

Foreign Robots Invade American Factory Floors



The U.S. is being beaten by European and Japanese firms in the race to supply cutting-edge production machinery behind the new automated manufacturing sector

By Daniel Michaels

Vickers Engineering Inc. embodies the potential of American manufacturing. The New Troy, Mich., machining company supplies precision parts to clients including Toyota Motor Corp. and Volkswagen AG, and exports to Mexico and Canada. Its staff has risen fivefold and average pay has doubled over the past decade, says Chief Executive Matt Tyler.

What's helping to power Vickers's made-in-America success? Advanced Japanese and German factory equipment. When Vickers first bought industrial robots in 2006, it chose between only European and Japanese models, says Mr. Tyler, and has been adding Japanese robots ever since. "We were not aware of any American-made option."

America is losing the battle to supply the kind of cutting-edge production machinery that is powering the new automated factory floor, from digital machine tools to complex packaging systems and robotic arms.

Commerce Department data show the U.S. last year ran a trade deficit of \$4.1 billion in advanced "flexible manufacturing" goods with Japan, the European Union and Switzerland, which lead the industry. That is double the 2003 deficit. It was down from \$7 billion in 2001, but much of the decline came from foreign equipment suppliers expanding in the U.S., not from an American comeback.

U.S. firms are also losing market share at home, according to Germany's VDMA industrial-machinery trade group. In 1995, they satisfied 81% of domestic demand for factory equipment. In 2015, the most-recent data, that had slipped to 63%.

The trade gap presents a conundrum for President Donald Trump, who wants the U.S. to manufacture more and import less. He has criticized makers of cars, air conditioners and farm equipment for moving production abroad. Companies have responded by touting investments in U.S. factories. Yet a resurgent U.S. manufacturing sector would fuel more equipment purchases from foreign firms, because companies have little other choice.

If Vickers could find what it needed domestically, "we would absolutely go with the American option," says Mr. Tyler, "all things being equal."

Manufacturers fret over the lack of U.S. automation suppliers because the digitized, miniaturized and customized products of tomorrow are increasingly intertwined with innovations in the machines used to make them.

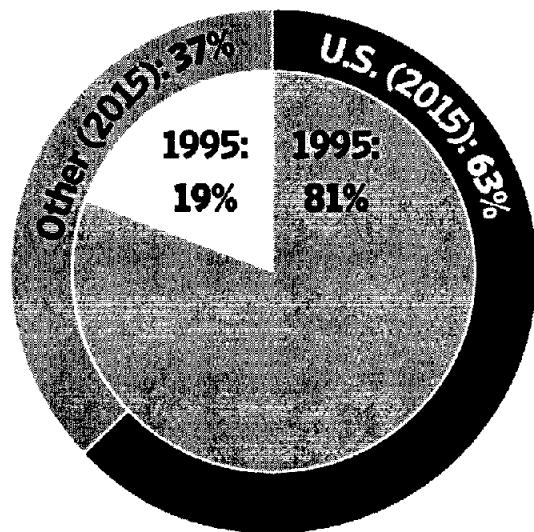
A report to President Barack Obama on advanced manufacturing, prepared by his council of science advisers in 2012, concluded that the "hard truth" was that the U.S. lagged other rich nations on manufacturing innovation.

The Defense Department, which wants sophisticated factories to help field a modern arsenal, last year proposed steps to “help Rosie the Riveter become the Digital Native she is destined to become.”

Factory Imports

The U.S. produces a declining proportion of its industrial production equipment.

U.S. Industrial machinery market share



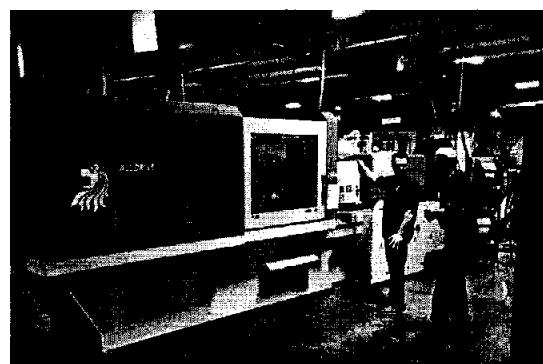
Source: VDMA

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The network uses American elements such as motors and sensors and U.S. systems for product-

design and process-management, she says, “but Fanuc is the heart of our system.”

Ms. Rogers and her husband frequently attend manufacturing trade fairs to “stay ahead of the pack” by seeing which suppliers are most innovative. “You see the same names and companies every year” and they are consistently Japanese or European, she says. “I want to buy from the people who are always trying to make their systems better.”



A German injection molding machine at Noble Plastics in Grand Coteau, La. PHOTO: NOBLE PLASTICS

China, meanwhile, is seeking to move beyond its reliance on cheap labor to compete globally. Its ‘Made in China 2025’ strategy aims to dominate advanced manufacturing, in part through aggressive foreign acquisitions such as appliance-maker Midea Group’s purchase last year of Germany’s Kuka AG, a world leader in industrial robotics.

The current White House declined to comment on whether Mr. Trump considers the factory-technology gap a problem.

Noble Plastics Inc. in Grand Coteau, La., a family-owned producer of molded-plastic parts ranging from oil-rig components to glue-bottle tips, started in 2000 with one used molding machine made in Ohio by a U.S. company, Newbury Industries. Typical of the industry, Newbury was bought in 1996 by a German company, which a Japanese rival acquired in 2008.

Today, inside what President Missy Rogers describes as “a very unimposing building in a very small town,” Noble operates a digital network linking automated injection-molding machines from Germany’s Arburg GmbH and robotic arms from Japan’s Fanuc Corp., the world’s largest industrial-robot producer.

The U.S. dominated advanced manufacturing through the 1970s, when the cutting edge was largely machine tools. Detroit was at the forefront. The world’s first industrial robot, the two-ton Unimate built in Connecticut, was installed in 1961 at a General Motors Co. plant in Trenton, N.J., according to the International Federation of Robotics, a trade group. GM

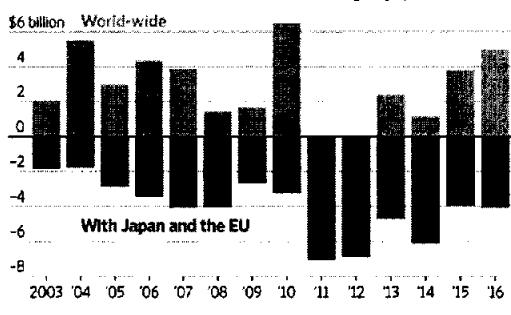
and Ford Motor Co. tested robots through the 1970s. GM and Fanuc in 1982 created a joint venture.

In the 1980s, as U.S. manufacturing slumped, almost seven of 10 American machine-tool companies closed due to falling demand, the strong dollar and strategic miscues, according to a 1993 Rand Corp. study.

Robot Gap

The U.S. runs a global trade surplus in advanced-technology 'flexible manufacturing' equipment but a large deficit with countries that lead the field.

U.S. balance of trade in 'flexible manufacturing' equipment



Source: Commerce Department

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The decline continued this century as U.S. manufacturers outsourced more and baby boomers retired. Shrunken manufacturers demanded fewer production experts, accelerating the factory-technology decline. "In the U.S. there's been a brain-drain in manufacturing technology," says Alex West, manufacturing-technology analyst at London consultants IHS Markit.

In Japan and Europe, industries such as electronics and pharmaceuticals pushed their automation suppliers for increasingly specialized equipment. Governments funded research and development.

Car makers including Toyota and BMW AG, which faced high labor costs and sought product improvements, prodded their domestic machinery suppliers for automated systems to boost efficiency and quality.

A struggling GM in 1992 sold its half of the Fanuc venture to Fanuc, which kept growing. Today Fanuc supplies multiple industries and nearly all of GM's industrial robots. "We look for the best manufacturing equipment suppliers to provide the quality and scale we need," says GM spokesman Klaus-Peter Martin.

The U.S. today runs a global surplus in "flexible manufacturing" goods, but its exports are mainly components and less-sophisticated machinery, and to developing nations. It imports more advanced equipment.

Among importers is Tesla Inc., often cited as a model for high-value, U.S.-based manufacturing. The electric-car maker's Fremont, Calif., factory is packed with red Kuka robotic arms from Germany. Tesla in November bought German factory-automation specialists Grohmann GmbH to help build its Nevada battery factory. Tesla's announcement said it sought "the best engineering talent in automated manufacturing systems."



German-made Kuka robots assemble vehicles at the Tesla Motors Inc. factory in Fremont, Calif. PHOTO: JOSEPH WHITE/REUTERS

Tesla declined to comment for this article. "If you want to build new production

facilities in the U.S.," says Torsten Gede, a manager at German investment group Deutsche Beteiligungs AG, which sold the Grohmann to Tesla, "a large part of the

machinery and technology has to be imported because local alternatives are rarely available."

By 2006, when Vickers Engineering in Michigan decided to automate, it had only European and Japanese options. Intimidated by the idea of adding industrial robots, "we wanted to buy as safe and reputable machines as possible," says Mr. Tyler. His team pondered questions such as "would they hold up in the used market if they turned out to be a dog?"

Vickers chose Fanuc robots and digitally controlled machine tools from DMG Mori Co., formed from the merger of German and Japanese companies. "If you're going to invest millions of dollars in a piece of equipment," says Mr. Tyler, "you want to be sure they'll still be in business in 10 years."



Kel Guerin, right, chief technology officer at Ready Robotics, shows what robots using the company's interface can be programmed to do at its facility in Baltimore. PHOTO: GREG KAHN/GRAIN FOR THE WALL STREET JOURNAL

DMG Mori's 2012 opening of a California plant pleased Mr. Tyler because it simplified conversations about innovations. He is also excited that nearby Lake Michigan College recently opened a \$12 million building devoted to teaching advanced manufacturing. "We need to catch up with Germany and Japan in romanticizing engineering," he says.

That was part of the idea behind the 2014 Revitalize American Manufacturing and Innovation Act, passed following the Obama administration's 2012 report. The government has since committed more than \$1 billion to establish a "network for manufacturing innovation" that includes government research labs, universities and companies. Other participants have committed over \$2 billion.

The network, dubbed Manufacturing USA, in January announced its 14th institute, the Advanced Robotics Manufacturing Innovation Hub hosted by Carnegie Mellon University in Pittsburgh. Led by the Pentagon, it will focus on making automation easier to use, especially for small companies.

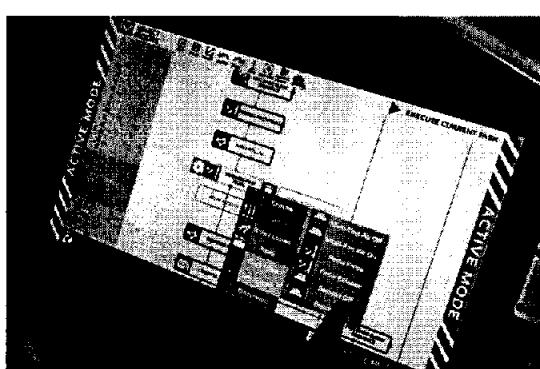
A White House spokeswoman says: "The Manufacturing USA institutes are an interesting experiment in public-private partnerships with the worthwhile goal of increasing U.S. manufacturing competitiveness and promoting a robust and sustainable national manufacturing R&D infrastructure. The administration will be reviewing the effectiveness of this approach during the coming months."

When Drew Greenblatt bought Marlin Steel Wire Products LLC, a small Baltimore maker of wire baskets for bagel shops, he knew nothing about robotics. That was 1998, and workers made products manually using 1950s equipment, and the result "was like a Charles Dickens novel, with guys missing eyes and fingers from accidents."

Pushed near insolvency by Chinese competition in 2001, he started investing in automation. Since then, Marlin has spent \$5.5 million on modern equipment. Its revenue, staff and wages have surged and it now exports to China and Mexico.

A few of Marlin's machines are from U.S. suppliers, but its most advanced equipment comes from suppliers including Japan's Yaskawa Electric Corp. and Germany's Trumpf GmbH. Mr. Greenblatt isn't thrilled with that option, not only because he'd prefer to buy American, but also because most industrial-automation equipment is designed for big companies with technology departments.

About two years ago Mr. Greenblatt linked up with a group of Johns Hopkins University graduates to launch a startup, Ready Robotics, that makes smartphone-style interfaces for industrial robots, aiming to make automation easier for small firms. "A lot of innovation is happening Stateside," Mr. Greenblatt says.



A user interface for programming robots made by Ready Robotics. PHOTO: GREG KAHN/GRAIN FOR THE WALL STREET JOURNAL

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ns, says he sees an opening for "the American mentality in software development." Trumpf's world-wide center for laser research and production is in Princeton, N.J.

By augmenting robots with sensors for vision, motion and touch—a field where the U.S. is strong—American innovators are enabling automation systems to be reactive and not just follow rote tasks. Jeff Burnstein, president of the Association for Advancing Automation, an Ann Arbor, Mich., trade group, says that among small tech companies "you're seeing a lot of drive toward innovation in automation in the U.S."

Some U.S. companies are building up their industrial-automation expertise by buying it—from abroad. General Electric Co. last year bought 3-D metal printing companies in Sweden and Germany for roughly \$1.5 billion and is expanding their operations. Europeans, says Christine Furstoss, a vice president in GE's research arm, "did a great job on equipment."

Teradyne Inc., a supplier of automated semiconductor-testing equipment based near Boston, a few years ago sought a high-growth acquisition focused on cobots—collaborative robots—and found "surprisingly few U.S. companies," says its CEO Mark Jagiela. "You find more in Europe and Asia." In 2015 Teradyne bought Denmark's Universal Robots A/S, the largest cobot producer.

"It's unfortunate the U.S. hasn't participated in developing industrial automation," Mr. Jagiela says. "But the U.S. will benefit from it."

—*Ted Mann, Natascha Divac and Mike Colias contributed to this article.*