White paper

Becoming Lean and Agile with ADC and Real-Time Technologies

Intermec®

The widespread movement to lean and agile manufacturing is pulling many companies into unfamiliar territory. Customers and competition are forcing manufacturers to produce their products with less waste, inventory, personnel and resources, while simultaneously giving customers more product and configuration options, all on shorter lead times with more delivery flexibility.

There are other strong signals that customers are exerting more control over their suppliers. More than half of manufacturing companies are encouraging their suppliers to implement lean manufacturing techniques, and 58 percent are specifically requesting just-in-time production, according to a 2003 study by ARC Research and Microsoft. As customers asserting their control over terms and relationships and competition forces improve efficiency, companies must respond by gaining more control over their own processes, materials and suppliers.

The techniques and processes for accomplishing these goals are often grouped together under the term "lean and agile manufacturing." However, "lean" and "agile" are not the same. Improving business processes in response to customer or internal initiatives would be much easier if the goal was to become more lean or agile, but unfortunately such a choice is not an option. Lean manufacturing essentially says to do more with less. Agile is often doing more for the same – for example giving more configuration and delivery options for the same price. The important differences between lean and agile can cause conflicts in how processes are established and resources are managed. Fortunately, there is enough common ground between the two models to enable companies to be lean and agile. Automated data collection (ADC) and real-time communication technologies make it possible to profitably transition to lean and agile processes, and enhance their ability to work in harmony.

The technologies must be at the base of lean and agile manufacturing initiatives. Using bar code or radio frequency identification (RFID) to identify materials, parts or components builds the foundation for a company to execute many elements of lean and agile manufacturing strategies, such as continuous replenishment, build-to-order production and just-in-time/just-in-sequence delivery. Paperless putaway, picking and replenishment, with 100 percent accuracy, real-time work-in-process tracking, and secure lifetime product traceability are a few of the ADC applications that support lean and agile manufacturing models.

Industrial mobile computers and wireless networks help lean and agile manufacturers satisfy their needs for distributed information and decision making. As this white paper will show, companies who have committed to lean and agile processes and supported them with real-time data collection systems are producing more goods, in more configurations with fewer errors and less labor than ever before.

Understanding the Basics: Lean Manufacturing

The clearest and simplest definition of lean manufacturing is: manufacturing without waste. Lean manufacturing principles are organized around the goal of reducing waste and excessive materials, inventory, labor and capital equipment. Many supply chain management programs complement lean manufacturing because they are intended to drive out excess inventory.

Lean techniques are not limited to production operations and often extend to receiving, materials management, inventory and distribution. Lean manufacturing elements include:

- Just-in-time receipt of raw materials;
- Direct replenishment to the factory floor with no intermediate storage;
- Cellular manufacturing;
- Pull-based replenishment and work scheduling systems;
- Total quality management or Six Sigma;
- Rapid setup or setup reduction, which is also referred to as Single Minute Exchange of Die (SMED);
- Just-in-time shipping and just-in-sequence shipping.

Two of the most important measurements of lean manufacturing effectiveness are inventory turns and asset utilization. For many lean manufacturers, materials inventory is measured in hours of supply, not days. While the definitions and requirements of lean manufacturing may sometimes be hard to understand, the benefits of carrying less inventory are not, and can be applied to virtually any business.

Agile Manufacturing

Agile manufacturing, also known as "flexible manufacturing," tends to be less strictly defined and is often shaped by the desired outcome. It may be best described as quickly adapting to changing customer demands. Agile manufacturing extends lean production techniques for environments where the product mix is complex and customer demand is highly variable.

For example, agile manufacturers often engage in:

- Build-to-order production;
- Delaying final assembly until the most optimal point;
- Product genealogy/cradle-to-grave part and product tracking;
- Just-in-sequence, just-in-time delivery;
- Frequent deliveries of small quantities;
- Real-time event management;
- Supply chain collaboration with customers and suppliers.

The explosive growth in the number of SKUs in many industries is evidence that customization, multiple configurations, and the resulting need to be agile are growing. Successful agile manufacturers have to minimize their dependence on economies of scale and frequently operate multiple, small production facilities near their customers, than large, central facilities. Agility may take the form of product customization, prowess at just-in-time and just-in-sequence delivery, the ability to work on extremely short lead times, or other types of challenging performance.

Finding the Common Ground
Lean and agile manufacturing systems share many attributes. Foremost is the need for extremely strong operational visibility and control. The processes and applications that enable lean and agile manufacturing require accurate, timely information about inventory, labor and production. In turn, obtaining accurate information from manufacturing, material handling and distribution environments requires automated data collection and real-time communications, which are foundations of lean and agile manufacturing programs.

Bar code, radio frequency identification, industrial computers and wireless LANs provide the data that drives scheduling, materials management, manufacturing execution systems and other sophisticated applications that make lean and agile manufacturing manageable. The processes, applications and tools for lean and agile manufacturing do not begin or end with the manufacturing cell. The following sections show how companies are benefiting from using real-time ADC systems to improve many processes to meet lean and agile performance challenges.

Receiving
Companies that carry only a few hours of materials inventory can't afford delays at the receiving dock. Receiving is typically expedited by scanning bar code pallet labels to identify the shipment and match it to an Advance Ship Notice (ASN) EDI transaction that was previously received. This process is common and effective in traditional manufacturing. However, problems arise in just-in-time environments because physical shipments often arrive before their corresponding ASN, leaving receiving personnel with a puzzle to solve at the busy dock door.

An effective alternative is to include data-rich shipment details on the actual pallets using two-dimensional (2D) or matrix bar codes, or RFID tags. RFID readers can identify entire shipments in seconds – including tagged components and cartons within the pallet. RFID readers can be mounted on dock doors as portals, integrated with mobile computers used by receiving personnel, or mounted on forklifts. When used with a wireless LAN, the process of identifying loads, and logging them in to inventory or materials management systems can be accomplished in seconds with no manual inquiries to the software application and no manual data entry required. The software application then returns handling instructions, such as "Deliver to cell 7 immediately" or "place into storage location CS4" to the operator's dock-door, forklift-mounted or handheld computer over the wireless LAN.

Similar results can be accomplished by encoding shipment information in a 2D bar code on the pallet. This application requires more user participation to scan labels, but like RFID it accurately identifies the materials on hand to provide a foundation for further accurate, automated resource management operations.

Putaway & Materials Management
Data collection systems can interface with ERP, warehouse management, inventory control and other enterprise systems so automated receiving can be seamlessly integrated with efficient material handling and management. Personnel equipped with vehicle-mounted or handheld wireless computers can be directed to store, retrieve and deliver materials with tremendous efficiency. Mobile and wireless systems make workers more productive and reduce the labor required to manage materials, even with the frequent replenishment moves common in lean and agile manufacturing.

Complementing wireless-directed material management with bar code or RFID data capture improves and preserves inventory accuracy while providing the real-time visibility that scheduling, ERP and other applications require. For example, when Johnson Controls transitioned to just-in-time manufacturing at its automotive interior component plant in Neustadt, Germany, the company began tracking all work-in-process and stock movements in real time. Items are scanned whenever they are picked or transferred, the transaction is reported to its shop floor and ERP applications in real-time, and the items immediately are deducted from inventory. Inventory is now more accurate than ever before, and the labor required for inspections and stock management has been reduced. The facility now manufacturers in a just-in-time, just-in-sequence environment, and has almost completely eliminated errors resulting from installing the wrong part in an assembly because of real-time, bar code-based part tracking.

Materials management systems can subsequently be integrated with kanban or other replenishment applications to extend efficient material flow directly to the factory floor.

Factory-Floor Replenishment
Lean and agile is based on demand-pull, not production-push philosophies. Therefore pull-driven replenishment is a standard technique of lean and agile manufacturing operations. Replenishment may come from storage or directly from receiving, and is frequently done just-in-time. Because manufacturing cells often make different types of products, parts can't be efficiently staged at the cell to ensure availability. Cellular manufacturing uses efficient replenishment techniques such as kanban or just-in-time delivery. Executing these processes relies on real-time communication of material orders and accurate identification of parts and work-in-process assemblies, so wireless data collection systems are practically a requirement.

Kanban is the best-known lean replenishment technique. Parts are delivered in containers, such as totes, bins, racks or carts, and users take some action to signal that an empty container needs replenishment. Wireless computer and data capture systems can automate the signaling process to save time and labor. For example, scanning a bar code on an empty bin could trigger a replenishment request over the wireless LAN. With RFID, empty racks could be simply pushed past a reader, or bins returned to their shelf locations to trigger the replenishment.

Just-in-sequence manufacturing requires more sophisticated replenishment techniques, but real-time ADC systems can still make the process convenient and accurate. For example, Visteon must conduct just-in-sequence manufacturing at its Milan, MI bumper plant to satisfy its automotive customers. Bumper assemblies differ by style, color, grill, wiring and other variables. To ensure the proper assembly, workers use handheld Intermec mobile computers to scan separate bar code ID labels on the bumper and the component prior to installation. Scan information is sent over a wireless LAN to a computer that hosts the order database. A quick database lookup confirms the parts to be installed, and the assembly can continue. Later, Visteon uses bar code scanning to trigger another wireless database lookup to ensure assemblies are loaded in proper sequence for shipment. The Milan plant has eliminated sequencing errors since the real-time error-proofing system was implemented.

Sequencing and advanced replenishment systems often require item-level identification. The sooner bar code, RFID or other identification is applied to parts, components or materials, the more automated tracking applications can be implemented. There are numerous ways to apply identification marks to materials, including direct part marking, marking during the receiving process, using mobile printers during picking to create an ID label associating the item with an order or assembly, or at work cells during production.

Work-in-Process Tracking

WIP tracking benefits by having items marked before they enter the assembly process. Bar codes and RFID tags on assemblies and components enables accurate tracking and routing without time-consuming and error-prone manual data entry. Many WIP systems are similar to Visteon's error-proofing application, using automatic data capture to identify objects and to record work performed. The benefits are accurate data entry, real-time visibility, and improved productivity because minimal labor is required to record activity with ADC.

SteriPack, a packaging provider to the medical industry, created a real-time work-in-process tracking system that drives numerous enterprise applications. The company operates a just-in-time production environment and must create complete product traceability information to satisfy medical industry requirements. Instead of merely scanning finished goods to log them into record-keeping systems, SteriPack applies bar codes to work-in-process to drive automated production and documentation.

All work activity and product movements are recorded by scanning a bar code with a wireless handheld computer. The information is sent to SteriPack's manufacturing control system in real time, which updates WIP status, scheduling, materials planning and other applications. The system is also integrated with SteriPack's customer service operations to give customers visibility into their order status. Scanning throughout the production, storage and distribution processes provides error proofing while meeting traceability and documentation requirements with minimal labor.

Cellular manufacturing operations at Avnet Applied Computing, a $9 billion distributor of computer and networking equipment, semiconductors and electronics, illustrate the benefits of reporting WIP status in real time. Thirty technicians at the company's Integration Solutions Center in Phoenix, AZ, are responsible for custom configuring customer orders. They receive build instructions on a laptop computer at the work cell over an Intermec wireless LAN. Previously, build orders arrived on a wheeled cart. Technicians would manually sign off on each step, with the information being processed in batches throughout the day. Now the information is exchanged in real time and technicians can get immediate answers to questions about the order. Avnet has identified savings of between 10 and 15 minutes per technician per order since the system was implemented, which has improved productivity by several thousand hours per month.

Wireless workstations also provide the flexibility to quickly reconfigure the shop floor without incurring the time and expense of relocating network cable. HON Industries estimates its wireless work cell system, which features scanners, industrial computers and wireless LAN equipment from Intermec, saves the company six to 20 hours – and thousands of dollars – every time its work space is reconfigured. HON, the second-largest office furniture manufacturer in North America, often offers custom configurations to win orders. The company's wireless data collection system makes it profitable to do so.

The 3DayCar Programme is a joint UK research initiative intended to explore the barriers and possibilities for producing cars within three days of receiving the order with exact specifications from the consumer. The project has produced new insight into lean manufacturing, including the following conclusions that underscore the value of real-time information exchange: "The major information technology barrier to the 3DayCar is batch processing," according to a 3DayCar report that also said the un-sequenced flow of information causes significant production delays and inefficiencies.

Real-time work-in-process tracking techniques can be adapted for use in a variety of production, quality control, testing and sequencing operations. Durable bar code labels, nearly indestructible RFID tags, industrial mobile computers and the cable-free flexibility of wireless LANs can extend track-and-trace capabilities into virtually any manufacturing environment.

Shipment Verification

Automated tracking needs to be extended to the loading dock to prevent shipping errors and to preserve just-in-sequence integrity. Reading bar codes or RFID tags on outbound shipments can match specific items to specific orders, dock doors or trucks, and prevent shipping errors. Captured information can also be used to generate master shipping labels, manifests, ASNs and other documentation, with little or no human intervention required.

Werner Ladders has integrated its wireless warehouse operations with its ERP and shipping systems to improve accuracy and efficiency. The optimal load sequence is calculated as items are picked. Items are scanned again prior to loading to ensure orders are loaded correctly. The scan also drives a shipment verification application, which has led to a 72 percent reduction in credits issued for shipping errors. Fill rates are up, inventory is accurate and workforce productivity has improved 21 percent since the system was implemented.

Asset Management

Many of the same principles used to track and manage materials can be applied to fixed assets. Assets are like inventory in that, without accurate visibility into quantities and availability, companies are forced to carry expensive safety stock that ties up capital without adding value. ADC technologies enable efficient asset and maintenance management by providing a convenient way to record and provide usage and service information.

Lean and agile manufacturing, with its frequent production changeovers, high asset utilization and drive for improved productivity, can create acute asset and maintenance management needs. Companies who keep their inventory down to several hours of supply can't afford the delays caused by a missing tool or inoperable piece of equipment. The ripples from slight disruptions can make waves throughout the supply chain, making it imperative to ensure equipment and asset availability.

Automating tool crib operations is an easy way to improve asset availability and employee accountability. Employees can check equipment out of the tool crib by scanning bar codes on the object and on their ID cards. The scan records possession in less time than it takes to write the information down, and creates an accurate, accessible electronic record. For security applications, RFID tags can be applied to assets with readers set to automatically record all movements and sound alarms if necessary. Such systems reduce theft losses and improve asset availability without inconveniencing users.

Syncrude, which runs a massive mining and oil processing operation in Alberta, Canada, uses bar code technology to perform 1,000 cycle counts a day. The company has more than 90,000 line items in its asset inventory, but records are so accurate and up to date from bar code scanning and wireless LANs that Syncrude only takes physical inventory counts one a year.

Maintenance needs tend to increase significantly when asset utilization reaches 80 percent of capacity. Data capture and mobile computing technologies play a role in improving maintenance management and asset availability. The first step is to permanently identify the equipment or tool with a bar code, RFID tag or some other identifier. Each time the asset is used or maintenance is performed, the identifier can be read with a mobile computer to record the activity. This builds a record of service time and maintenance history without time consuming manual data entry and transcription. Maintenance, history and configuration records can be updated and marked on the object itself either by writing the data to a read-write RFID tag on the object, or by encoding and printing a bar code label. Data from the mobile computer can be uploaded to a variety asset and maintenance management software applications. The software may track life cycles and issue alerts, schedule inspections and maintenance or recommend other preventive action. These integrated hardware/software systems minimize down time and enable proactive management so users can get more from their equipment investments.

Conclusion

Lean and agile is not a fad, but a strategic philosophy that is making a lasting impact on industry. Even companies who are not engaged in formal lean and agile programs are implementing or considering some of the principles identified in this paper. Implementing ADC systems is an important step that produces immediate benefits and sets the foundation for meeting future lean and agile manufacturing goals.

Intermec Technologies Corp. is available to help you learn more about automated data capture and wireless communications technologies for manufacturing automation. Visit the Case Studies section of Intermec's Web site, www.intermec.com, to read more about any of the customers referenced in this white paper. The White Papers section of the site includes papers on getting started with ADC and wireless technologies, RFID, work-in-process tracking, logistics automation, pallet identification and other relevant topics.

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