Production automation gets IEs off the shop floor

Technology helps optimize scheduling and workforce in the engineer-to-order space

By Thomas R. Cutler

Fundamentally, industrial engineers work to optimize complex processes, systems or organizations by eliminating waste, improving quality and productivity, integrating systems and supporting operations management.

The profession has evolved into a hard discipline where data can be recalled at any time and decision-making can be improved through the use of models and simulations. The technology evolution referred to by many monikers, including Industry 4.0, big data and the IIoT (industrial internet of things), is giving industrial engineers the ability to analyze and optimize complex systems throughout an organization. The field also has become more specialized over the years, much like mechanical engineering in the earlier 20th century. Industrial engineering offers several sub-specialties, such as human factors, which includes ergonomics, job design and labor psychology, and systems engineering. Now it is common for industrial engineers to work on planning systems, supply chains, accounting systems and organizational policies. The best lean initiative teams in the manufacturing sector almost always have an industrial engineer as a change agent on the team.

Lean manufacturing concepts have a unique and specific role for industrial engineers who work to eliminate waste, including, but not limited to, wastes of time, labor, materials, energy and other resources.

Moving your labor up

A fundamental concept in management is optimizing your labor force – ensuring that higher-level work teams tackle higher-level projects. You don't want your accountants mopping floors. The same goes for your IE teams, and the above noted increase in automation over the years allows your industrial engineering teams to do higher-level work.

Without automation, machine, environmental and contextual data can be difficult to gather and organize into usable information. This hampers the effectiveness of industrial engineers who work in earnest to plan, organize and design most effectively. A connected manufacturing environment, however, lays the framework for the utility of collecting data and automating the use of such information. When machines, sensors and systems are networked and automatically sending data as production is occurring and customer orders are progressing, IEs have up-to-the-second feedback on status, environmental conditions and machine readings. They have complete production diagnostics, the ability to evaluate all conditions and parameters down to a fraction of a second through a single interface. They have a better understanding of prime performance conditions and the ability to predict manufacturing results through data patterns. They can execute automated workflows to enforce standard operating procedures and ensure consistent action. Better, they have the information to take corrective actions, such as preventive maintenance, to reduce downtime.

Take the example of Wenger Manufacturing, an engineer-to-order manufacturer headquartered in Sabetha, Kansas, which specializes in commercial extrusion systems, including industrial dryers, toasting ovens and mixers for the cooking industry. Managers at the extrusion systems manufacturer wanted to reduce cycle time and get a handle on production capacity to do a better job of meeting customers' needs.

"We didn't like the scheduling packages that came with most of the ERP (enterprise resource planning) solutions," said Brad Wenger, vice president of manufacturing. "We simply had no idea how much production capacity was on the floor."

With a mixed product line and an engineer-to-order environment, the company usually has 1,500 work orders on the floor at one time. With daily change orders, it was a difficult environment to keep stable. Dynamic scheduling and execution capabilities were needed to drive velocity and respond to minute-by-minute changes. IEs wanted to put an end to work-in-process imbalances, uncoordinated actions and off-target tasks. If a sales order came in midday for a part, that order needed to be prioritized immediately on the shop floor.

The industrial engineering team's goal was to balance the dynamics of the ETO (engineer-to-order) space, achieving rapid, predictable customer deliveries while getting the most from the company's legacy investments. Wenger adopted the demand-driven manufacturing method and synchronized technology, which included production planning, scheduling and execution that integrated with the company's ERP system.

When orders are received, industrial engineers need to calculate materials, production availability and constraints. Work released to the shop floor must be in full alignment with the pace of the constraint(s), clearing any congestion and driving flow. Order statuses (and related issues) must be visible throughout the organization, allowing industrial engineers to step away from the production line. The production team, supply chain management, customer service, sales and leadership must all work from the same factual, up-to-the-minute information.

Automating production scheduling eliminates the need to build and update manufacturing schedule spreadsheets, allowing industrial engineers more time to revise products based on ongoing customer specifications. Allowing your industrial engineers to pay attention to improving your deliverables, rather than handling the day-to-day firefight of scheduling, is a winning business strategy. Better products better meet customer wants and demands.

The evolution of production automation

While there are still very large manufacturers using physical (manual) kan-

Print production profitability

While U.S. businesses have long been tantalized by automated production, the printing industry should take another look at newer options that can automate workflows and increase profitability, according to the website for *Printing Impressions* magazine.

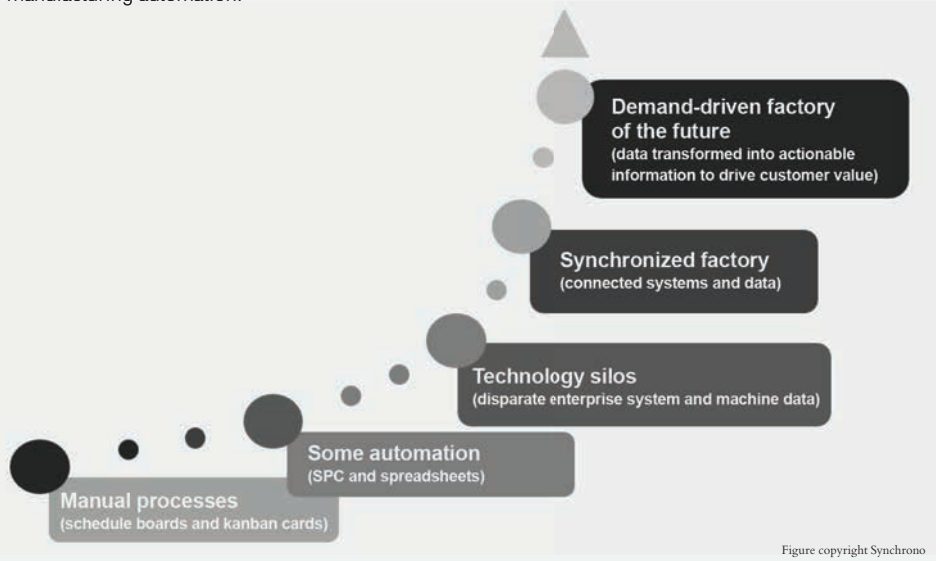
While many print shops looked askance at automation solutions a few years ago, newer technology does a good job of creating and delivering documents through numerous channels, including mobile, along with improving quality and pushing through higher volumes, according to the publication. Some solutions even help produce 3-D products.

The magazine cited a number of success stories. Executive Press bought a package that has reduced manual touches drastically, automating prepress, saving six man-hours a week and $1,600 a month. Associates International began implementing a web-based solution and was able to add 200 to 300 new print-on-demand orders each day, all while reducing costs by 40 percent.

FIGURE 1

The evolution of manufacturing automation

The ability to connect, access and synchronize data can help manufacturers move up the curve of manufacturing automation.



ban cards for inventory replenishment and spreadsheets to schedule production, part of the evolution into the big data environment involves moving into higher levels of automation.

Figure 1 details the evolution of manufacturing automation. Any single manufacturer may fit into multiple areas of the evolution curve based on maturity and areas of investment priority. The catalyst in moving up the curve – and enabling greater degrees of automation – is the ability to connect, access and synchronize data. And at the demand-driven pinnacle, manufacturers are managing their operations and the extended supply chain through a single system of record that is driving production based on actual demand (or consumption).

In this lean and fully connected enterprise, everyone is working from the same information. IEs have a single view into the status of all the machines on the shop floor to pinpoint and resolve issues quickly. The optimal pace for end-to-end production is established by understanding the capacity of the system's constraints. The root cause of a downtime event is made clear by viewing contextual data – not just process data. Greater communication, collaboration and innovation follow.

Industrial engineering benefits when production constraints are automated, the route Wenger went to solve its shop floor, works-in-process and other issues. Demand-driven manufacturing requires synchronization to drive end-to-end production flow. Synchronization is achieved through a closed loop between planning, scheduling and execution. A system that aligns materials, methods, machines and resources can make dynamic adjustments in real time.

Now, orders are released into production based on the capacity of the constraints in the system. This allows manufacturing to achieve a constant level of work flowing through the entire production process (versus localized machines, lines or work cells). Establishing an optimal level of work-in-process (WIP) inventory increased capacity.

Wenger found its technology solution, now in effect for four years, included a patented scheduling algorithm that automatically establishes the optimal production rate based on the capacity of its constraints and releases work into production accordingly. The results were impressive:

- On-time delivery increased from 40 percent to 95 percent-plus
- WIP reduction of 15 percent in first few months
- Reduced stock outs of stocked parts by 25 percent

There is a change in how industrial engineers are used in automating manufacturing facilities, particularly those with complex processes or systems. The impact of end-to-end production planning, scheduling and execution facilitates rapid response to customer demand. Automation, coupled with empowering the right people with the right data and the right time, permits innovation and focused continuous improvement. ❖

Thomas R. Cutler, president and CEO of TR Cutler Inc., is the founder of the Manufacturing Media Consortium, which includes more than 6,000 journalists, editors and economists who write about trends in manufacturing, industry, material handling and process improvement. Cutler authors more than 500 feature articles annually regarding the manufacturing sector and is the most published freelance industrial journalist worldwide.