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As authors Eric Spiegel and Helmuth Ludwig observe in their important article entitled *America's Real Manufacturing Advantage*, “The most common tool a production worker carries at the newest auto plants in the Carolinas, Michigan, and Tennessee is not a wrench or a screwdriver. It’s an iPad.”

With better, more powerful software, the need for making a tradeoff between manufacturing efficiency and product customization that has existed since the dawn of the Industrial Revolution in the late 18th and 19th centuries is quickly disappearing. Today, as design software better communicates with automation equipment, products like cars, athletic shoes, medical implants, and turbines can be customized to meet a particular customer requirement quickly and at a low cost. Some see this as the start of a new industrial revolution; many are calling this phenomenon “mass customization.” Today, through software, product ideas can be quickly simulated, modeled, and tested inexpensively before being released to manufacturing. What one can perform on a computer, one can do instantaneously on the factory floor. To be sure, lead times are rapidly shrinking.

And software is being used today not only to design products, but also to optimize plant floor practices in both process and discrete manufacturing environments. Some very large facilities are even using drones with sophisticated sensors to monitor everything inside the facility, from the operating performance of the capital equipment to the amount of electricity being consumed at different times of the day. These drones are also used to compare the efficiency of production lines, pinpoint problems on the floor, and take an inventory of equipment.

Like software, 3-D printing technology is evolving into a much more advanced state from what it was when first introduced commercially in the 1980s. At that time, 3-D printing was used for prototyping parts; today, however, it is often the final step in manufacturing. In years past, for example, orthopedic surgeons would make a hip or a knee fit by shaving and cutting a rough approximation of the implant. More often than not, the implant fit imprecisely. By contrast, in some hospitals, CT imaging equipment, used to scan the body to determine the precise dimensions of the implant, communicates directly with 3-D modeling software which, in turn, drives a 3-D printer generating a perfect, net-shape replacement joint, often inside the operating theater.

With all of these advancements in operations, it is clear that the chief operations officer of the not-too-distant future will need to be a different breed of person. Starting with education, people destined to lead operations will need to have a very strong foundation in mathematics and data analytics, including a deep understanding of the interconnected nature of software, production equipment like 3-D printing, and other enabling technologies in an operation.



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And they will need to know more. As one group-level leader of a premier industrial corporation said, “Our facilities are becoming more and more data-rich environments; so leaders must be very smart about data analytics and technology in general.” He went on to say that most people today know Lean and Six Sigma and believe in them. They also have a strong international background. But where many operations leaders fall short is in understanding the entire supply chain, especially demand patterns and how to build a supply chain from the ones inherent in their particular industry. This holds true from vehicles and medical devices to toys and specialty chemicals.

Of course, like all effective leaders, those heading operations will be evaluated on their ability to work effectively across the entire company—marketing, sales, finance, research and product development, and beyond—and to get things done. They will need to be effective leaders, of course—people who know how to build top-performing organizations through training and mentorship and through inspiration. They will need to possess excellent overall business acumen and intuition and have the polish and communication skills that allow them to interact successfully with senior leaders within their own company and among their customer base. In short, the new breed of operations leader must think and behave like a full-line business leader with an insatiable appetite for acquiring new knowledge and skills. ■