# What Is Smart About Smart Manufacturing?

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A few decades back, we might have asked, "What is lean about lean manufacturing?" But nowadays, everyone knows what lean manufacturing means and what the guiding principles are. For smart manufacturing, we are just starting to educate on the principles and how to tell if projects and initiatives are making progress toward a smart manufacturing enterprise. I am confident that a few years from now, everyone will know what it means.

Smart manufacturing is an endeavor to elevate the connectivity and orchestration of manufacturing processes across the entire value chain to new heights. In smart manufacturing, the digital information about each part or product—its digital twin—follows along with the physical part or product, accumulating more data as it makes its way through production and inspection processes, supply chain processes, assembly and test processes, and is eventually handed over to the end customer as a bundled physical and digital product or service.

Today's manufacturing reality is far from this digitally connected dream, so smart manufacturing is an endeavor that will still take many years to achieve. However, industry leaders are positioning now to be the market-disruptive innovators and are making strides to be among the first wave of companies ready to join these new smart manufacturing ecosystems as they are established.

What should manufacturers be doing now to get ready? Companies need to create their own roadmaps for the journey and start investing in projects and initiatives that get the company closer to a digitally connected real-time enterprise. The following are some guiding principles to keep in mind for your smart manufacturing initiatives:

- Minimize manual data entry, translation or transformation of information at each process step.
- Processes should hand over structured parsable data (like XML or JSON web services) as output to successor processes to facilitate publish/subscribe mechanisms to systems within the company and into the value chain.
- Establish distributed nodes of autonomous diagnostic and decision support at the machine, factory and enterprise levels. These nodes should roll up transaction information for each machine, factory and product unit as needed.
- Allow ubiquitous use of mined information throughout the product value chain, including end-to-end value chain visibility for each product line, connecting the manufacturer to customers and the supplier network.

- Automate routine tasks and decisions, but include people in the process loop wherever needed to handle non-routine situations, manual adjustments, and complex decisions assisted by the analytical insights.
- Implement optimization schemes that leverage acquired data, advanced analytics and machine learning algorithms to recommend process adjustments at different levels of the enterprise from controls to operations to value chain.
- Adopt machine-to-machine (M2M), application-to-application (A2A) and business-to-business (B2B) integration standards that will enable multi-vendor hardware and software plug-and-play solutions with open integration platforms to the Internet. Learn about organizations that are establishing and promoting standards for data exchanges among assets, production processes and the supply chain.
- Develop a collaborative culture and new workforce skills that encourage projects that cross old functional boundaries like production, automation and IT. Manufacturing automation personnel need to understand IT and vice versa. Workers will need to learn to configure and maintain smarter machines and robots.

Over the next few years, smart manufacturing will evolve to new levels of connectivity. Revolutionary productivity gains are expected from the resulting integrated value chain processes. These are exciting times to be in manufacturing. Make sure you are not a spectator on the sidelines watching others make progress because it could be hard to jump in later and catch up if you wait too long to get started.