EE News EUROPE

Published in: http://www.eenewseurope.com/news/real-time-supply-chain-management-industry-40

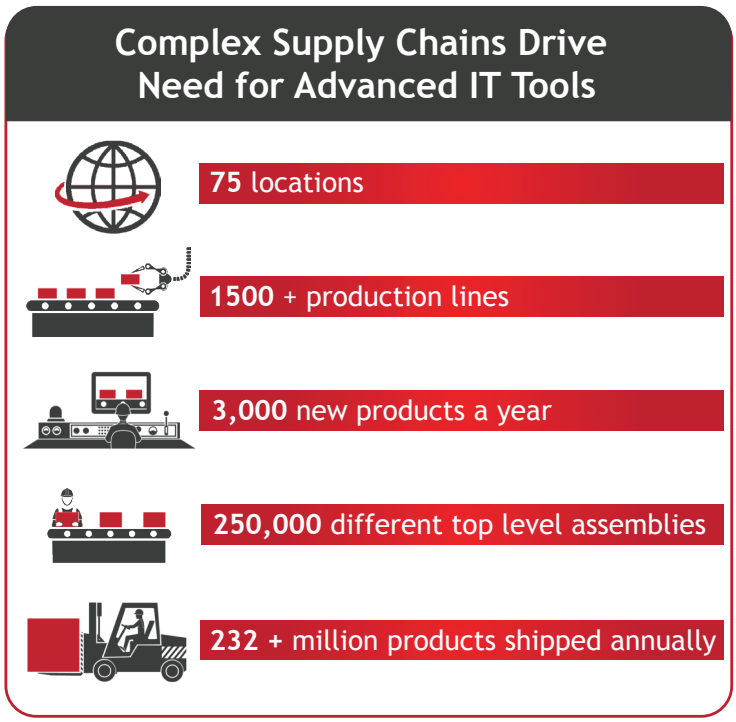
June 27, 2017

# Real-time supply chain management for industry 4.0

**Automation in factories is often the first thought people have when they consider Industry 4.0. While manufacturing automation can be the most visible aspect of Industry 4.0, it is also making a significant impact on inventory and supply chain management.**

Supply chains for complex products are often global with components manufactured in different countries, sub-assemblies in others and finished products in yet another location. Delays and technical issues encountered at the component or sub-assembly level can impact the finished product quality and on-time delivery.

Risk in managing global supply chains can be reduced if you have real time visibility throughout the supply chain. WIP level visibility can indicate whether sub-assembly and product manufacturing have started on-time. Yield data is a good indicator of component and sub-assembly quality and whether there are any technical issues with the manufacturing process. Knowing this information in real-time has real value to operations and supply chain management. It prompts them to allocate resources to resolve issues as they occur, maintaining quality and on-time delivery performance. Here are some examples of how Industry 4.0 has been applied to provide visibility and control to complex, global supply chains.




## Simplifying real-time global factory management

Industry 4.0 uses cloud technology, interoperability and machine-to-machine communication to automate manufacturing, quality control and supply chain management. Integration across the production floor using cloud Manufacturing Execution Systems (MES) and machine-to-cloud communication enhances supply chain visibility. This integration ties together each aspect of the manufacturing process, machines and shop floor data collection systems, which eliminates human error and provides real-time visibility into production lines and supply chain dynamics.

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One example of this is Sanmina's Operations Management System (SOMS), which converts data from the Manufacturing Execution System (MES) into a visual representation of the factory and production. These "virtual factory floors" can be accessed by supply chain managers and operations executives from anywhere in the world using a browser to see the status of component inventory, production problems and delivery schedules.

Large electronic manufacturing facilities may manufacture hundreds of different products using a dozen or more SMT (Surface Mount Technology) lines and many custom-designed system assembly lines. Each production line could have 10–15 different assembly and test stations generating pass/fail and parametric data. Data generated throughout the manufacturing and test process is collected in the cloud MES and is used to measure and manage yield, throughput, WIP ageing, labor efficiency and productivity. Managing and analyzing the volume of data collected is extremely complex.

The MES data is converted by SOMS into visual signals. The visualization provides real-time status at product, workstation, production floor, plant, regional and global levels. The system monitors yield, throughput, work-in-process (WIP) ageing, labor efficiency and productivity against predefined targets. In the event of an issue causing an interruption to production or yields falling below target, the system sends real-time alerts to technicians. If a problem is not solved within a defined time period, automatic text and email escalation messages are initiated. SOMS is currently deployed in over 50 factories worldwide at Sanmina. It enables more efficient and cost-effective management of complex manufacturing processes, with real-time data visibility anywhere in the world.

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## Machine-to-Cloud interoperability automates inventory management

Customer service representatives, production planners and supervisors require accurate data about quantity and location of components, WIP and finished sub-assemblies. This data is accessed using materials requirements planning systems (MRP). Warehouse operators provide individual components to the production team for specific work orders. The physical movement of the material from the

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warehouse to the production floor is recorded in MRP. Production floor supervisors physically manage components, WIP and finished sub-assemblies and provide information to the planner for a transaction known as "backflushing". This transaction is a critical step in the management of inventory as it reduces the quantity of individual components and increases the quantity of finished products showing on the production floor in the MRP. The process is dependent upon the input of many people, resulting in potential data entry delays and errors.

Communications are complex in a factory with numerous production lines and thousands of employees. Communication timing may result in production planners thinking they have enough components to meet production schedules that day, however they may be looking at "pre-backflush" data. This can result in production lines being stopped because planners don't have real-time inventory data.

Many of Sanmina's factories have now implemented automated backflush transactions, with real-time data consumption and reporting. Under the new system, when a printed circuit board assembly (PCBA) completes automatic optical inspection (AOI), the AOI machine sends a request to the MRP for immediate backflushing. Manual communication from the production team to the planner is eliminated along with the associated delay and inevitable human errors.

The new system based on the Industry 4.0 concepts of interoperability, machine to IT communication and cloud MES has turned a manual, reactive system dependent on effective human communication into an automated predictive system with real-time accuracy.

The two examples described here have been implemented and are operating in over 50 global manufacturing facilities at Sanmina. Automating a key aspect of inventory management, WIP and yield visibility was enabled by implementing the Industry 4.0 concepts of machine-to-machine, interoperability and cloud technology. The result has transformed these operations into smart, digital factories with superior supply chain predictability, visibility and performance.

## About the author:

Gelston Howell is Senior Vice President at Sanmina Corporation - www.sanmina.com