Smart, Connected Products

Transforming customer relationships and how manufacturers compete
Experts predict we’ll see as many as 50 billion "things" connected to the Internet by the end of this decade in a massive trend often called the Internet of Things (IoT). That’s a four-fold increase in just six years.

Others predict the IoT will generate as much as $6.2 trillion in global economic value over the next ten years. That’s about ten times as much economic value as will be created by 3D printing, another transformative trend.

Although there are more things getting connected to the Internet; it’s the fundamental nature of products—the ‘things’ in the IoT—that’s changing and driving innovation. The Internet is just a tool to amplify the value in smart, connected products, not the value creator itself.

First, the smart components of a product amplify the value and capabilities of the physical components. Then, connectivity amplifies the value and capabilities of the smart components. Together, smart, connected products enable a virtuous cycle of innovation.

Smart, connected products are transforming industries, customer relationships, and the nature of competition. With the right strategy, manufacturers can capitalize on these new opportunities to capture real economic value. In the end, it’s about making the right strategic choices, selecting the right partners, and enabling the right capabilities to create and sustain competitive advantage.
EVOLUTION OF SMART, CONNECTED PRODUCTS

To expose the transformational impact of smart, connected products, we outlined their evolution from physical assets to complex, evolving, and interconnected systems of smart, connected products across five phases:

1. **Physical**: The physical product is composed of mechanical, electrical, and other material components. Digitization—replacing analog product and service information with a fully accurate digital representation that can be easily leveraged across the value chain (e.g., engineering, factory floor, service)—drives efficiencies in this phase.

   While the physical product remains the foundation on which incredible amounts of new value are being created, it is now a necessary but insufficient component to drive innovation and sustain competitive advantage.

2. **Smart**: Manufacturers seeking to accelerate product and service innovation and efficiently meet the growing diversity of customer demand and regulation increasingly turn to embedded software, sensors, and processors.

   Smart products enable enhanced product and service capabilities and a user interface that expands user control and interaction with the product. This shift also requires a systems engineering approach where product hardware and software development processes are integrated.

3. **Smart and Connected**: Manufacturers increasingly add wired or wireless connectivity to their smart products to enable new product and service capabilities. Regardless of the type of connectivity, the ability to get data to and from remote products transforms the way manufacturers create, operate, and service that product.

   This transformation requires new infrastructure and capabilities.

   IT is often embedded within product and service organizations, and new business applications leveraged across business functions use connectivity and product data to deliver new features, quality improvements, remote service, and optimization of existing design, manufacturing, and service processes.

4. **Product System**: Some manufacturers move to integrate products—usually within the same industry like a smart farm, automated mine, or a fleet of vehicles—into a product system.

   Product systems require enhanced and often real-time analytics leveraging predictive algorithms to optimize system performance. New partnerships and personnel—like data scientists—and integration of other enterprise systems and processes, are critical to executing and capitalizing on these value opportunities.

5. **System of Systems**: Some manufacturers interconnect other products, product systems, and things. For example, a medical device connected to a smart home can analyze how frequently appliances are used to better measure the health of an elderly patient.

   Manufacturers looking to expand their system capabilities or efficiencies by coordinating with other systems must enhance their data management, privacy, and security capabilities, and requires the integration of third party systems outside their traditional partners, suppliers, and industry.
EVOLUTION OF SMART, CONNECTED PRODUCTS

There is an exponential growth in value opportunities for manufacturers as products become smart and connected.

<table>
<thead>
<tr>
<th>VALUE</th>
<th>Physical</th>
<th>Smart</th>
<th>Smart and Connected</th>
<th>Product System</th>
<th>System of Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product</td>
<td>Product is physical (i.e., mechanical, electrical)</td>
<td>Product incorporates software, sensors, processor</td>
<td>Product incorporates wired or wireless connectivity</td>
<td>Product is integrated in a product system</td>
<td>Product is coordinated across other systems</td>
</tr>
<tr>
<td>Product Capabilities</td>
<td>Core product capabilities</td>
<td>Enable personalization, enhanced functionality, and user interface</td>
<td>Enable remote monitoring, control, and service</td>
<td>Enhance product features, operation, and optimize system performance</td>
<td>Expand system capabilities and automate/coordinate with other systems</td>
</tr>
<tr>
<td>Systems Integration</td>
<td>Digitization of product definition</td>
<td>Hardware and software product definition are integrated</td>
<td>IT, product, and service systems are integrated</td>
<td>Other enterprise systems are integrated</td>
<td>Third-party systems across industries are integrated</td>
</tr>
<tr>
<td>Data Analytics</td>
<td>None</td>
<td>Batch analysis of historical product data</td>
<td>Ongoing analysis of product condition and use</td>
<td>Perform real time analytics and predictive algorithms</td>
<td>Machine learning and predictive analytics across systems</td>
</tr>
<tr>
<td>Business Opportunity</td>
<td>Product sale</td>
<td>Enhance product and service capabilities</td>
<td>Expand product and service capabilities and optimize existing process</td>
<td>Enable new process, and expand product and service capabilities</td>
<td>Transform business model and enable new business</td>
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CAPABILITIES OF SMART, CONNECTED PRODUCTS

As products evolve, they enable an entirely new set of functions and capabilities that create value for customers, manufacturers, and the connected ecosystem. Smart, connected product capabilities can be grouped into four categories: monitor, control, optimize, and automate.

<table>
<thead>
<tr>
<th>MONITOR</th>
<th>Sensors and connected data sources enable comprehensive monitoring of the product’s condition, operation, and external environment to generate alerts and actionable intelligence.</th>
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<tbody>
<tr>
<td>CONTROL</td>
<td>The operation of smart, connected products through remote commands issued by the manufacturer, user, or logic and rules built into the product enable control and personalization.</td>
</tr>
<tr>
<td>OPTIMIZE</td>
<td>The rich flow of monitoring information coupled with the capacity to control them allows manufacturers to enhance product performance and perform remote service and repair.</td>
</tr>
<tr>
<td>AUTOMATE</td>
<td>Applying software algorithms and business logic to data about the product, user preferences, and broader system over time enables the product to perform autonomously.</td>
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THE CHALLENGE: FAR SIDE OF THE MOON

These new smart, connected product capabilities create opportunities for consumers and manufacturers.

For manufacturers, one opportunity is solving an age old challenge. We’ve pursued the goal of product and service lifecycle management, but until now we all lose sight of the product once it’s been delivered to the customer. We call this the “far side of the moon” challenge.

What was required was a flawed relationship, where manufacturers talked to the customer to understand how their product was performing, how it was being operated, and how it could be improved.

During this longest period of the lifecycle—the “use phase”—we often only hear from the customer when something is wrong with the product, and we don’t know the customer relationship is in jeopardy until they call. This is no longer the right approach to customer relationship management.

When the Apollo 8 spacecraft orbited the moon for the first time in history, NASA mission control could only hold its breath and hope for the best—that it would reappear at the right time and at the right speed and course to make a successful landing. It had a happy ending, but imagine about how valuable it would have been for NASA to remain connected to the orbiter the whole time.
THE OPPORTUNITY: INCORPORATE THE VOICE OF THE PRODUCT

Smart, connected products have a voice and can exchange data with the manufacturer throughout the longest period of its lifecycle—the "use phase." This will bring about a new standard for managing the lifecycle of the product and customer relationship. One that was only imagined before.

Just think about how valuable it would be for manufacturers to stay connected to the products they develop and service every day. Instead of asking customers about product performance, they would gather design and quality insight from the product itself. They could provide more efficient service by knowing something was about to break instead of waiting for customers to tell them it’s broken. Imagine the business growth manufacturers could drive if they knew how their product was being used, and were then able to deliver additional value-added services as needed throughout the life of the product.

What is required is a fundamental transformation, from talking to the customer about the product to talking to the product about the customer.

Incorporating product usage data into product and service lifecycle management will require new skills, infrastructure, and cultural norms. The winners in this smart, connected world will be those who understand how to capture, analyze, and capitalize on these new streams of data. Those who don’t place their current competitive advantage at risk.
THE TRANSFORMATION: CLOSED-LOOP LIFECYCLE MANAGEMENT

By listening to the product during each and every stage of its lifecycle, you can access the information you need to transform how you create, operate, and service smart, connected products.

At PTC, we’ve been thinking about all this for a while. Our business and technology strategy has been guided by our realization that you need a partner that can deliver a closed-loop lifecycle management solution for products and services that are increasingly smart and connected.

With our heritage in computer aided design (CAD) and product lifecycle management (PLM), we help you plan for and drive innovation in product design to meet highly personalized global market demand. With our application lifecycle management (ALM) technologies and enhanced systems engineering capabilities, we help you manage the explosion of software driving much of product innovation today. Our supply chain and manufacturing planning (SCM) technologies allow manufacturers to collaborate with product development and identify an optimal set of parts, materials, and suppliers to reduce costs and time-to-production. With our market-leading service lifecycle management (SLM) technologies, we help you progress along a maturity model that enhances your service business from only support for “break/fix” to new services and service-lead business models.

And, with our acquisition and integration of the leading IoT technology companies, ThingWorx and Axeda, we can help you establish secure and reliable connections to your products, build the applications that can help you learn quickly from your products, operate them after the point of sale, and service them in new and more efficient ways.
As products have evolved from physical assets to complex and interconnected systems of smart, connected products, they have enabled four new categories of capabilities: monitor, control, optimize, and automate.

To capitalize on all of the opportunities smart, connected products enable, manufacturers must make critical strategic choices, and enable the right capabilities to create real value for their customers and differentiate themselves from competitors.

PTC’s own strategy has been guided by this evolution, and our solutions transform the way manufacturers create, operate, and service smart, connected products. The result? Closed-loop lifecycle management that delivers product and service advantage.

TO LEARN MORE

Visit PTC.com or contact PTC to discuss how PTC can help your company create, operate, and service smart, connected products.

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