

# The Future of Manufacturing

An Economist Intelligence Unit research programme sponsored by GE

## List of interviewees

**Mike Vander Wel**, manufacturing technology domain leader for Boeing

**Jay Knoll**, president of Energy Conversion Devices (ECD)

**Brad Gold**, general counsel and vice president of eco products for Adams Foam

## About the research

In August 2011, the Economist Intelligence Unit conducted a survey of 360 senior executives from manufacturing firms across a range of industries to assess attitudes towards the future of manufacturing in the US. All respondents are US-based, but 10% work for companies headquartered overseas. Forty-two percent of respondents are board members or C-level executives, including 96 CEOs. Over one-half of the survey respondents (51%) work for companies with global annual revenues exceeding \$500 million, including 33% with annual revenues over \$10 billion. Thirteen industry sectors are represented by the survey sample, including high-tech (22%), electronics (15%), pharma/biotech (13%), energy (9%), food and beverages (8%), and chemicals and plastics (7%).

## Introduction

As 2011 rolled in, manufacturing in the US appeared to be gathering momentum, propelled by continuing fiscal and monetary stimulus, as well as improving exports. Industrial production posted its biggest rise in five months in December 2010, putting it 11% above its recession low in June 2009, according to the Economist Intelligence Unit (EIU). But the specter of uncertainty has shaken the fragile foundations of recovery: in August the EIU revised down its US growth forecast for 2011 to 1.7%, from 2.4%, as data revealed a much sharper slowdown in the first half of the year than previously thought. Durable goods orders also fell in the second quarter of 2011.

With darkening clouds overhead, in August 2011 the EIU conducted a survey of 360 senior executives from manufacturing firms across a range of industries. The results reveal a mixed picture. While 41% of respondents see US-based manufacturing as modestly declining – and a further 14% say it is strongly declining – 23% see the industry as stable and 22% say it is improving.

Rising labour costs in emerging markets and the US's innovative heritage offer reason for guarded optimism in the future of the US as a manufacturing destination. "Investment in technology and innovation will create jobs and drive output for the future," says Mike Vander Wel, manufacturing technology domain leader for Boeing, the aerospace giant headquartered in Chicago. This commitment to innovation is likewise reflected in survey respondents' focus on ongoing investment in people, and new processes and new products that take advantage of advanced skills and technology.



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- **Ninety percent of executives say that high-tech sectors will drive the future of US-based manufacturing:** Green tech (selected by 43% of respondents), energy (42%), high-tech (42%) and pharma/biotech (37%) are seen as the industry sectors with the greatest opportunity for growth over the next three years. This is supported by respondents' view that the US's competitive advantage lies in its ability to offer high levels of security for intellectual property and being able to meet the needs of high-tech sectors, selected by one-third of respondents each.
- **Manufacturing executives see innovation in products and processes as more valuable to the long-term competitiveness of US manufacturing than cost-cutting:** While 62% of respondents see cost-cutting boosting US-based manufacturing in the near term, 90% identify innovation as the key to long-term success. The President's Council of Advisors on Science and Technology agrees, arguing in its June 2011 report that the country needs "a fertile environment for innovation" to remain a global leader.
- **When asked what the government can do, executives value investment in STEM education over corporate tax cuts.** Complementing the long-term innovation-focused outlook of the survey respondents, 38% of executives consider government investment in STEM (science, technology, engineering and mathematics) education as second only to tax incentives – selected by 51% of respondents – in supporting the US as a manufacturing destination. Corporate tax cuts come in third, selected by 34% of respondents. Access to highly skilled workers was also cited as the single most critical factor in determining a country's manufacturing competitiveness in the June 2010 Deloitte Global Manufacturing Competitiveness Index.
- **Only 18% of respondents think that the government is providing a supportive regulatory environment for the manufacturing industry:** Forty-six percent of respondents have a negative or very negative attitude towards the current regulatory environment's ability to support growth in US manufacturing, while 36% are ambivalent. But they believe the government can help them regain their competitive advantage through tax incentives, better education and a regulatory environment that doesn't penalize US manufacturers. "Without government support, manufacturing jobs will go elsewhere," says Jay Knoll, president of Energy Conversion Devices (ECD), a solar thin film manufacturer in Michigan. "We need advantages to scaling production in our own country."

## Uncertain times

The manufacturing industry has been a slow but steady force in rebuilding the US economy since the 2008 global financial collapse brought growth in the OECD to a near standstill. Manufacturing employment grew steadily throughout 2011, adding 35,000 jobs per month in the first four months of the year, 14,000 in the following four months, and another 36,000 in July, according to the Bureau of Labor Statistics. But this growth represents just a fraction of the 150,000 jobs that need to be created each month to stabilize unemployment across the economy, or to replace the 2.1 million manufacturing jobs lost in the recession.

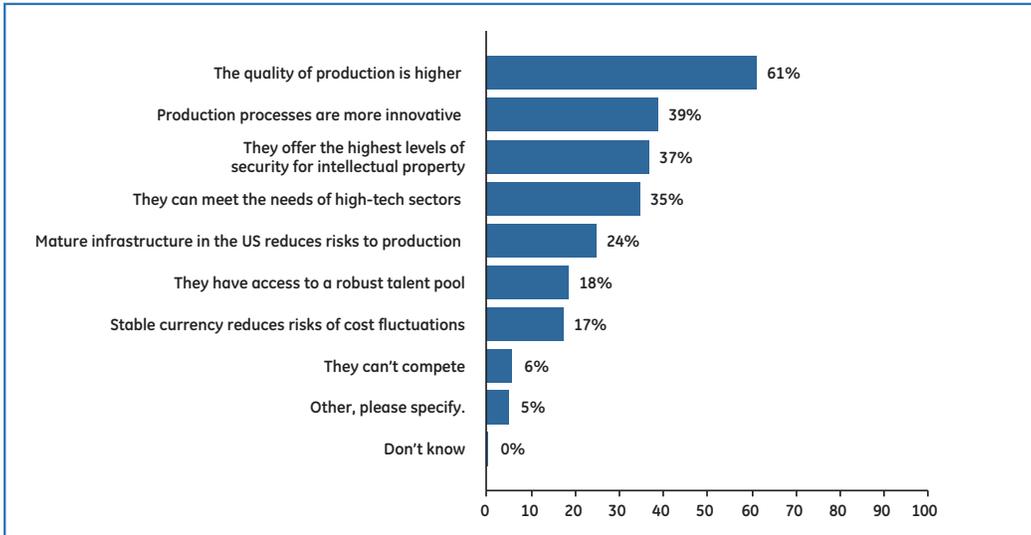
Since June, the outlook for the global economy has worsened, substantially raising the risk of a new contraction in global output. Business and consumer sentiment has slumped, negatively affecting retail spending, business investment and hiring, and manufacturing output. On the other side of the Atlantic, the euro-zone debt crisis has spread beyond peripheral markets, and tentative action by the bloc has raised the risk of a break-up of the single currency.

The experience of Chicago-based Adams Foam, a small family-owned manufacturer of foam cushioning products used in shipping and finished goods, illustrates the difficulties affecting producers nationwide. All of Adams Foam's clients are US-based manufacturers, and despite increasing its customer base in the last few years, the company's sales are down compared to 2006-07 because its customers are doing less business. "If they aren't selling products, we don't have a business," says Brad Gold, general counsel and vice president of eco products for Adams Foam, noting that even slight fluctuations in market confidence have a cascading effect on his operations. When the Purchasing Managers Index (PMI) fell in August, the company's purchase orders fell immediately, and it was forced to reduce factory workers' hours to less than 40 hours a week.

## A competitive edge

The challenges are significant, but the US's strong entrepreneurial tradition can help manufacturers overcome some of the many pressures they currently face and help the country retain its position as an innovative powerhouse. For example, one fifth of all patents registered globally in 2008 originated from the US, according to the latest data from the World Intellectual Property Organization (WIPO). According to survey respondents, the three greatest assets the US manufacturing industry has over emerging markets are the high quality of products (61%), innovative processes (39%) and the protection of intellectual property (37%).

*In what ways can US manufacturers compete against low-cost emerging market producers?*



Source: Economist Intelligence Unit survey, August 2011.

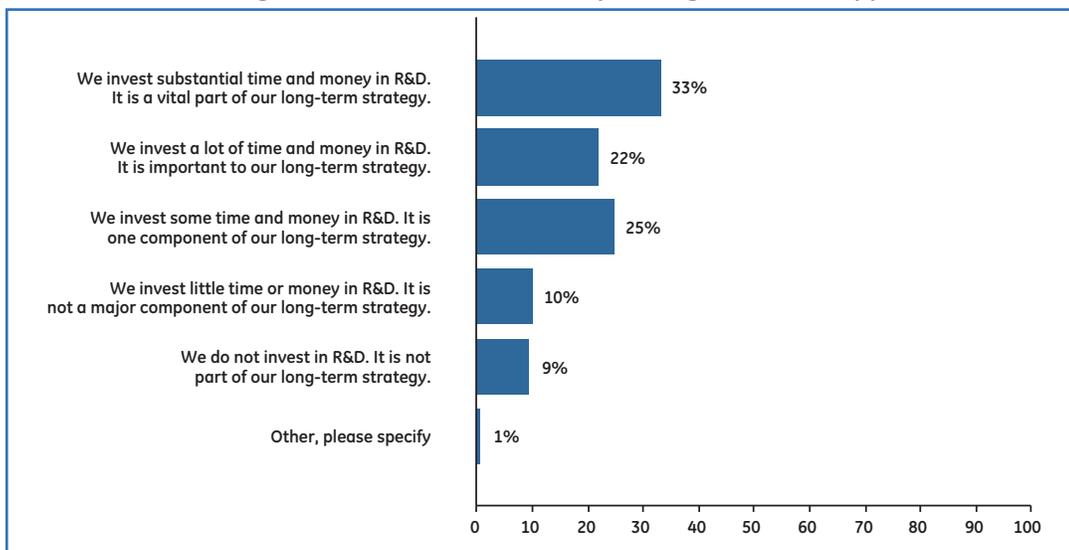
Boeing, which employs 164,000 people – mostly in the US – is the country's largest exporter by value, and the third-largest aerospace and defense contractor in the world. With such a large US presence, its success directly influences the ebb and flow of the entire manufacturing economy.

Boeing believes that its long history of producing innovative solutions will drive its global competitive advantage. Mr Vander Wel points to Boeing's new 787 Dreamliner airplane, which is innovative in everything from use of materials to its internal layout and was approved for production by the Federal Aviation Administration (FAA) in August 2011. "In a staid commodity-based industry, the 787 generated excitement and made people think about the US as a driver of high technology," he says.

Boeing's recognition that future success depends on a continued ability to innovate applies to manufacturing as a whole. In the survey, 90% of respondents across all sectors say innovation in manufacturing processes is either extremely important (63%) or important (27%) to the long-term success of the US as a manufacturing destination.

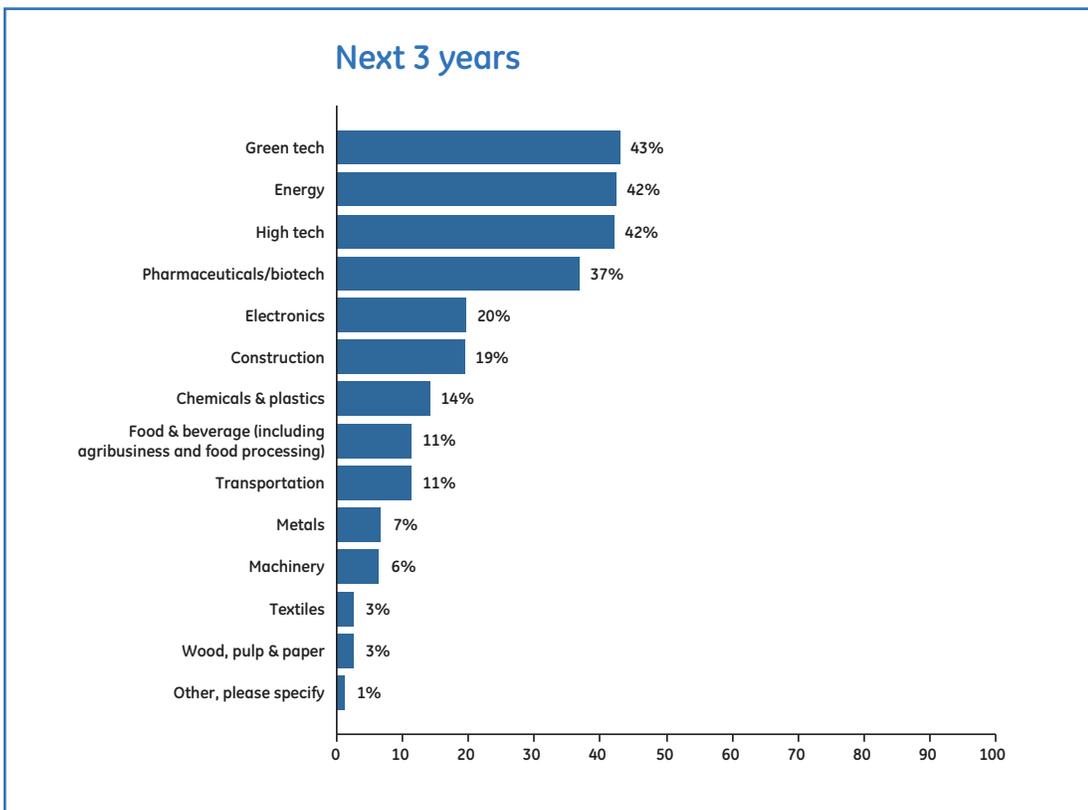
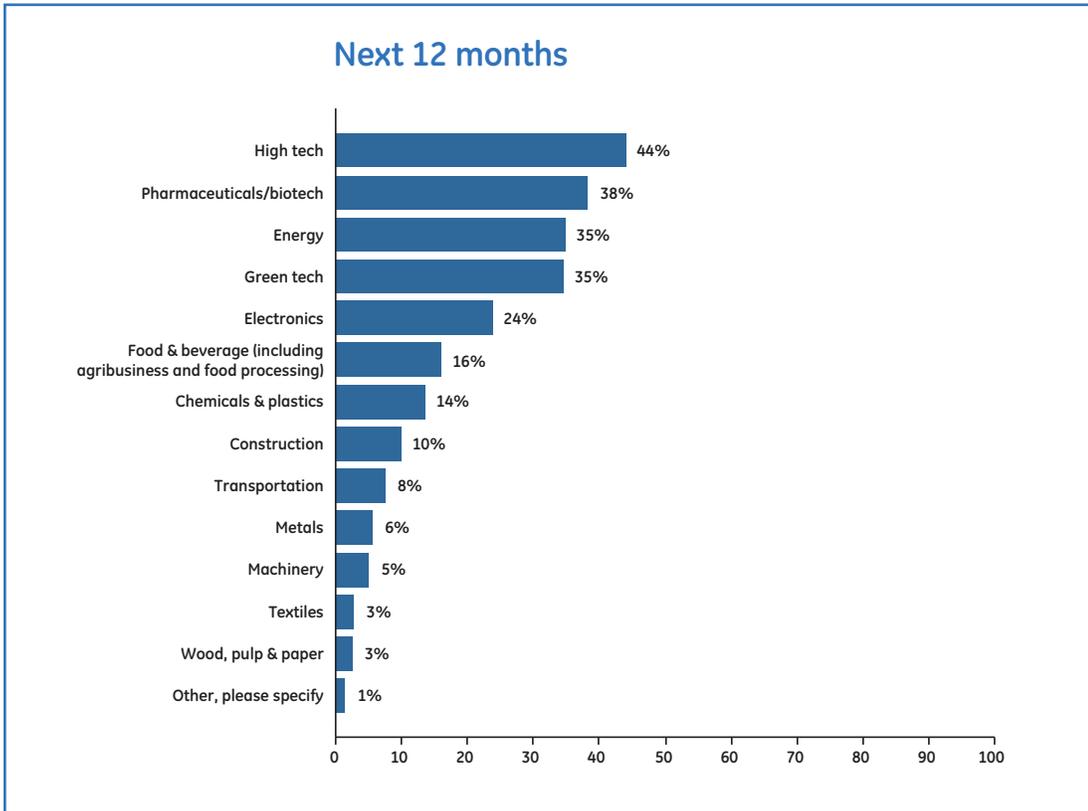
And they invest accordingly. Fifty-five percent of organizations surveyed either invest substantial time and money (33%) or 'a lot of' time and money (22%) in R&D efforts. That number jumps to 64% among manufacturers in high-tech, green tech, energy and pharma/biotech sectors. Indeed, most manufacturing professionals believe that advanced high-tech products will be critical to the fortunes of the US manufacturing industry in the future. Green tech, energy, high-tech and pharma/biotech are ranked by survey respondents as the industries with the best chance of thriving over the next three years; metals, machinery, textiles, and wood, pulp and paper rank the lowest for both the one- and three-year outlooks.

*Which of the following statements best describes your organization's approach to R&D?*



Source: Economist Intelligence Unit survey, August 2011.

Which industry sectors hold the greatest opportunity for growth in the US over the next year?



Source: Economist Intelligence Unit survey, August 2011.

Adams Foam is hoping that investments in 'Green Cell Foam' will help build loyalty among environmentally focused customers. Together with several other small companies, Adams Foam spent 6 years and \$2 million developing the product, which is slightly more expensive than traditional foams but uses no fossil fuels and is biodegradable. The company launched the new product in 2006, and sales have grown steadily.

But Mr Gold laments the fact that the US government has offered little assistance to help his company build that side of the business. Mr Gold has considered moving production to the UK, where his company has been offered tax breaks on office space, free accounting assistance and help growing its customer base. "I spent six years trying to find that kind of support in the US," he says.

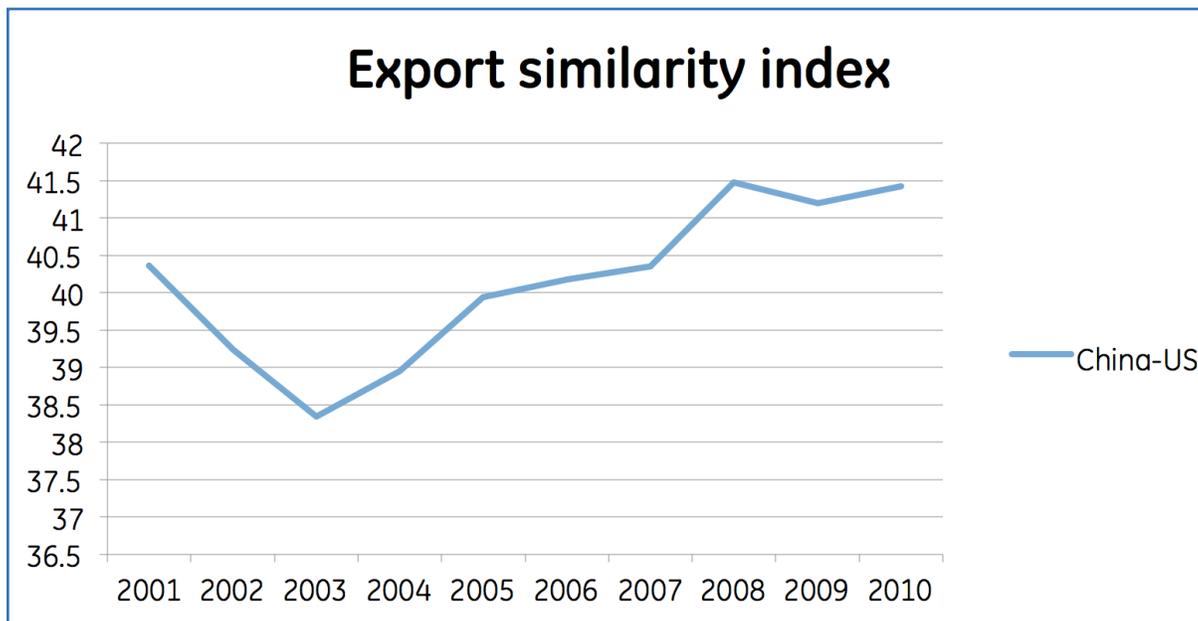
Boeing has been more fortunate in terms of government support. With lucrative defense contracts, the company has fostered a long relationship with the US government that has helped it grow to the size and global leadership position it enjoys today. But Mr Vander Wel is quick to point out that it is Boeing's quality people and processes that make the company thrive. "We are all operating under the same regulatory requirements, and the best way to meet those regulations is through quality and efficient design," he says.

### Competition rising

The US still dominates global manufacturing output, accounting for 19.5% of the total in 2009, according to the World Bank. But the country's dominance is being challenged: while in 2000 the US accounted for 26.6% of global manufacturing output, eclipsing even the EU by 1.2 percentage points, the US's share has steadily declined over the last decade. Simultaneously, China's share of manufacturing output has risen from 6.6% in 2000 to 18.6% in 2009.

Emerging market manufacturers are wielding increasing weight and influence in the global marketplace – and their might goes beyond their ability to simply undercut manufacturers in the developed world. Consider, India's Bharat Forge in forging, China's BYD in batteries and Brazil's Embraer in airplanes, all global brands in their own right. The rise of such companies goes hand in hand with an increase in the number of patents originating from BRIC countries, which has grown from 6% of the global total in 2000 to 18% in 2008, according to WIPO.

Yet, the degree of direct export competition between developed countries and their emerging market counterparts remains relatively low. While 84% of survey respondents consider China the US's biggest competitor, the Export Similarity Index (ESI) ranks the degree of overlap between China's exports and those of the US as 41.4 out of 100, based on data from 2010. A score of 100 suggests identical export structures, while a score of 0 means that the exporters do not participate in any of the same markets. The levels of correlation between the US and China are still low, but the trend is clearly upwards.



Sources: ITC; Economist Intelligence Unit calculations.

Emerging market manufacturers have demonstrated an ability to assimilate technology, adapt products and processes, and to do so quickly and cheaply. Several years ago the US led the world in the development and production of solar panels. But today, thanks to a concerted effort, and billions of dollars of investment by the Chinese government, China has taken over the industry, leaving many US producers scrambling to survive. In 2010, the Chinese Development Bank gave nearly \$30 billion in low-interest loans to its leading solar panel makers, with most of the money earmarked to expand manufacturing capacity and drive down costs. This, coupled with the elimination of European tariffs for solar power, has stoked market uncertainties and forced companies like ECD to rethink efforts to keep manufacturing in the US.

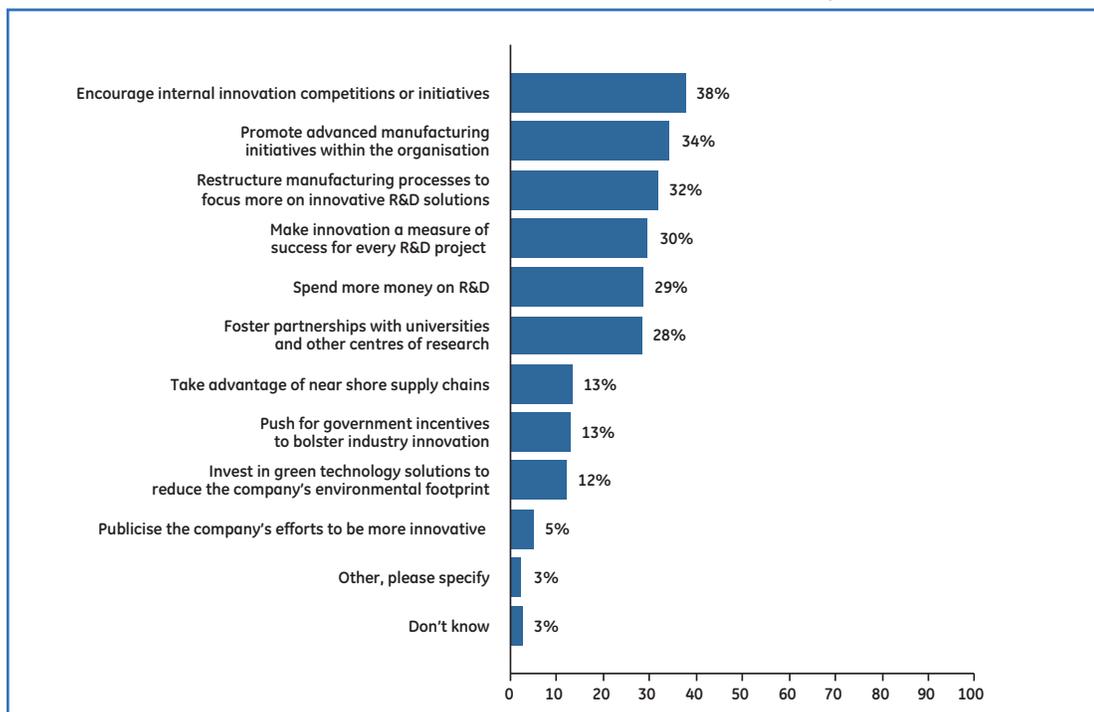
ECD was founded in Detroit in the 1960s, and today, with 1,300 employees and annual revenues of \$233 million, it is one of the largest producers of flexible thin-film solar cells in the world. But the company has seen its consolidated revenues slide dramatically this year, with a 69% drop from Q2 2011 and 70% from its Q3 2010 results.

When the solar business was booming in the mid-2000s, the company built three plants in Michigan to bolster production. “We had an ambitious growth plan, and to be effective we wanted to keep new production near our core operation in Detroit,” says ECD’s Mr Knoll. But in the face of fundamental shifts in the solar playing field over the last few years, ECD has been forced to lay off employees, restructure the business, and move many of the lower-skilled jobs to a facility in Tijuana, Mexico. “We still have expertise and capital equipment in Michigan, and we will continue to do high-skilled manufacturing and R&D here,” he says. “But we can’t be parochial and say we can do it all in Michigan.”

## Better STEM education

The overall sentiment of the respondents surveyed pointed to business-led initiatives as being key to the future competitiveness of the industry. Encouraging internal innovation competitions and initiatives was ranked first, selected by 38% of respondents, followed by promoting advanced manufacturing initiatives and restructuring manufacturing processes, selected by 34% and 32% of respondents respectively.

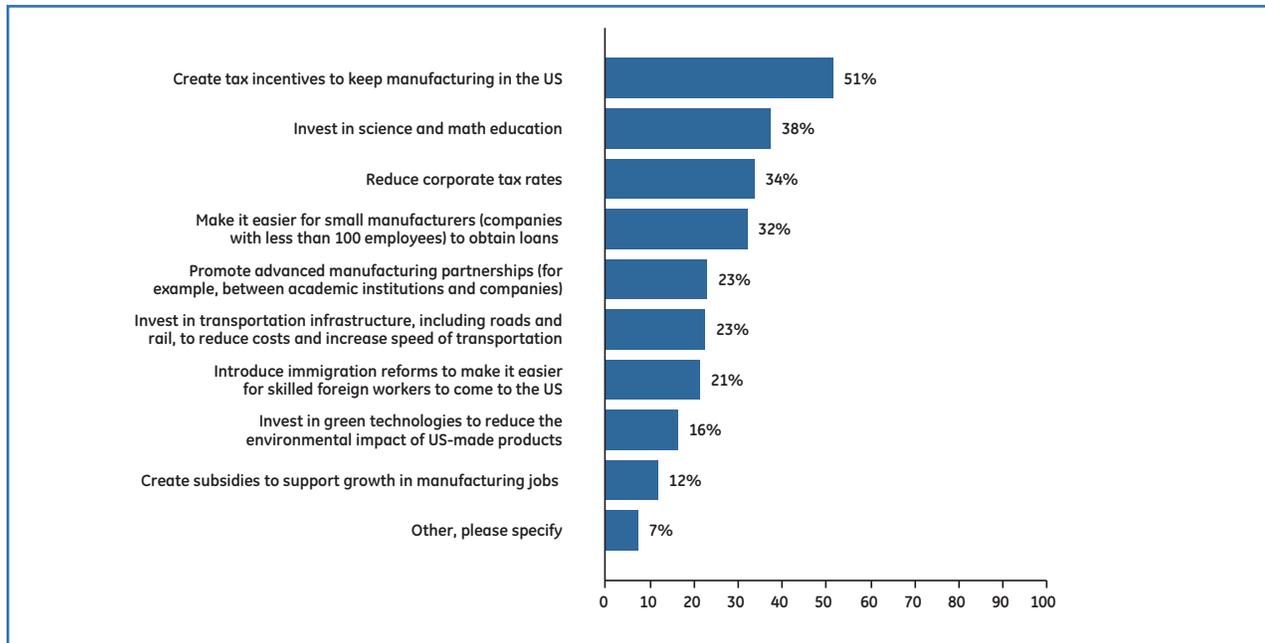
### How can US manufacturers increase the level of innovation in their operations?



Source: Economist Intelligence Unit survey, August 2011.

The government is left playing a supporting role: only 13% of executives surveyed see government as having a role in increasing the level of innovation in their operations. Yet the government’s ability to support the development of the next generation of skilled workers is valued by manufacturing executives and complements the overall forward-looking attitude reflected in the survey: 38% believe investment in STEM education will improve the status of manufacturing in the US. This comes ahead of reducing the corporate tax rate, cited by 34% of respondents. “Continued investment in education is necessary for the industry to maintain a competitive advantage,” says Mr Vander Wel. “Government support of national labs and universities can be parlayed across the manufacturing base to create long-term advantages for the country.”

## What are the most important things the US government can do to improve the status of the US as a manufacturing destination?



Source: Economist Intelligence Unit survey, August 2011.

Such investments in education are vital to an industry that will increasingly rely on skilled math- and science-educated workers to deliver new innovative products and solutions. Yet, the most recent assessment of global students in fourth and eighth grade shows US children coming in at a mediocre 11th and 9th place respectively, while students from Asian countries dominate the top five rankings.

The current US administration has pledged to improve science and math education by training 100,000 new elementary and secondary school science and math teachers over the next decade. It has also created a \$500 million matching fund to ensure technology is integrated throughout schools and effective assessments are performed.

In the meantime, companies are ramping up their own training and development programmes. Boeing's aging workforce, coupled with competition for talent from Lockheed Martin and Northrop Grumman, has motivated the company to invest heavily in recruiting and training workers. "Access to highly qualified college grads today is very competitive," says Mr Vander Wel. Along with aggressive recruiting at colleges, Boeing is actively pushing younger workers into leadership positions to ramp up their skill set and ensure their loyalty to the company. Similarly, ECD works with local colleges and universities to recruit new workers and to develop the skills of its existing team.

## Conclusion

Although China does present a growing challenge to the US's global manufacturing dominance, the US still outstrips the Asian giant in terms of the number of patents awarded. It is the US's strong culture of entrepreneurship and supportive environment for innovation that have allowed this – and these are the same conditions that can enable the US to revitalize its manufacturing strength.

There is no room for complacency, however. China's phenomenal pace of catch up in the past decade suggests the gap could narrow significantly. The journey forward will be challenging, and will require US-based manufacturers to address head-on the rising competition from increasingly sophisticated producers in the emerging world. Faced with these challenges and ongoing turmoil in global markets, US manufacturers are understandably divided about the future. One-third of respondents believe the industry will be stronger in 10 years, while one-third believe it will be the same and one-third think it will be weaker, indicating that no-one is sure what the future holds.

Manufacturers are not looking to government to solve all their problems: most point to business-led initiatives as being key to the future competitiveness of the industry. Although government is being asked to do more to improve the standards of STEM education, the EIU survey suggests that industry-led initiatives are likely to promote greater innovation and companies are likely to invest more in training and employee development. A focus on the long term is essential. Here survey respondents and executives interviewed for this report are almost unanimous.