



# What About the Widgets?

The importance of **manufacturing** has gotten a little lost in today's knowledge-based economy.

But b-schools haven't forgotten what it takes to keep the factory humming along.

by Sharon Shinn

**T**he rise of the knowledge economy has vastly undermined the importance of the manufacturing sector and led business schools to concentrate on more glamorous business functions as they train MBAs for the corporate world.

Or has it?

It's true that fewer schools today offer business concentrations that focus on heavy manufacturing—but what's happened is that b-school administrators are expanding their view of what counts as manufacturing. They've also revised their opinions on just what skills managers need when they enter the industrial world. Today's manufacturing-oriented business course is surprisingly integrated across core disciplines, as administrators stress that students need to understand the entire commercial enterprise to add value to any business that is producing goods.

"What many schools have done is to broaden their scope," says Christopher McDermott, associate professor at the Lally School of Management and Technology, Rensselaer Polytechnic Institute in Troy, New York. "They don't call it manufacturing; they call it operations, which includes manufacturing and service organizations. A lot of the same techniques used in a manufacturing environment are readily transferable to a service environment. For instance, many of the quality of management principles that people got fired up about in the '80s are now being applied to health care and service environments. Obviously, a lot of that shift in focus has to do with where the jobs are."

While fewer people are working in the manufacturing sector, the sector still accounts for 22 to 25 percent of the gross domestic product, notes Gerald Susman, Klein Professor of Management and co-director of the Quality Manufacturing Management program at the Smeal College of Business Administration, Pennsylvania State University in University Park. That percentage hasn't changed much for 50 years, he adds. "So the people who do remain in manufacturing add a significant amount of value and will continue to add value," he says. "It's important to focus on how to plan for it, how to be technologically sophisticated, and how to introduce new technology to manufacturing."

Given these factors, McDermott says it's unfair to claim that manufacturing as a field is dead. "There can't just be a knowledge economy where people don't understand operations, which is the transformation process of

converting some kind of raw material into a finished good at a higher value. An understanding of operations is still relevant to what makes companies tick. There are different focuses today on what people are doing in operations, but there are still a lot of people making things."

### **It's All About the Process**

Much of what's being taught today in manufacturing-oriented management classes revolves around hot business topics such as lean manufacturing, Six Sigma, and supply chain management. Many of these, say administrators, really boil down to process improvement—how can any company streamline or upgrade? Moreover, process improvement has vast implications for both the manufacturing and service industries.

"When you really think about it, there's an awful lot of commonality between service processes and manufacturing processes, whether you're making widgets or delivering services," says Peter Ward, professor of operations management and director of the Center for Excellence in Manufacturing Management at Fisher College of Business, The Ohio State University, Columbus. "If you go into a manufacturing company, you'll see that *tons* of services processes are there. The truth is, if a factory has been working for 100 years, there's been 100 years of effort going into making that process as good as people can make it. So the real potential for savings is not in making widgets; it's in getting the order from the customer to do whatever triggers the making of the widget, and all the other ancillary processes that are involved in designing the widget. If we can get better at those processes, that's where the real savings will be."

Old topics are also getting fresh spins in today's manufacturing management courses. For instance, managing logistics might be recast as supply chain management. McDermott shows students how Wal-Mart saves time and money by forgoing warehouses, instead transferring goods directly from one truck to another. "That's really managing an operations function," he says. Process improvement leads to efficiency, which improves competitiveness. "How do you configure your processes, how do you arrange people, where do you locate? These are all operations functions," says McDermott.

Lean management, which focuses on techniques to make processes waste-free and enhance value creation, is another popular subject in schools, and one that can be broadly applied across industries. Hospitals and financial services are extensively using lean manufacturing,

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says Ward. “Both are process-oriented in different ways, and both are struggling with how to pull waste out of their value stream using manufacturing techniques.”

Students studying the new manufacturing MBA are also learning how process management relates to the enterprise as a whole, and how multiple skills are needed to keep a company functioning. At Smeal, a distinction is made between “little m,” which is manufacturing, and “big M,” which refers to all the corollary processes that surround manufacturing.

“Big M includes at least two or three pieces, such as design and manufacturing, that have to be linked together very closely, because how you design a product has a lot to do with how effectively you can make it,” says Susman. Big M also considers distribution channels, quality assurance, warranties, brand image, and pricing structure. “All of these issues ought to be included in any MBA curriculum that deals with manufacturing,” says Susman.

That’s the same position taken at Lally, where students learn about innovation and entrepreneurship right along with manufacturing. “One of the most important things any company does, whether it’s a manufacturing or a service organization, is to develop a new product,” says McDermott. “New product development has to be managed in cross-functional ways. If you want to be innovative in developing new products, and efficient in bringing them quickly to market, this is a parallel rather than a serial process. Students must understand the overall role manufacturing plays in the larger organization. In the past, you’d get a manufacturing expert who was kind of a head’s-down guy. But for companies that are trying to be more cross-functional, managers need to understand how to work with accounting, how to work with engineering, and how to speed a product to market.”

As the industry sees a shift from traditional heavy manufacturing to more agile industries, such as telecommunications, there is a greater need for creativity, innovation, and entrepreneurship than ever before, says Neil Allan, director of studies for the Engineering Management Partnership at the University of Bath in England. “We’re seeing organizations grappling with ways to change their culture,” he says. “We’ve become part of that cultural change.”

### **Cross-Functional Courses**

In fact, since today’s manufacturing manager needs cross-functional skills, many manufacturing-oriented programs are highly integrated across disciplines—and between schools. At Lally, for instance, several streams of courses are team-taught by cross-disciplinary faculty. McDermott, who has an operations background, is involved in a two-semester new product

development course in which he teams with faculty members specializing in design, marketing, and finance. In the fall, students form teams and are instructed to find an industry, develop a product, do research, and discover a user need. Then they must generate ideas for potential solutions, design a solution, design a manufacturing facility around it, and develop a marketing plan.

“They have to say, ‘OK, we’ve got a widget. How do we market this? What conferences do we go to? How do we advertise this? How do we launch?’” says McDermott.

Such courses show marketing majors, for instance, that they’re only one part of the entire process. “They’re forced to recognize that their company isn’t about doing great operations, it’s not about doing great marketing. It’s about getting out great products,” says McDermott.

A number of schools have joint programs that draw on the expertise of both engineering and management faculty. The University of Bath is the headquarters for the Engineering Management Program in which six U.K. schools participate. Faculty move between the engineering and management schools to teach classes; administrators from the two schools sit on each others’ boards; and researchers carry out joint projects. Likewise, Pennsylvania State University’s Quality Manufacturing Management program is a joint venture between Smeal and the engineering school. The one-year program, which consists of eight integrated courses, can be taken after a student has received an MBA, or instead of second-year management electives.

This fall, Iowa State University in Ames is launching a five-year program that combines a bachelor’s in engineering with an MBA. Freshman, sophomore, and junior engineering students will be able to take a slightly accelerated engineering program through their first six semesters; during their last six semesters, they will integrate engineering requirements with MBA courses. In addition to core courses, classes will cover communications, economic theory, global and diversity perspectives, and statistical data analysis. Practical experience is provided by at least two internships in engineering and business.

Northwestern University’s Kellogg Graduate School of Management in Evanston, Illinois, works with the school of engineering to offer a joint Master of Manufacturing Management program. It’s built around seven streams of knowledge: processes, materials and technology; product design and development; logistics and supply chain management; information technology; quality management; analytical tools; and human resources. “If students are going to graduate with a manufacturing-related degree, they need to become



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experts in at least three of these areas," says Sunil Chopra, IBM Distinguished Professor of Operations Management and director of the MMM program.

In addition to taking required courses, Kellogg students participate in the Product Fair, for which they dream up a product, justify a need for it, design it, create a prototype, and plan how to introduce it to the market. Then, in the middle of their second year, teams of management students, supervised by a faculty member, take on an integration project at a corporation. "The idea is that, by this time, they should be able to apply their learning to solve a problem for a product-focused enterprise," says Chopra. "They have learned the basics, and they have become more deeply involved in manufacturing. Can they pull together and solve a problem?"

For instance, Chopra recently oversaw a team that worked with a major pharmaceutical firm to help it meet its product availability requirement. "Twenty percent of their orders were not going out on time," says Chopra. "The team was able to help identify some problems and come up with suggestions." The firm was impressed with the students' recommendations and is now considering implementation of their plan.

### Allying with Industry

To keep its manufacturing-oriented classes up-to-date, Kellogg relies on an advisory board of industry representatives who vet the curriculum and suggest changes. Industry reps also teach some courses and are on hand to support the school's Product Fair.

In fact, for most schools emphasizing management and manufacturing, the input of industry is critical. "Bath University's whole ethos is excellence and relevance," says Allan, who works with Rolls Royce and other organizations to design the school's program. "As soon as we add the word 'relevance,' it means if we don't engage industry, we're not meeting our own goals and mission."

To make sure its own program remains relevant, Smeal hosts a retreat every two years and invites faculty and industry reps to "reassess, revitalize, and redo" the curriculum, says Susman. At Lally, McDermott brings in industry reps to design product development courses and to give guest lectures. A fall course on managing technical projects regularly features guest speakers, including someone from the R&D division of GE and a former partner from a consulting firm specializing in IT.

At Fisher College, Ford Motor Company was deeply involved in the formation of the Tomorrow's Lean Enterprise Leadership program. Ward had been invited to attend a ses-

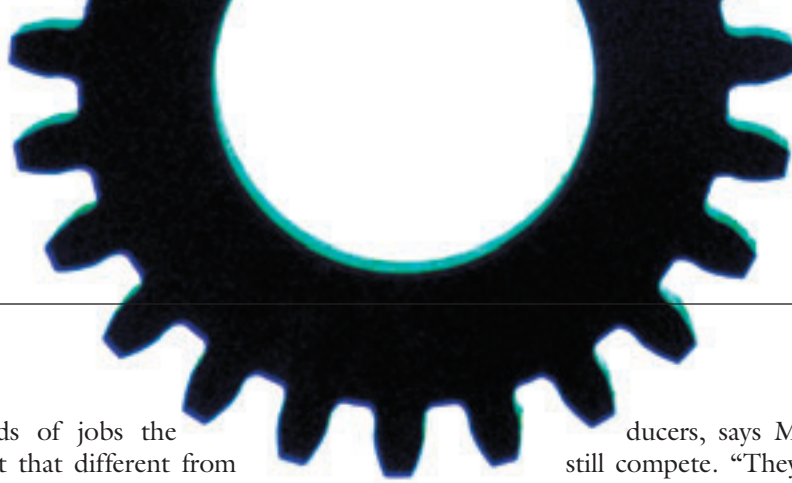
sion with an advisory group assembled to help Ford broadcast the principles of lean manufacturing through the supply chain. There, executives complained that they couldn't find university graduates who understood the basic concepts. "I said, 'Help me develop a curriculum,'" says Ward. Ford executives still teach many of the classes and give input on changes in state-of-the-art manufacturing.

In addition, Fisher College students typically participate in internships, at Ford or other companies, where they can instantly apply what they've learned. "Typically, they'll join a continuous improvement team and be mentored," says Ward. "They might work with a factory floor team or an engineering team, but there will always be experienced people who help them learn the ropes. We do a lot of mapping at Fisher, so they often do mapping on their internships and then identify areas for improvement."

Because students go to the internships with a basic set of skills, and because the lingo for mapping and process improvement is the same in industry and in academia, says Ward, students can instantly make a contribution. He believes that the enormous input of industry reps contributes to a smooth transition for students as they move between the classroom and the real world.

### Job Search

Internships, industry contacts, and an interdisciplinary education give graduates a good shot at a wide range of jobs in all kinds of enterprises. Says Chopra, "Companies like John Deere, 3M, Intel, and Cisco will recruit our students for a variety of functions, from supply chain management and operations, to finance, business, development, or sales. What they need are people who understand manufacturing. Even a firm like Cisco, which doesn't do its own manufacturing, needs people who understand technology and how to coor-



dinate processes. The kinds of jobs the MMM students get are not that different from what a regular MBA would get, with one difference. Regular MBAs are often hired into consumer goods sectors. Our students are likely to end up in firms that are more technical.”

Graduates with a joint degree in business and engineering are also perfectly poised to become entrepreneurs, says Anthony Hendrickson, associate dean of graduate programs for Iowa State’s College of Business. “The degree prepares engineers to be entrepreneurial by providing them with the business skills necessary to take a product concept to market successfully, from capital acquisition, to technology transfer, through market promotion.”

Nonetheless, Iowa State is prepared to help those who would rather work in a more traditional setting. The career services departments of its College of Business and engineering school have recently launched a combined career management system that will give engineering/MBA candidates access to a wider variety of job opportunities—particularly entry-level jobs with engineering firms. “We expect recruiters from technology consulting firms and traditional engineering recruiters to be interested in the engineering/MBA candidates,” says Hendrickson.

McDermott points out that there’s still a place in the manufacturing world for the specialist who can “find the best algorithm to get the fewest number of workers on the production line.” However, he says, what is more in demand these days is a manager who can be a strategic link for the organization, and who understands how all parts are integrated. “Many companies want to take advantage of their core competence,” he says. “Understanding a company’s core competence and managing it requires cross-functional abilities.”

Obviously, some MBAs with a manufacturing focus *will* go on to be plant managers—even though many of those jobs have now moved overseas. Administrators acknowledge that outsourcing has affected the availability of certain types of heavy manufacturing jobs, but they hesitate to portray this development as wholly unwelcome. For instance, Susman notes, ten of the biggest exporters from China to the U.S. are American companies. “That means a significant amount of U.S. resources are still going to be devoted to manufacturing,” he says.

Even foreign companies that outsource offer job opportunities for manufacturing MBAs. “Outsourcing isn’t just, boom, we design it, they make it,” says McDermott. “In most cases, there’s a lot more hand-holding.”

Outsourcing might make it increasingly difficult for companies in developed countries to compete as low-cost pro-

ducers, says McDermott, but they can still compete. “They just have to depend on high quality or great flexibility or innovation,” he says. “It means they have to configure their manufacturing or their service operations differently.” Such requirements create even more opportunities for managers with a manufacturing-based education.

### **Not Just Engineers**

What kinds of people are signing up for that manufacturing-oriented education? At the University of Bath, typical students might be looking for an MBA or MSc in engineering management that will help them move up within their companies or even go out and start new ones. “Once they understand their managers’ and leaders’ behaviors and put them in a framework, they’re much more confident,” reports Allan. “They say, ‘I could do that, and I could probably do it better.’”

At Smeal, many students in the QMM program have backgrounds in engineering, operations management, production, or supply chain management, says Susman. While they know they could ascend the corporate ladder by being strictly on the technical side, they don’t want to pursue jobs as senior technical people. “They’ve decided pretty early that they want to be managers. They just want to be managers in the manufacturing sector,” he says.

When Northwestern’s MMM program first began, Chopra admits, it took some wooing to convince students that it was right for them. Today, he says, it’s easy to fill a class, and students often transfer into the MMM program after some exposure to it.

On the other hand, Ward still does some “missionary work” to interest students in Fisher’s MBA geared toward lean manufacturing. “If you were to ask students on the first day if they were interested in manufacturing, a small fraction would probably say yes,” he says. “But by the time they get through our first course and the required course in manufacturing, they start thinking, ‘This makes sense.’ Then they see that internships are available and that people are getting hired. They realize that not only are the classes interesting, but they could lead to a sustainable career. Whether they’re interested in manufacturing or service, they’ve bought into the religion of processes.”

The stereotype of the typical student would be a male engineer who isn’t particularly good at interpersonal communication—and while administrators admit there are some students like that in their programs, they claim that the classes are really far more diverse.

For those who *are* tech geeks, the classes can prove to be

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a challenge at first. “They’re used to finishing up a project and saying, ‘OK, the answer is seven. It’s done, and we can move on,’” says McDermott. “But in most management courses, the answer isn’t seven, and there’s not a right answer, and it’s never done. There’s kind of a culture change.”

Ward feels a kick of disappointment if the whole of an incoming class appears to be engineers with manufacturing experience. “I think, ‘Boy, are they going to be easy to place.’ Then it turns out they want MBAs so they can expand their horizons and become investment bankers.”

In fact, at Fisher College, says Ward, the engineers are balanced out by the individuals with a bias toward supply chain management and other process improvement theorists. “We get good gender diversity and undergraduate major diversity in the supply chain management courses,” says Ward. “There are some people who have an undergraduate degree in engineering and want to return to manufacturing. There are an equal number of people who want to get *out* of manufacturing. When I look at our classes, they look like any other MBA class.”

Classes with a wide mix of students are the most enjoyable, says McDermott, particularly as cross-functional abilities come into play. “When we get to a mathematical part of the product development course, where students have to balance the production line and decide how many people are needed at each station, the quantitative people can shine. But when we get to the parts of the class where people have to talk to actual customers, or create an instrument to measure something that everyone can understand, or come up with creative ad copy, other people can shine. It forces them away from silos of thinking.”

Administrators admit there aren’t as many women in the programs as they’d like—usually less than 30 percent. “We work hard to change that,” says Chopra. “The funny thing is, the women we have do *incredibly* well, both within the program and when they leave.”

### **Factory Future**

MBA programs with a manufacturing or engineering emphasis are successful enough in some cases that schools are looking to expand their offerings. This fall, the Iowa State College of Business is introducing an experimental course on the management of technology. Topics to be covered include transformation of technologists into managers, human resources in technology organizations, career paths, behavior of technology professionals, leadership in technology, technology transfer from other fields, and technology and entrepreneurship.

“We see continued development of courses and programs

such as these, especially in the areas of technology,” says Hendrickson. “There’s a strong interest in programs that address the leadership needed to take an idea and successfully market it.”

Other administrators predict that shifts in the world market will dictate changes in manufacturing management programs—as the emphasis moves away from manufacturing and more toward processes. That’s because not only are more jobs going overseas, says Ward, but the workplace itself is getting more productive.

“There are fewer people working in manufacturing, so we need fewer to control the manufacturing,” says Ward. “In the future, we’ll see more services that are related to manufacturing. The world is just *full* of processes that have not been worked on for a hundred years, so they’re pretty lousy. There are a lot of opportunities to add value and make money by making these processes better.”

While Susman expects no radical program changes for the future, he does think manufacturing-oriented management degrees will continue to offer graduates lucrative and rewarding careers. Outsourcing, increased productivity, and greater reliance on technology will combine to diminish the number of people needed in manufacturing, he says. “What will be left will be a special core of people. Most sophisticated companies that make products realize how integrally those products are tied into their strategic plans. Thus those special people will have an increasing voice at the table—as they should.”

Administrators also expect to see manufacturing management courses relying even more heavily on cross-disciplinary integration. Both businesses and business schools are fighting their way out of functional silos, says Allan, so they can improve communication and have a better understanding of the big picture. “These days more and more students come into the program with degrees in foreign languages or political science,” he says. “They’re not so deeply specialized, but they end up with a broader sense of skills.”

Despite the advantages of a manufacturing MBA, some schools may need to work a little on selling such a program. “There are still people who think that if you’re studying manufacturing, you’ve got grease under your nails,” Susman says. “I think we have to update this image and have people appreciate the challenges of being in this field.”

As long as the world keeps revolving, factories will continue to produce goods, and people will want to buy them. Figuring out how to get those goods designed, produced, and sold most efficiently will increasingly be the province of the b-school graduate with a deep understanding of manufacturing—and every other aspect of making widgets. 