



Shop floor automation: A necessity for competitive manufacturing

The manufacturing industry has seen great turbulence over the past decade. Global competition has reached new heights. Customers expect products more quickly than ever—and at a lower cost. To keep up with these demands, manufacturers have to improve their operational processes. Advances in IT and manufacturing technology are widespread, but the most basic process improvement—automating the shop floor—still holds the greatest potential for streamlining activities, trimming waste, and boosting profitability. Automation at the factory floor level is the foundation for a holistic manufacturing transformation. In this paper we'll examine the barriers to adopting automation, the three levels of automation available to manufacturers, and offer advice for choosing the type of automation that makes the most sense for your manufacturing operation.

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What are the barriers to automation?

Since the 1980s, manufacturers have routinely turned to ERP solutions to manage their operations.

According to [Aberdeen](#)'s report "To ERP or not to ERP," 96% of top performing organizations use ERP solutions; 88% of the average performers use ERP solutions; and 79% of the laggard firms use ERP solutions. It's safe to say most manufacturers understand the benefits of real-time connectivity and visibility, key benefits of ERP solutions. Yet, ERP solutions often stop at the shop floor, where outdated disparate systems and paper-based solutions still linger.

Stephanie Neil describes the reluctance to change shop floor strategies in a recent issue of [Automation World](#), saying, "State-of-the-art technology surrounds the manufacturing industry—from predictive analytics to the industrial Internet of Things and cloud computing. But manufacturers are not quick to jump on the bandwagon.... It's not because they don't understand the value of new technology, but because companies, especially in process industries, have built a solid, immovable infrastructure that has deep, rigid roots in control and quality procedures. No one wants to mess with an architecture that can withstand the test of time, but, more importantly, it's just not economically feasible to constantly change capabilities."

Reluctance to change is just the most basic barrier to shop floor automation. The shop floor is highly complex, by nature, with a wide range of IT technology being used to run the different pieces of equipment and specialized actions. The typical shop floor can encompass everything from RFID scanners and barcodes, to GPS tracking and smart sensors.

Connecting these disparate systems can be a challenge. Finding common machine-to-machine languages and developing protocols for data sharing are still in early stages.

Recently, this shop floor challenge has been dubbed the "last mile" (or last meter). This refers to the need to connect back office IT solutions with the final stages in production, warehousing, and shipping to the customer. This last mile is often the most under-automated part of the manufacturing process, but it's one of the most critical aspects of meeting customer expectations for on time delivery of on-spec products.

Dave Edstrom, chief technology officer at an automation company in Ontario Canada, says in an interview with [ThomasNet News](#) that there are both technical and business challenges involved in making that last-mile connection. The types of connections that must be managed range from a multimillion-dollar machine tool, to a sensor that costs less than \$1 and is smaller than a dime. "Solving the last-meter problem," Edstrom says, means "getting data from countless devices and putting it into an easy-to-read format, so data can become actionable intelligence anywhere, anytime, on any device."

The typical shop floor has numerous standalone machines, often with dozens of different proprietary controls. "It's impossible to tie such a hodgepodge setup to the company network, limiting automation and giving management little visibility into factory operations and thus production optimization," Edstrom says. To make matters worse, he reports that "Only 2 percent to 3 percent of all manufacturing plants are being monitored today," says Edstrom. "And the average initial equipment utilization is 32 percent."

But there is hope. Edstrom says that companies “working on the last-meter problem often find that installing a solution will increase equipment utilization 20 to 50 percent, with an ROI period of three to six months.”

What are the different levels of shop floor automation?

Shop floor automation has dramatically changed in recent years, especially in light of the increase in M2M technologies, industrial robotics, and the use of machine sensors. Even startup manufacturers, growing family-owned companies, and small- to medium-sized businesses (SMBs), can now afford to add automation capabilities to their production processes. Manufacturers can choose from a wide range of enterprise solutions that offer everything from the basic ability to track customer orders and jobs in the production queue, to solutions that manage a virtual workforce of robotics.

At one end of the spectrum, manufacturers still rely on manual systems for scheduling, planning, assigning crews to tasks, monitoring through-put, and locating products and components. In some job-shop industries, such as metal fabrication, manufacturers and fabricators tend to be especially reluctant to retire job packets and the classic scheduling board that is mounted on the wall where it can be seen across the floor. This old-school technique is still embedded in some shops, largely because it continues to fill a purpose. Production managers need to see at-a-glance which machines are running particular products or processes. The paper-based systems can accomplish this, but with low levels of efficiency and accuracy. In small shops with low volume, this may not be a serious concern. But there are more effective options.

Ground level automation systems

For manufacturers operating with tight margins and serious competition, paper-based systems are insufficient. Basic, ground level automation systems provide a tighter handle on job costs, machine efficiencies, and workforce productivity. Basic shop floor automation helps identify the areas of waste, such as idle machines, gaps in workflow, and costly delays due to stock outs.

Identifying the issues is only half of the problem. Manufacturers must also find solutions, take action, and then monitor activities for signs of improvement. In many cases, the automation tools that spot the problems may also point to possible remedies. For example, two pieces of identical equipment may produce very different through-put results. The performance tracking details may also help manufacturers spot variables that could cause the poor performance in one machine, such as overdue maintenance, calibration requirements, or changes in temperature that can signal a more serious overheating condition.



Basic automation tools also help manufacturers track performance, such as cycle times, and order-to-delivery times, so that they can measure improvements. This tracking ability provides a historical record, as well as analytics that can be used to predict future needs. With this information, manufacturers can keep a close eye on trends in production orders, and use them to identify seasonal and customer buying trends and triggers. This insight can be helpful in planning for needed resources—from personnel to raw materials.

Logistics tracking is another one of the basic capabilities that can be easily adopted by manufacturers, with minimal investment. Bar codes and bar codes scanners are relatively low-cost, but highly effective solutions for tracking materials, from parts and supplies to finished goods in the warehouse.

Bar code and warehouse tracking systems provide many benefits, including greater accuracy of inventory and better tracking of components and parts as they are put into the shop floor production queue. As material is moved on the shop floor, tracking location is especially critical and helps ensure there are no delays while pallets of supplies are tracked down. For organizations with multiple plants, multiple warehouses, and material that is moved from site to site—or even off site—accurate material tracking is essential. Automation makes this complex job easier and more accurate, and allows company-wide visibility. This visibility—and one shared version of the truth—are very helpful for companies building a customer-centric approach. Account managers and customer service managers can easily check on the status of a customer order and provide the customer with accurate, real-time information on timing.

Labor has a major impact on cost, so it's crucial to track employee time on particular jobs. Basic shop floor automation processes can help here, too. Tracking labor makes it possible to bill more accurately, plus helps manufacturers adequately set pricing on future projects and provide accurate bids to customers. Understanding the cost of labor also helps manufacturers evaluate when robotics or other automation tools may be cost effective. Without accurate data on labor, such planning is strictly speculation.

For manufacturers that want a minimalistic approach to automation, eliminating the paper-based spreadsheet needs to be the first priority. Automated processes that operate in real-time, and that can be updated instantly, help manufacturers react to marketplace changes in a timely manner. With an automation solution, manufacturers don't have to reference job packets, clip boards, or spreadsheets that are outdated the minute they are printed.



Intermediate-level systems

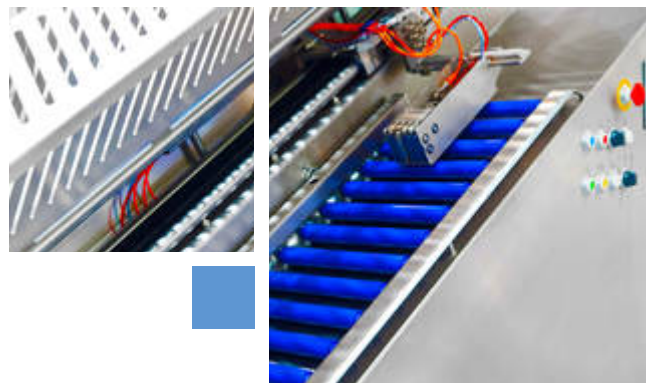
The next level of shop floor solutions allow manufacturers to automate and streamline select processes, such as aligning jobs with the correct machines and crews, matching high priority projects to the next available machine, and signaling crews when machine maintenance is required. Manufacturers can create event triggers and workflows, so that next steps in the production cycle are assigned automatically, eliminating the need for a person to make a decision and take action. For example, an automated solution can help signal the packaging department that a certain product run is coming to them and calculate for them how many boxes and cartons will be required. Those materials can automatically be pulled from inventory, and the material handling team can receive an order to deliver the goods to the right machine, at the right time.

It's at this intermediate level of shop floor automation where sensors are usually introduced into operations. One of the most elementary—but beneficial—uses of smart sensors is for monitoring equipment performance. Sensors can track various symptoms of performance degradation, such as temperature, vibration, or changes to output volume or flow rates. The goal is always to spot potential issues early, so that maintenance or intervention can be scheduled when it will cause the least amount of disruption.

Intermediate-level automation systems also allow manufacturers to track jobs assigned to machines and keep an accurate record of jobs, components used, special customer requests, and as-configured details. By having these types of production details in a database, the manufacturer can easily comply with tracking and traceability issues. Rather than manually looking through log books and trying to piece together a historical snapshot, manufacturers can conduct simple searches to find which cycle run used a particular part or component that may be affected by a safety recall.

Traceability is becoming increasingly important in today's manufacturing landscape, as highly complex products have multiple components, often produced by other suppliers, and industries are heavily regulated with strict reporting requirements. Automation makes it easier to comply with requests for reports.

This is why an automation system that can handle multi-level serial number hierarchies (end item, sub-assemblies, parts etc.) is important. This allows the manufacturer to track material consumption, scrap rates, and machine run rates for various parts and components.



Advanced automation systems

The next level of plant floor process improvement introduces a fully automated manufacturing environment that has the ability to collect machine information, plus create production schedule workflows. This is done based on input from various other systems, such as the ERP system and asset management system. The process typically requires executive level involvement and endorsement from various teams (finance, operations, maintenance, HR, IT etc.) to be successful. Organizations considering moving in this direction will need some level of basic plant floor automation as a foundation. Many implementation experts recommend using a phased approach so that ongoing operations can continue and service to customers is not interrupted.

Advanced systems typically involve sensors in machines, as well as sensors on the products being manufactured. In both cases, these sensors are used to determine location and condition, such as continually monitoring for environmental conditions if the product is sensitive to heat or humidity. Advanced systems will undoubtedly also employ robotics for some processes, such as spot welding or inspections. Robotics can also be used in the warehouse to speed pick-pack-and-ship processes and movement of materials from one station in the work flow to the next.

Advanced automation can also take the form of machines telling other machines when to take action, eliminating the need for human intervention. In some cases this can be time-saving and cost effective. For example, a piece of shop floor equipment that is overheating may signal the HVAC system to adjust the room temperature to help control the condition, until it is determined if there is a malfunction causing the problem. A piece of equipment may also schedule its own maintenance with the field maintenance team, including reserving necessary replacement parts from inventory. The level of automation is really limitless as robotics, sensors, and processes can be orchestrated with great detail.



Which type of system is best?

Whether a manufacturer should step up their operational automation to this level or rely on a more modest approach is determined by many factors. Volume of production, speed of delivery expected by customers, and the complexity of shop floor operations all need to be considered. There is always a correlation in investment and how long it takes to achieve a return on investment (ROI).

In order to remain competitive in today's highly global market place, it is important for organizations to continually evaluate their current processes and look for opportunities for improvement. Providers are continually introducing new technology for shop floor automation; so, it is important to remain informed about changing capabilities and standards for best practices. It is also important to make selections that are compatible with current needs—as well as future growth. This is why IT solutions that are flexible often offer the best investment.

Manufacturers should avoid solutions that require heavy modifications, as this will make future expansion and growth more difficult. Modern automation solutions are built on the latest technology and can be deployed across a variety of industrial and consumer based devices, such as tablets and phones. They sport a fresh, intuitive user experience to allow operators to access information in an easy and efficient manner.

Whether beginning with a system to manage labor and scheduling or opting for fully integrated systems that can manage their entire planning and production processes, manufacturers can benefit from the convenience, cost efficiencies, and improved use of resources that come with automation. Automation is important element of remaining competitive today.

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