MANUFACTURING INTELLIGENCE

Led by CEO Keith Nosbusch, Rockwell Automation is helping companies achieve a greater competitive edge.
CEO Keith Noshubch shows his company's support of technology education at a FIRST Robotics Competition at Bradley Tech High School in Milwaukee.
ROCKWELL AUTOMATION INC. (ROK) Chairman and CEO Keith Nosbusch has seen the future of manufacturing and says that 20th-century muscle is being replaced with 21st-century ingenuity. Consider TATA MOTORS LTD.’s (TTM) new “smart factory” in the state of Gujarat in India, built for a reported $417 million. Operating with Rockwell Automation equipment that measures and monitors everything happening in the plant, the factory is turning out the Nano, a car that can be bought for less than $3,000, which, according to its maker, eventually will be available around the world and will undercut the price of new automobiles sold anywhere.

That the Nano can be built in India for so little has less to do with cheap labor and more to do with smart manufacturing. Factory workers use Rockwell’s hardware and software to control every aspect of assembly, from the color of paint used on the exteriors to the type of audio system installed in each car based on customer preference, explains Sujeet Chand, chief technology officer at Milwaukee-based Rockwell. Information from Rockwell’s controllers — clusters of computers and sensors installed on the shop floor — alerts Tata factory managers when a piece of equipment requires maintenance and allows the factory to get parts (seats or components for the heating and cooling systems, for example) from suppliers in real time, when they’re needed and in the right quantities based on orders received from Nano dealers.

“The myth about emerging countries is that they use cheap labor with abysmal working standards in terrible plants and abusive environments” to turn out low-price goods,” says Nosbusch, 60, who joined the company as an application engineer straight out of college and was promoted to CEO in 2004. “The fact is, often these are high-tech facilities.”

China’s emerging middle class bodes well for Rockwell Automation. For details, visit nysemagazine.com/automatingchina.
Indeed, Nosbusch observes, smart manufacturing is emerging as the next big competitive advantage — and the U.S. had better start retraining its workforce to catch up. “If we don’t invest in and make constant improvements to our manufacturing sector, America will lose its preeminence in the global economy,” he says.

Today Rockwell Automation is providing the brains that make factories run more efficiently. Its products and services let manufacturers such as Ford Motor Co. (F), Kraft Foods Inc. (KFT) and The Procter & Gamble Co. (PG) control an array of factory-floor functions automatically and simultaneously. Imagine a master control for your house that not only runs the lights, hot water heater, air conditioning and phones but also adjusts them higher, lower, on or off based on how many people are using them and when — and alerts you to any mechanical hiccups — and you’ll have a good idea of what Rockwell does for manufacturers.

Rockwell’s roots go back to 1903, when Stanton Allen and Lynde Bradley launched a business to sell their initial product, a motor controller. The privately held company prospered over the next five decades, particularly when American manufacturing took off after World War II. In 1985, Rockwell International — then a huge conglomerate making parts for rockets, airplanes and cars — bought Allen-Bradley for approximately $1.6 billion. The deal redefined Rockwell’s future: Over the next decade it spun off or sold its aerospace, automotive and other businesses to concentrate on commercial electronics, finally splitting into two companies in 2001, with one named Rockwell Automation.

A NEW ERA

Nosbusch predicts that the way goods are made — be they cars, cookies or detergents — will undergo profound change during the next decade. This transformation toward smart
manufacturing is already taking place: CTO Chand says that by using the company’s controllers and software, most of its customers are collecting data from machines on their factory floor and linking them together for greater efficiency. A few customers are in phase two, Chand notes, which he describes as “turning the data into manufacturing intelligence.”

For example, the Los Angeles water department — a Rockwell customer for the past three years — is collecting data on water consumption. Working with the city, Rockwell’s engineers constructed a computer simulation model to predict water demand at various times of day, during different seasons and under a number of weather conditions. Based on the simulation, Chand explains, the city can now decide how and when to route water from particular reservoirs to meet demand. Ultimately, Rockwell helps the city save money by reducing the energy used for pumping water and allowing it to plan reservoir capacity in advance. All this connectivity, Chand says, will usher in a day when consumers can “tell” a factory exactly what car to build or how they want their jeans cut to fit.

Rockwell is positioning itself to be the linchpin of this manufacturing renaissance. “This isn’t just about customers buying our hardware,” says Ted Crandall, senior vice president and chief financial officer. “It’s our knowledge of their manufacturing processes and our global support capabilities that helps to improve their productivity and sustainability.”

This concentration on what’s ahead is a nice change, given where Rockwell has been. Since most of its customers are manufacturers, the company is a bellwether for the overall economy. And in the financial crisis of 2008-2009, that clearly wasn’t good news. “After the recession began, we saw an incredible pullback in both capital and operating spending among our customers,” Nosbusch admits. “Customers weren’t maintaining machines, they were idling lines and deferring planned, preventive maintenance. The attitude was one of survival.”

Rockwell felt their pain. By the end of fiscal 2009, revenue was down 24 percent to $4.33 billion, and profits had plunged by nearly two-thirds to $221 million. The company shed approximately 10 percent of its global workforce of 21,000.

But by the beginning of fiscal 2010, Nosbusch reports, things began to turn around. “Manufacturers place orders with Rockwell when they’re confident about demand for their own products,” says John Heywood, an economist at the University of Wisconsin, Milwaukee. “The company is doing well financially, so that’s a sign that customers are feeling more optimistic about the economy.”

For fiscal 2010, reported earnings more than doubled, to $464 million on $4.86 billion revenue, which increased 12 percent. The positive news continued into the first quarter of 2011, as the company reported earnings nearly doubling and revenue up 28 percent.

**PATHS TO GROWTH**

By targeting the most promising sectors for industrial automation (cars, food and beverage, and infrastructure builders) and the most robust regions (China, India and Latin America), Nosbusch says, Rockwell can achieve 6 to 8 percent annual organic growth over a business cycle. The company should be able to generate an additional point or two of growth through “bolt-on” acquisitions that juice the top line, the CEO says. In fact, during the past five years the company has spent close to $400 million on acquisitions that either have increased exposure to particular industries or have expanded its reach into different markets.

Rockwell now operates in 80 countries, and sales outside the U.S. account for half of its revenue. Nosbusch says the goal is to increase that to 60 percent within the next five to seven years. Emerging markets represent 20 percent of sales, a figure that has doubled in the past decade. “It used to be that these markets were depending on low-cost labor to compete,” Nosbusch says. “That’s still a factor, but now they’re investing in automation to capture the same advantages that manufacturers in developed countries have.”

**IN MY OWN WORDS**

>> If I could meet my 20-year-old self, I’d advise him... to find an opportunity to live abroad. Today business success requires cross-cultural competencies.

>> My worst job was...delivering newspapers on dark, cold Wisconsin winter days.

>> My favorite way to unwind is...spending time with my family and supporting my kids’ activities over the years.

>> My favorite book is...The Loyalty Effect: The Hidden Force Behind Growth, Profits and Lasting Value by Frederick F. Reichheld.
INDUSTRIAL EVOLUTION

TODAY'S WORLD OF MANUFACTURING IS LEANER, GREENER AND SMARTER THAN EVER. HERE'S HOW SEVERAL COMPANIES ARE BRINGING BRAINS TO THE BRAWN OF THE PRODUCTION LINE.

BY CHRIS WARREN
PHOTO ILLUSTRATIONS BY NOLA LOPEZ
WHEN A GROUP OF CEOs, CONSULTANTS AND
policymakers convened at the Detroit
Economic Club for a special summit on
manufacturing two years ago, a former U.S.
Department of Commerce official shared a
tale about TOYOTA MOTOR CORP. (TM) that
resonated with many at the closed-door
meeting. A few years back, she said, the
automaker was considering spending
$1 billion to locate a factory in the southern
U.S. But, she continued, its executives at the
time worried that the prevailing perception
of manufacturing in America — dumb,
dirty and in decline — would limit their
ability to hire skilled workers.

That was then, this is now: The reality of
smart manufacturing directly contradicts the
image of factories spewing pollution from
smokestacks, while, inside, workers with
little training and education perform
repetitive tasks. In fact, rather than being
defined by the “three Ds,” say executives
from ROCKWELL AUTOMATION INC. (ROK),
whose executives attended that meeting,
smart manufacturing is becoming even
smarter, safer and more sustainable.

In an open letter to industry leaders and
policymakers, Rockwell Chief Technology
Officer Sujeet Chand and Jim Davis, vice
provost of information technology at the
University of California, Los Angeles, and
the principal investigator of a National
Science Foundation grant on Smart Process
Manufacturing, lay out a broad definition:
“Smart manufacturing marries information,
technology and human ingenuity to bring
about a rapid revolution in the development
and application of manufacturing
intelligence to every aspect of business. It
will fundamentally change how products are
invented, manufactured, shipped and sold. It
will improve worker safety and protect the
environment by making zero-emissions,
zero-incident manufacturing possible.”

In part, the evolution toward smart
manufacturing is a natural reaction to the
economic challenges of the recession, says
Don Lesem, vice president of design and
supply chain at IHS INC. (IHS), an information
and insight company that focuses on
capabilities such as supply chain, energy,
defense and sustainability. “If you look at 2008,
the rate at which manufacturing just stopped
was unbelievable — it was a hard stop,” he
says. “Now, as factories are brought back up
and capacity back online, companies want to
better understand and anticipate the demand
and the capacity they need to make available.”

THINKING AHEAD

As president of the industry automation
division at Siemens Industry Inc., part of
SIEMENS AG (SI), Raj Batra aims to help
manufacturing companies optimize their
entire value chains, from product design
and development to production, sales and
service. “When I talk smart manufacturing,
I’m talking about elements from product
design all the way to the manufacturing
floor,” he says. In the past, Batra explains,
each of these elements was typically
handled independently, a scenario he
contends led to waste and inefficiency.

Virtualization in product design is one
element of how Siemens helps its customers
avoid that waste. “It’s a known fact in our
environment that 75 percent of
manufacturing costs are pre-determined in
the product design phase,” Batra says.
“Whether it’s less plastic in a bottle or the
reduction of the number of parts going into
a jet, we are able to model a lot of scenarios.
Because we can see complexity in the virtual
world before we mechanically put things
together, a lot of optimization is possible.”

IHS’ Lesem says that his company assists
its clients by giving engineers and R&D
The push for smarter manufacturing may, in part, be a natural reaction to the recession.

As consumers become more conscientious about where their products come from, supply-chain visibility becomes increasingly important. This is especially true for food companies, as the quality and safety of their ingredients is vital, says Rockwell's Chand.

At Smithfield Foods Inc. (SFD), Henry Morris, the company’s senior corporate vice president of operations and engineering, says that technology is deployed throughout the manufacturing process to allow for a complete record of the supply chain. “Smithfield employs computerized systems to provide traceability all the way from farm to fork,” he says. Morris says that Smithfield has incorporated enterprise-wide software systems tailored to its needs to include information it requires from suppliers of ingredients, packing materials and other items.

Batra recounts how Siemens recently worked with an automotive supplier that had won a piston contract from a European car company. “The supplier wouldn’t be awarded the order until it had a very clearly documented and verifiable process to track the genealogy of that piston,” he says. “So if there were ever a recall or a situation where something went wrong with that piston, the car company would have a documentable way to understand where the breakdown occurred in the process.” The solution was to use a Siemens Manufacturing Execution System software product called SIMATIC IT, which links processes from order management to assembly on the factory floor to achieve transparency. The same software is used in the pharmaceutical industry to track the origins of drugs, Batra notes.

In a small New England town on the banks of the Androscoggin River is a manufacturing facility making big environmental strides. At the end of 2010, The Procter & Gamble Co. (PG) announced that its facility in Auburn, Maine, which makes Tampax feminine-care products, had become the company’s first in North America — and its ninth globally — to send zero waste to landfills. The Cincinnati-based maker of consumer products such as Pampers diapers and Head & Shoulders shampoo says that the Auburn manufacturing facility is part of an ambitious long-term environmental sustainability vision that includes powering all of its plants with 100 percent renewable energy and using 100 percent renewable or recycled materials for all of its products and packaging.

According to Keith Harrison, Procter & Gamble’s global product supply officer, achieving this goal is possible when manufacturing waste is disposed of in three ways: recycling, repurposing and turning waste into energy. “These give value to waste,
whereas waste that ends up in landfills has no value,” he says. “We want to ensure that more than 99.5 percent of what enters our plants goes out the door as finished product or has some other beneficial end-of-life use by 2020.”

At the Auburn manufacturing facility, Procter & Gamble teamed up with Sonoco Sustainability Solutions LLC, a.k.a. S3, a division of SONOCO PRODUCTS CO. (SON), in a three-year effort to ensure that none of the nearly 2,300 tons of waste it generates annually goes into a landfill. Harrison says that all manner of techniques was used by Sonoco and the plant’s employees, who he says are naturally thrifty Mainers. “They donate samples and auction off retired tools and used furniture to employees, and then donate the money to the United Way,” he says. “They partner with Sonoco to recycle more than 60 percent of the plant’s waste, such as cardboard, plastics and mixed paper, and send the remaining 40 percent to a local waste-to-energy incineration facility to generate energy.” That energy, Harrison notes, is then sold to the local power company.

Marty Pignone, Sonoco’s vice president of global manufacturing, says that his company is working with other companies, including KRAFT FOODS INC. (KFT) and UNILEVER PLC (UL), to achieve the most sustainable factories possible. Pignone says that S3 experts visit each customer’s manufacturing site and identify all of its waste streams — even climbing into Dumpsters when necessary — to figure out where it all should go. Making this effort is both sustainable and economical, he says, because it results in lower disposal fees and more revenue from the sale of recyclable materials and waste converted to energy. “A large consumer-goods plant will typically net several hundred thousand dollars,” he explains. “What some people see as garbage we see as revenue.”

Joe von Rosenberg, the chairman, president and CEO of OMEGA PROTEIN CORP. (OME), a manufacturer of fish meal and organic fish solubles and reportedly the world’s largest producer of omega-3 fish oil, says that the company’s sustainability initiatives are a way to both improve its operations and enhance its reputation in the community. “Everything we do has the end goal of increasing efficiency and improving environmental responsibility,” he says. For the past few years, von Rosenberg says, the company has taken steps to become a cleaner manufacturer, making significant investments in equipment that reduces the amount of water and energy required to convert menhaden fish into end products.

Omega’s most significant recent investment, he says, was its $10 million acquisition of airless dryers for its manufacturing facility in Virginia, which are used after the fish are caught and pressed and before they’re separated into fish meal and fish oil. “That had far-reaching environmental impact,” von Rosenberg recalls. “Most noticeably, we were able to remove a tall smokestack at our factory that was visible to boaters and neighbors. They were happy to see it removed and pleased with the reduction of the steam and gases that cause the unpleasant odor associated with fish processing.”
INTELLIGENCE REQUIRED

An enduring misperception about manufacturing work is that it is repetitive and mindless, requiring little skill or education. But given today’s high-tech factories, the bar for highly trained, skilled manufacturing workers tightly aligned with design and procurement has been raised, typical in the current competitive market, says IHS’ Lesem. The Heritage Foundation, a Washington, D.C., think tank, released a report last October indicating that although U.S. manufacturing jobs disappeared over the past decade, down to 11.7 million in 2010 from 17.5 million in 1987, the number of employees in manufacturing with advanced degrees increased 44.4 percent between 1992 and 2009.

Sonoco’s Pignone agrees that it takes a lot of education and training to optimally run complex processes. “In a paper mill, there are thousands of process parameters that can be important and should be monitored,” he says. “Things can go wrong and equipment can fail, but by monitoring the processes and data you can react quickly and fix things.” For example, Pignone says, the quality of recycled paper is very much dependent on the amount of moisture in it, which can be affected by a variety of factors that need skillful monitoring and adjustments. “With the digital control systems and analytical tools we have today, an engineer can quickly and automatically have a computer identify where the process shifted upstream and run correlations and statistical analysis to determine what the source of that moisture variation can be.” That is hardly a rote task, Pignone notes, which is why many workers at Sonoco paper mills are engineers who also get additional on-the-job training in Six Sigma, a quality-assurance program based on statistics developed by Motorola in 1986.

Smithfield’s Morris says that employees throughout his company must be properly trained to use the software and production equipment in its manufacturing facilities. “Even production-line workers often interact with computerized touch screens and electronic equipment that requires specialized skills and training to generate the quality and efficiency that these systems are designed to produce,” he says.

One way Morris says his company ensures that employees have the skills they need is by working with universities, community colleges and suppliers to provide training. Morris says Smithfield partnered with Iowa State University to develop the Brown Belt Meat & Poultry Science Training Program, in which employees participate in three weeklong sessions focusing on microbiology, computer formulation and processed-meat technology. “As a final assignment, students must develop a lean manufacturing project to be implemented at their facility,” he says. “Close to 200 employees have been through the program, with the projects they developed generating savings in excess of $20 million.”

ALWAYS INNOVATING

Regardless of where companies are in the process, a full transformation to smart manufacturing requires continuous innovative thinking. At General Mills, Church admits, the move toward holistic margin management, or HMM — which includes smart manufacturing — was disruptive, requiring the company to change its overall business model. “As a consumer products company, we enjoyed a long run through the ’70s, ’80s and ’90s of steady,
reliable input costs," he says. “We lived in a land of plenty. Our business model was predictable, and we enjoyed a period where our manufacturing organization delivered a 2 to 3 percent productivity increase year over year, which we could then use to offset any inflation.” But during the past decade, he explains, the increasing globalization of the economy, characterized by higher demand driven by developing markets, pushed up input costs by two to three times inflation.

Church says this challenge — and the recognition that tweaks to the supply chain would not be sufficient to keep pace with the changing business environment — led General Mills to recalibrate its business model and adopt HMM as its centerpiece, a process that began in 2005. Revamping products like Hamburger Helper, coupled with steps such as locating factories closer to where consumers live to reduce transportation fuel usage, has been a long process, but one that Church says has been financially worthwhile. In fact, in 2010 General Mills announced that it expected its HMM changes to yield savings of $1 billion through fiscal 2012 and $4 billion by 2020.

AKZO NOBEL NV (NYSE Euronext: AKZA) says that a commitment to constant product innovation helps it assist manufacturers in their quest to become smarter. Reportedly the largest global paint and coatings company and a major producer of specialty chemicals, AkzoNobel believes it has developed solutions that make one part of the manufacturing process much easier and cheaper for customers — for example, products that reduce or eliminate drying time when cars, planes or boats are painted. Graeme Armstrong, the company’s executive committee member responsible for research, development and innovation, gives the example of AkzoNobel’s work with the makers of a Formula 1 race car. “What we have done with them is create a solid polymer powder and then flashing it through the oven after it is painted,” he says. “The idea behind it is that time is money.”

Armstrong says that AkzoNobel is also in a trial phase of doing away with wet paint and the drying process that accompanies it for certain cars and trucks. “Instead of liquid, which takes time to dry, we are experimenting with spraying vehicles with a solid polymer powder and then flashing it through the oven after it is painted,” he says. “We want to make smart manufacturing take drying out of the process entirely.”

As companies work to accelerate turnaround, decrease their environmental footprint and keep the innovations coming, expect the world of manufacturing to continue its evolution. Omega Protein’s von Rosenberg, for one, says that his company won’t be cutting back on its manufacturing upgrades anytime soon. “As a publicly traded company, we are mindful that our obligation to make a profit has to factor in somewhere,” he explains. “To make these investments, you have to come up with significant capital. But at the end of the day, you can’t afford not do it.”

SAVY COMPANIES ARE FINDING WAYS TO RECYCLE AND REPURPOSE EXCESS MATERIALS TO COMPLETELY ELIMINATE WASTE.

brand, and when your brand takes a hit, so do your financials,” Whitman says. But getting employees involved with manufacturing to focus on quality isn’t enough, she says, noting that a QMS has to be systemic for it to mean anything. The QMS is the tool that companies use to manage quality, Whitman explains, and although 67 percent of employees her team surveyed understand how a QMS helps their companies succeed, only a small percentage believe that a focus on quality will lead to positive outcomes in their jobs. Changing this mindset could translate to a 30 to 40 percent improvement to cost metrics, she adds.

The trick is getting an entire organization to embrace a QMS. Its adoption is driven by such factors as management accountability and employee ownership, Whitman says, not by a company’s culture. In other words, it’s holistic and requires commitment from senior leaders to implement. As Whitman notes: “Quality is bigger than just making sure products meet spec, and compliance does not equal adoption.”

IT’S ALL ABOUT THE CUSTOMER

QUALITY CONTROL LEADS TO BETTER PRODUCTS — AND BETTER CONSUMER EXPERIENCES.

The belief that high quality and low cost are mutually exclusive is wrong, says Amy Whiteman, who runs the Operations Leadership Exchange at THE CORPORATE EXECUTIVE BOARD CO. (EXBD), which supplies guidance to business leaders to help them make better decisions. She and her team of researchers have delved into the importance of adopting a Quality Management System, or QMS, which she describes as the business processes and policies around quality management at a company. “The top adopters of QMS,” she says, “have been able to improve cost and quality at the same time.”

How does this apply to manufacturing? Consider the recent spate of recalls due to poor product quality. “That is inextricably linked to your