline of manufacturing. In 2006 in constant dollars, U.S. manufacturing output was the highest ever, even higher than before the 2001-02 recession.¹

MANY SMALLER COMPANIES

A significant portion of manufacturing companies are small. Ninety-two percent of them had fewer than 100 employees, and 99% had fewer than 500.² Manufacturing firms with fewer than 500 employees have consistently accounted for about 29% of manufacturing output.^{3,4} The small manufacturing company is a significant contributor to the U.S. economy.

Data of economic analysis for 2006 from the bureau puts the number of full-time equivalent employees working in the manufacturing sector at almost 14 million.⁵ Over the years, this number has declined while productivity has increased and has supported the increasing wages and benefits of the U.S. manufacturing worker. Bottom line: The manufacturing sector continues to be an important part of the economy, and, in spite of many challenges, the dollar value of its output continues to grow.

MORE INTERNATIONAL COMPETITION

The international character of the market is evident to the consumer in many products: Automobiles, consumer electronics, pleasure boats, clothing, and numerous other items now labeled "made in China" or Thailand or Mexico or elsewhere. Even the industrial consumer sees overseas firms making production equipment, steel, and semiconductors or providing contract manufacturing.

Manufacturers face many challenges in the international market: More competition, increased technical competence of these competitors, cost pressures, market expectations, and the availability of a skilled work force.

Many executives believe that they are successful in this market. In a 2007 survey of 321 North American manufacturing executives, 41% believed that they were more competitive than their leading global competitor, and only 13% viewed themselves as being less competitive. These leaders expected these percentages to improve to 57% and 11% respectively by 2012.⁶

While a majority of them expect the cost of production in North America to be less competitive by 2012, many still expect to expand production capabilities in the U.S.^{7,8} So as the dynamics of international competition continue to evolve, other forces beyond cost must be entered into the decision about where to place production capacity.

The bottom line as stated in a report by Deloitte for the U.S. manufacturer is "... long-term success is dependent on developing, selling, servicing, and producing new products for new and existing customers around the world."⁹

INCREASING OFFSHORE INNOVATION

European countries have long been recognized for their technical competence. Over decades we have learned to recognize the technical competence of first Japan, then Korea, and recently China. During 1994-2007, the granting of U.S. patents increased by 61%, and the percentage of U.S. patents granted to foreign inventors has increased from 43% to 49%. Also, the number of patents issued to inventors from Pacific Rim countries has almost doubled, increasing the percentage of U.S. patents granted to inventors there from 24% to 29%.

During the period from 1994 to 2007, patents issued to inventors from India have increased 20-fold, and those issued to the former republics of the Soviet Union (FSU)

*Bottom line:
The manufacturing sector continues to be an important part of the economy, and, in spite of many challenges, the dollar value of its output continues to grow.*



have doubled. Although India represents only 0.3% and the FSU only 0.2% of the U.S. patents granted in 2007,¹⁰ we are learning to recognize their technical competence and increasing levels of innovation.

COST PRESSURES

The cost pressures faced by U.S. manufacturing companies arise from governmental mandates as well as rising raw-material, energy, labor, and benefit costs. As one of the more mature industrial countries, the U.S. has recognized the need to protect the consumer, investor, worker, and environment. Our laws and regulations result in manufacturing costs for people, systems, and equipment to meet and demonstrate compliance. The costs associated with these mandates are seen by 65% of executives surveyed as a barrier to competitiveness.¹¹ Until other regions of the world mature and recognize the need for similar mandates, compliance imposes an extra burden on U.S. firms.

As the consumer was painfully aware, the cost of oil peaked dramatically in the third quarter of 2008. But oil is not used just for energy; it is a raw material in many of today's products. Dupont, Rohm & Haas, airlines, and other companies are passing these increased costs to their customers as increased prices or as surcharges. The costs of raw materials and energy have been cited as a barrier to competitiveness by 56% of the surveyed leaders, who further responded that they expected to expand procurement of raw materials and components from other countries. Importing materials may cost even more because of increased transportation charges should the cost of oil return to the 2008 levels. From another perspective, because a significant percentage of oil and other raw materials used by U.S. manufacturers are already imported, any decline in the strength of the U.S. dollar also poses real concern for the U.S. manufacturer.¹²

Labor costs include wages, health care, vacations, insurance, and pensions and were cited by 71% of executives as being a barrier to competitiveness. Health-care premiums during 1999-2006 increased at an average annual rate of 9.9 percent. In 2006 the average health-care cost per family to an employer was \$8,500, in addition to payments by the employee!¹³

Other barriers to productivity include labor-contract stipulations such as work rules and job classifications.

Although membership in labor unions has decreased over decades, many contractual stipulations remain to impede improvements in productivity.¹⁴

The emerging economies of the Pacific Rim and Eastern Europe do not have these contractual limitations or employee benefit costs. These differences, along with abundant labor forces, enable them to have significantly lower labor costs, although wages are increasing in Japan, South Korea, and now China. Until conditions in these countries evolve to minimize these differences, U.S. manufacturers must

overcome them to remain competitive.

TALENT CRUNCH

Because of the interaction of demographics and technology, the availability of a skilled U.S. labor force is falling behind the need. The experienced *baby-boomer* employees will be retiring in large numbers, creating an extraordinary demand for technically skilled employees. The *post-baby-boom* generations have smaller pools of workers. A 2002 *Time* magazine article claimed, "Though the average retirement age is creeping up...demographers say there still will not be enough qualified members of the next generation to pick up the slack. So with 76 million baby boomers heading toward retirement during the next two decades and only 46 million *Gen Xers* waiting in the wings, corporate America is facing a potentially mammoth talent crunch. Certainly, labor-saving technology and immigration may help fill the breach. Still, by 2010, there may be a shortage of four-to-six million workers."¹⁵

In many cases, replacements increasing lack technical skills needed for manufacturing jobs that are being driven by computer technology and advanced production equipment, processes, and products.¹⁶ Today's manufacturing jobs are technology jobs. Employees at all levels must have the wide range of skills to work in an increasingly complex environment.¹⁷

In a 2005 survey, 80% of the firms responding expect skilled production workers to be in short supply over ensuing years, and 35% expect a shortage of engineers and scientists.¹⁸ Meanwhile, the number of technically skilled people from other countries is increasing, as indicated by invention activity and technical-school graduation rates. As international companies seek to remain viable, the shortage of skilled workers in the U.S. and availability of them elsewhere will affect future strategic decisions of where to locate engineering, production, and operations.

CHANGING EXPECTATIONS

The marketplace has evolved to expect high product quality, rapid introduction of enhanced product functions, and quick delivery on orders. In a 2006 survey, 70% of U.S. manufacturing firms stated that high quality was *the* focus of their market strategy.¹⁹ The speed at which new products are being brought to market is accelerating and is most obvi-

ous in the electronics industry—with improved computers, cell phones, cameras, and other personal products being announced within months of the previous generation. This trend is true in all industries. Companies are challenged to employ concurrent engineering practices and computer-aided engineering technologies to shorten product development cycles.

Likewise, rapid delivery of orders, even for products with arrays of options, is expected by more customers. An obvious example of a company successfully operating in such a market is Dell Computers with its online ordering and rapid delivery of highly customized computer products. The 2006 survey also found that 32% of U.S. manufacturers include fast delivery as a pillar in their strategy.²⁰

Such trends will persist. A National Academy of Science study highlights the following forces that will be important to manufacturing enterprises during the next decade:²¹

- The competitive climate, enhanced by communication and knowledge sharing, will require *rapid responses to market forces*.
- Sophisticated customers, many in newly developed countries, will demand *products that are customized* to meet their needs.
- The basis of competition will be *creativity and innovation* in all aspects of the manufacturing enterprise.
- The development of *innovative process technologies* will change both the scope and scale of manufacturing.
- *Environmental protection* will be essential as the global ecosystem is strained by growing populations and the emergence of new modern-technology economies.
- Information and *knowledge on all aspects of manufacturing enterprises and the marketplace* will be *instantly available* in a form that can be effectively assimilated and used for decision making.
- The global distribution of *highly competitive production resources, including skilled work forces*, will be a critical factor in the organization of manufacturing enterprises.



COMPANIES RESPOND

U.S. manufacturers are responding to these cost and competitive challenges using a variety of means. A 2007 *Industry Week/Manufacturing Performance Institute* survey tabulated the strategic practices being used (Table 1) and a variety of methodologies being employed to achieve continuous improvement (Table 2):

Table 1: Strategic practices²²

Practice	Percent Respondents Using
Continuous improvement	77
Recycling/reuse program	56
Quality certification (e.g., ISO)	56
Customer satisfaction surveys	51
Value-stream mapping	46
Kaizen events/blitzes	46
Environmental management	44
Benchmarking	42
Supplier management program	36
Total Productive Maintenance (TPM)	34
Energy management	33

Table 2: Continuous improvement methodologies²³

Improvement Methodology	Percent Respondents Using
Lean manufacturing	40
Lean and Six Sigma	12
Total Quality Management (TQM)	10
Agile manufacturing	4
Toyota Production System (TPS)	3
Six Sigma	3
Theory of Constraints (TOC)	3
Other	5
None	19

There is overlap between these two tables. Continuous-improvement methodologies often include many of the strategic practices of Table 1. For example, a lean manufacturing program often includes value-stream mapping, quick changeover (SMED), Kaizen events, and total productive maintenance to achieve the sought improvements.

In regard to the looming shortage of skilled workers, U.S. companies are employing a number of strategies and practices to counteract this reality (Table 3):

Table 3: Employment Practices²⁴

Practice	Percent
Reduce turnover	54
Improve attitude to manufacturing jobs	46
Attract younger workers	39
Use temporary/contract work arrangements	32
Attract older, experienced workers	26
Hire women	15
Hire employees from other companies	15
Delay retirement	13
Hire foreign nationals	10

CONCLUSION

Manufacturing is still an important component of the U.S. economy in both employment and economic output. Although large firms command the attention of the media, smaller companies are a large part of this sector with 92% of them having fewer than 100 employees. As the number of employees has steadily declined, the value of their economic output has increased because of productivity gains. U.S. manufacturing companies face complex international cost and competitive pressures and are using a variety of strategies and new technologies to compensate.

Manufacturing is becoming more technically complex just as there is a dramatic work-force change from retirements of the *baby boomers*. This is a unique challenge, and firms are adapting a spectrum of employment strategies to meet their needs. Therefore, I expect that U.S. manufacturing will continue to be a significant contributor to the national economy for years to come.

REFERENCES

1. Ikenson, Daniel, "Thriving in a Global Economy—The Truth about U.S. Manufacturing and Trade," Cato Institute, Washington, DC, August 28, 2007, pp. 6-8.
2. Bureau of Labor Statistics, Employment and Wages, Annual Averages 2006, Table 4. Private industry by supersector and size of establishment: Establishments and employment, first quarter 2006, by state, April 3, 2008, www.bls.gov/ce/wbultn06.htm#Tables (7/17/08).
3. Kathryn Kobe, Economic Consulting Services, LLC, "The Small Business Share of GDP, 1998-2004," SBA Small Business Research Summary, April 2007, p. 1 and Table 2, p. 8.
4. Bureau of Economic Analysis, "Gross-Domestic-Product-by-Industry Accounts," April 29, 2008, www.bea.gov/industry/gpotables/gpo_action.cfm?anon=75265&table_id=22079&format_type=0 (7/31/08).
5. Bureau of Economic Analysis, "Full-Time Equivalent Employees by Industry," April 29, 2008, www.bea.gov/industry/gpotables/gpo_action.cfm?anon=74674&table_id=22127&format_type=0 (7/17/08).
6. Deloitte LLP, "Made in North America," © 2008, p. 3.
7. *Ibid.*, p. 4.
8. *Ibid.*, p. 7.
9. *Ibid.*, p. 8.
10. U.S. Patent and Trademark Office, "Patents By Country, State, and Year—All Patent Types (December 2007)," www.uspto.gov/go/taf/cst_all.htm.
11. Deloitte LLP, "Made in North America," © 2008, p. 11.
12. *Ibid.*
13. Kaiser Family Foundation, "Employer Health Benefits—2006 Survey," ISBN: 978-0-87258-829-5, ©2006, pp. 1-2.
14. Deloitte LLP, "Made in North America," © 2008, p. 11.
15. *Time* magazine, "The Coming Job Boom," May 6, 2002.
16. Deloitte LLP, "Made in North America," © 2008, p. 11.
17. The Manufacturing Institute of the National Association of Manufacturers, *Keeping America Competitive—How a Talent Shortage Threatens U.S. Manufacturing*, © 2003, p. 1, www.nam.org/s_nam/sec.asp?cid=201721&did=230273.
18. Deloitte Development LLC, *2005 Skills Gap Report—A Survey of the American Manufacturing Workforce*, © 2005, p. 7, (www.nam.org/s_nam/bin.asp?cid=202426&did=235731&doc=file.pdf).
19. *Industry Week/Manufacturing Performance Institute*, "Manufacturing 2007—Executive Summary," p. 8.
20. *Ibid.*
21. Committee on Visionary Manufacturing Challenges, Commission on Engineering and Technical Systems, National Research Council of the National Academy of Science, *Visionary Manufacturing Challenges for 2020*, ISBN-13: 978-0-309-06182-7, National Academies Press, ©1998, p. 2.
22. Blanchard, David, "Census of U.S. Manufacturers—Lean Green and Low Cost," *Industry Week*, 1 October 2007, © Penton Media, Inc., www.industryweek.com/readarticle.aspx?articleid=15009.
23. *Industry Week/Manufacturing Performance Institute*, "Manufacturing 2007—Executive Summary," p. 8.
24. Deloitte Development LLC., *2005 Skills Gap Report—A Survey of the American Manufacturing Workforce*, © 2005, pp. 11, (www.nam.org/s_nam/bin.asp?cid=202426&did=235731&doc=file.pdf).



Donald W. Havas, New York Nu '67, has worked since 2001 as president and principal consultant of his firm, Applied



Technology and Science, Inc. He previously worked as a manufacturing engineer for IBM Corporation during 1969-93 and Visteon Corporation (formerly Ford Motor Company) during 1993-2001. He earned his B.S. in engineering science at the State University of New York at Buffalo in 1967 and his M.S.E.E. in solid-state electronics in 1969 at Case Western Reserve University. Holder of one patent and author of several invention disclosures, he is active in the International Microelectronics and Packaging Society and the Service Core of Retired Executives.