



MARKET SPOTLIGHT

Transforming Manufacturing with the Internet of Things

May 2015

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Manufacturers are increasingly adding software, sensors, and wireless connectivity to their products, providing a foundation for the Internet of Things (IoT), which IDC defines as a network of uniquely identifiable endpoints (or "things") that communicate without human interaction using IP connectivity. IDC forecasts that by 2020, there will be 30 billion connected devices in use by consumers and businesses. These smart and connected products in turn become critical components in the connected supply chain and smart manufacturing. IoT is fast becoming a reality: IDC survey results show that 55.0% of discrete manufacturers are researching, piloting, or in production with IoT initiatives. And IDC forecasts the worldwide IoT market will grow from \$1.3 trillion in 2013 to \$3.04 trillion in 2020. Yet, the lack of industry standards and well-defined best practices for IoT regarding connectivity, data storage, and even security presents substantial challenges to manufacturers as they ramp up their investments. There is no "off the shelf" package that integrates, maintains, manages, and services all of the technologies required. To take advantage of the efficiencies and new business opportunities enabled by IoT, manufacturers will need to work with service providers to bring together all of these components and create a strategy for moving forward.

Introduction: Key Drivers and Challenges in the Manufacturing Industry

IDC Manufacturing Insights identified key drivers that represent the current situation — the reality — for manufacturers today. The following drivers will influence why and how manufacturers invest in IoT:

- **Complex, dynamic value chains.** Manufacturers participate in and manage complex, overlapping value chains, with frequent change, as they seek new opportunities around the globe.
- **Emerging market growth.** Manufacturers continue to reshape supply chains and product strategies to support emerging market growth sourced from and manufactured in emerging regions and local markets.
- **Traceability, transparency, brand, and reputation.** Manufacturers will use increased traceability and transparency to strengthen their ability to deliver product quality and protect their reputations.
- **Demanding customers.** Manufacturers are compressing business cycles to meet customers' increasing requirements for personalized products and higher levels of service.
- **Converging technologies for manufacturing.** Technologies — operational technology (OT) and information technology (IT), including IoT — are mandatory for manufacturers to design, manufacture, and deliver their products.
- **Ubiquitous connectivity.** Connectivity is ubiquitous — in devices, interfaces, and processes — and extends to the edge, with manufacturers assuming that the communication infrastructure will keep up.
- **Truth in data.** Manufacturers are looking for the truth in data as they seek more valuable analysis of greater volumes and variety of data and the information that will bring them closer to digital execution.

We also think it's important to note the challenges manufacturers are facing in workforce management along two basic components:

- **Shortage of expertise.** An aging workforce — workers with a significant amount of expertise at or reaching retirement age — as well as stagnant or declining numbers of new graduates in manufacturing- and engineering-related disciplines
- **Technology savvy.** An incoming workforce that treats technology of all kinds as a natural component of the work process

However, technology-savvy workers will soon benefit from wearable devices and other IoT-enabled technology advancements deployed on manufacturing shop floors and in the supply chain to help increase productivity and efficiency.

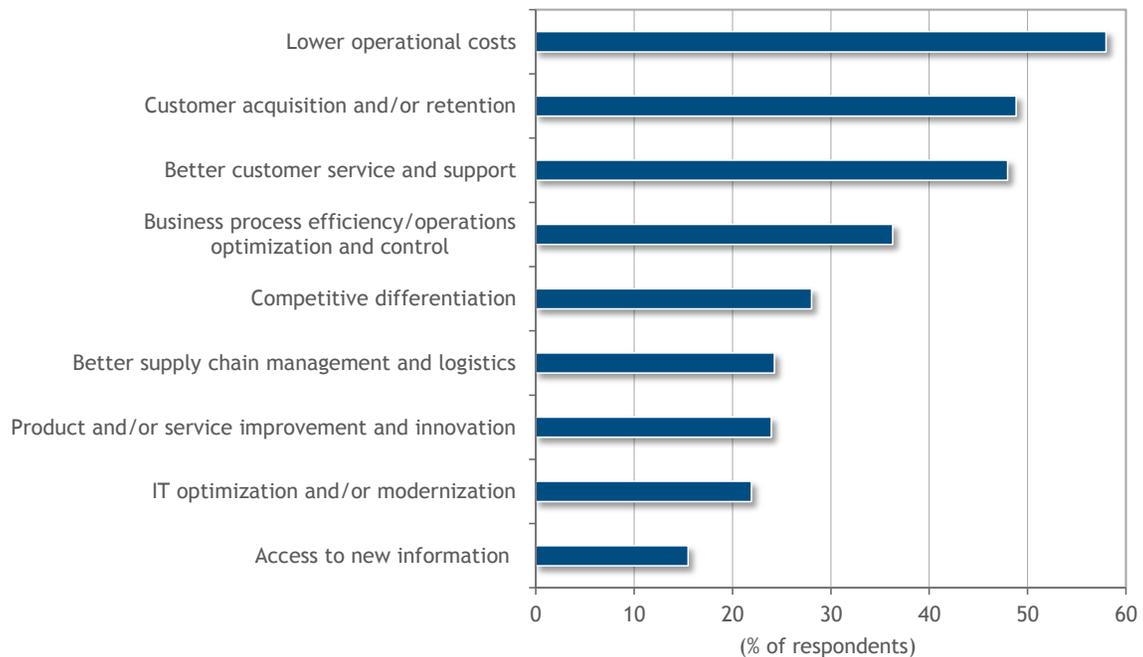
High Expectations for IoT in Manufacturers' Products and Processes

According to IDC's 2014 *Global Technology and Industry Research Organization IT Survey*, manufacturers in particular have high expectations for the IoT's impact on lowering operational costs. In addition, they expect IoT investments to yield advantages in retaining customers, attracting new customers, improving customer service and support, and differentiating from their competition (see Figure 1).

FIGURE 1

IoT Drivers in Discrete Manufacturing

Q. Which of the following areas have been identified as significant drivers of your organization's Internet of Things (IoT) initiatives over the next 12 to 24 months?



n = 95

Source: IDC's *Global Technology and Industry Research Organization IT Survey*, 2014

IoT opportunities can be split into two broad categories: supporting the process or supporting the product. For IoT-supported processes, we believe that by 2020, at least half of all corporate standard processes will have automated data acquisition and a quarter will have self-correction capabilities. For IoT-supported products, we also expect that manufacturers will see onboard service revenue double in its share of total industry revenue by 2020 because of IoT and connected products.

Manufacturers have the opportunity to adapt processes with IoT to lower costs, optimize operations, reduce resource consumption, improve productivity, enhance customer service, and manage the supply chain. Similarly, they can also use IoT to drive product-related benefits, such as improving product quality, increasing uptime (e.g., decreasing the time the product is down for maintenance or repair), and using actual performance data to drive future design changes in the next generation of products. As IoT provides the basis for an increasing amount of automated data acquisition, manufacturers will be able to adapt their processes and their products not just for incremental improvements but also for transformation of the product, service, and business model. IoT gives manufacturers the opportunity to create "intelligent" products that can sense, learn, and predict customer needs as well as interconnect with other product ecosystems.

Applying IoT to the Manufacturing Industry's Unique Requirements

Within manufacturing, we recognize three fundamental use cases that reflect the unique industry challenges: connected products, connected supply chain, and smart manufacturing. In the sections that follow, we expand our definition of these use cases and the benefits they bring to manufacturers.

IoT and Today's Connected Products

From a service perspective, manufacturers have significant opportunities to use IoT and connected products, starting with enhancing existing service delivery. Field service that is based on actual product performance data allows manufacturers and the service channel to improve customer satisfaction and time-to-repair metrics. Remote diagnostics and condition monitoring of connected products (and in some cases, remote fix) enables more loyal customer relationships, increases customer lifetime value, and allows manufacturers to uphold product quality standards throughout the product life cycle, including informing future design.

IDC projects that by 2018, 40% of the top 100 discrete manufacturers will rely on connected products to provide product as a service. Forward-thinking manufacturers are already beginning to deliver innovative services, such as assisted operations and ongoing maintenance supported by IoT. Another example of product as a service includes the paint manufacturer that can deliver a continuous supply of white paint to the automotive OEM, based on production schedules and real-time plant inventory status.

The key benefits resulting from the promise of connected products are as follows:

- Documenting actual product performance, creating early warning and detection signals, and enabling closed loop feedback to drive quality improvements in future products
- Easing the transition to new services that should bring substantially higher margins and greater customer satisfaction levels

IoT and the Connected Supply Chain

We've also seen substantial change in the supply chain from the adoption of mobile devices, as well as a variety of sensors, including RFID and GPS, to better track inventory and assets in the warehouse and in transit. But as much as supply chain performance may have improved over the past decade, there are still visibility gaps in the supply chain. Furthermore, manufacturers are facing higher customer

service expectations from their customers. One of the most significant expectations is faster delivery time. We predict that by 2017, 50% of manufacturers will explore the viability of micrologistics networks to enable the promise of accelerated delivery for select products and customers.

To reduce order lead time, many manufacturers are moving away from the traditional large, regional distribution center and exploring smaller, local warehouses to deliver a "micrologistics" network. This is not a trivial undertaking, and the implementation of such a network absolutely requires manufacturers to have even more visibility into their logistics operations and inventory to prevent costs from spiraling out of control. Through IoT, manufacturers have the ability to revisit some of their early expectations for RFID and see them become a reality.

The practical use of IoT in the connected supply chain may be primarily at the asset level (e.g., shipping containers, pallets, and trucks); it also relies on low-cost, simplified data acquisition to enable some of the critical decisions manufacturers need to make in the supply chain. In other words, in their supply chain, manufacturers will use IoT to help create a level of visibility that relates to a common set of "business objects" — orders, shipments, and inventory positions, for example. Furthermore, the availability of real-time or near-real-time data points that define supply chain performance will enable manufacturers to respond to issues or changes in the environment much more rapidly.

The key benefits resulting from the connected supply chain are as follows:

- Managing inventory positions throughout an increasingly complex logistics network, with greater visibility into actual inventory
- Increased fulfillment execution capabilities, including the use of smaller, more localized warehouses located closer to customers

IoT and Smart Manufacturing

As global market and industry dynamics push manufacturers to rethink their manufacturing operations, effective factory management is essential. Smart manufacturing requires IoT-driven data analytics to improve asset utilization and greater efficiency. Combining new and old data with analytics-driven insight will give manufacturing workers the degree of flexibility and decision-making capability they need to deal with increasing market complexity and demand variability. We've predicted that in 2015, 65% of companies with more than 10 plants will enable workers on the factory floor to make better business decisions through investments in operational intelligence.

Unfortunately, today, many plant-floor workers are overwhelmed by an increasing amount of data and struggle to quickly understand what that data represents. It's essential for smart manufacturing to include an intelligence layer that connects the shop floor with the executive suite, providing real-time analytics to key decision makers. The IoT-enabled operational intelligence platform should bridge real-time information coming from the machine level with transactional business intelligence that sits on top of enterprise applications. The most immediate benefit of the "Internet of Assets" is eliminating the need to have personnel acquire and enter data on the plant floor. The greater long-term benefit is the ability to run autonomic or self-healing processes. Eventually, manufacturers should be able to have the operational intelligence that allows them to "see" across products, materials, and back-office information.

The key benefits resulting from smart manufacturing are as follows:

- Increasing reliability and quality through ongoing access to operational intelligence
- Connecting shop-floor decisions with corporate-level objectives, whether they are primarily focused on lowering costs, increasing customer service, or increasing revenue

Considerations and Essential Guidance

We are entering a golden age for innovation in manufacturing products and processes, all enabled by IoT. To achieve any of these objectives, manufacturers will rely on what IDC identifies as the 3rd Platform foundation that is built on cloud, mobile, social and Big Data/analytics technologies. Essentially, IoT is an innovation accelerator, and it depends on (and is enabled by) the 3rd Platform. These technologies must be core competencies for manufacturers to transform their products, processes, and business models.

We recommend that manufacturers take the following approaches to ensure they are maximizing the value they derive from connected products, connected supply chains, smart manufacturing, and IoT:

- Place a value on IoT investments that connects to overall business requirements, such as satisfying product quality goals, increasing customer centricity, and creating new revenue opportunities. A partner may help you develop a business case that is optimal for your specific situation.
- For connected products and product as a service, ask how sensor information, location data, or connectivity can disrupt your product model and look at this from an execution perspective in designing, manufacturing, and servicing the connected product. A partner can help with systems engineering, embedded systems, and service delivery.
- Review gaps in technology expertise required for IoT use cases. Consider your experience in leveraging newer technologies such as Big Data/analytics and cloud as well as more established technologies such as connectivity and infrastructure, data privacy, and security. Look to partners to fill in the gaps, provide best practice knowledge, and accelerate your path and scale across your business.
- Review your integration requirements. For example, a connected products platform may require a substantial amount of up-front integration to connect processes, organizations, and systems that cross ERP, PLM, SCM, MES, and CRM boundaries. A partner will help identify top priorities and speed the work.
- Look for a partner with deep industry domain and business experience that understands your costs, customers, and competitors. The right partner should help you move forward today and identify transformational opportunities for the future.

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