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Industrial Equipment Providers Catch a Wave of Smart Device Technologies
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Intelligent manufacturing: Capital equipment suppliers should prepare for the perfect storm of technologies used in smart devices, such as low-cost memory, powerful processors, cloud-based software, big data, Internet of things (IoT), and advanced analytics. Original equipment manufacturers (OEMs), machine builders, and system integrators using smart devices will help the manufacturing industry to catch the wave toward greater productivity.

Intelligent manufacturing continues to accelerate with the technologies that continue to revolutionize our world, as evidenced by the pervasiveness of connected intelligent devices in almost every aspect of our lives. The world in which we live and do business is leveraging technology at an unprecedented rate. The result is a proliferation of smart devices-phones, watches, tablet computers, appliances, systems, and connected cars, to name only a few. This wave is being driven by technology advances such as low computer memory cost, high-performance embedded processors, and high-speed Internet connectivity. These intelligent devices combine to form intelligent systems when effectively integrated with software infrastructure components such as the cloud, big data, and advanced analytics (Figure 1). By the next decade, most lives will be integrated with many interconnected smart devices.
There is a similar wave occurring in the manufacturing sector with significant ramifications to the suppliers of capital equipment used in manufacturing. These changes are altering the manufacturing landscape and will leave it unrecognizable from what we knew 15 to 20 years ago. A major confluence of several phenomena is creating a perfect storm driving the next generation of manufacturing - intelligent manufacturing (Figure 2):

- Advances in handling large amounts of data
- Proliferation of real-time analytics technologies
- An explosion in network-connected devices
- Increased network bandwidth.

These trends are resulting in massive changes in the manufacturing process. The adoption of robotics and automation in manufacturing is increasing precipitously, the use of 3D printing is exploding, manufacturing machines are becoming more intelligent, and warehouse automation is expanding at a rapid pace. These intelligent systems are dependent on data; data that is shared and acted upon at all levels. This has led to changes on the data side as supply chains are being automatically linked for improved tracking and coordination. Advanced analytics are enabling real-time decision making on the factory floor, while manufacturing throughput and cycle time improvement and tool diagnostics are happening automatically and often remotely.
The Coming Wave of Technologies
Today’s manufacturers see this perfect storm upon them and realize that they must develop new strategies that leverage today’s emerging technologies. Manufacturers are demanding value-adding and competitive systems for the entire lifecycle, thus creating significant ramifications for capital equipment suppliers. Recent actions by several large, marquee companies show the accelerating trend toward intelligent manufacturing. Apple, moving toward fully automated U.S. production lines, has allocated $11 billion to robotics and automation technology. General Electric announced a $3 billion investment in the "Industrial Internet of Things." Google acquired eight robotics companies in 2013. And, Amazon bought Kiva Systems, a warehouse automation company for $750 million. Similar actions echoed by thousands of less well-known companies, albeit on a smaller scale, are generating a massive wave of intelligent manufacturing.

Value Chain for Manufacturing
The value chain for capital equipment used in manufacturing is changing dramatically. The value of the hardware will be more and more subjugated to the value of the overall system solution (hardware + software + data + analytics). This wave has the potential to destabilize high market share competitors and open up markets to disruptive solutions.
To succeed in this rapidly shifting market, capital equipment suppliers should take a proactive approach and begin preparing now to build a plan that may include some of these activities:

- Taking a step back to see if re-evaluating the product strategy and roadmap, or even the business model, may be necessary.
- Evaluating how to better connect equipment to centralized databases to provide distributed alerts and production information to managers within the customer organization.
- Exploring existing product boundaries to evaluate opportunities to extend the product with value-added software, either on or off the equipment.
- Determining the value of the current data generated by the equipment across the spectrum of potential users; and exploring the potential of externalizing additional valuable data that might be produced as part of the equipment function.
- Mapping out the customer experience and exploring how to leverage new technologies in the use of the equipment in such areas as user interface, connectivity, or analytics for decision making.
- Determining how to leverage remote diagnostics and access equipment performance data to drive equipment reliability and reduce labor within manufacturing facilities.
- Designing higher levels of automated operation and failure recovery to reduce labor intensity and uptime.
- Conceiving more sophisticated support for the overall manufacturing workflow including buffering, queuing, and manufacturing execution system or cell controller integration.
Developing strategies for in-situ inspection and metrology to improve production quality and consistency.

Integrating feedback and feed-forward capabilities to support workflow and quality improvements.

**Differentiation: Intelligent Manufacturing**

As value shifts to the overall system solution, capital equipment suppliers must devise creative ways to differentiate products. For example, remaking products using a richer set of data and connectivity allows delivery of something of greater value to customers—access to data that they never had before. And, now they can have that data when and where they need it in real time and in a manner that is useful for quickly optimizing the manufacturing process overall.

Instead of supplying a machine, the capital equipment supplier is providing empowerment, peace of mind, and a distinct competitive advantage.

The wave of intelligent manufacturing is being enabled and driven by a perfect technology storm. The confluence of connectivity, computing power, software, and the ability to manage large amounts of data will drive large productivity gains in manufacturing with many companies already taking advantage.

Capital equipment suppliers that realize this and act decisively will benefit from the added value that they can bring to customers. Warning to capital equipment suppliers: stop drifting, turn around, and catch the technology wave.

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