IN THIS WHITE PAPER

In today's market, discrete manufacturers must stay focused on traditional objectives — increasing uptime and throughput in the plant and closely managing costs throughout their operations. At the same time, they must also create and offer more integrated products and services and even new business models to enhance the customer experience. These new offerings incorporate increasing amounts of technology — including Internet of Things. Indeed, by 2018, nearly one-third of industry leaders will be disrupted by competitors that are digitally-enabled. For manufacturers, this IDC white paper examines the current and future Internet of Things (IoT) imperative for the following discrete manufacturing industries: automotive, aerospace and defense, high tech, and industrial machinery. We highlight IoT-enabled scenarios — those possible both now and in an Industry 4.0 future with smart manufacturing. (IDC defines IoT as a network of uniquely identifiable endpoints or “things” that communicate without human interaction using IP connectivity.) These scenarios more tightly integrate “things” with other information, processes, and even value chains. Further, we demonstrate how companies in these industries leverage technology to create business value today and disruptive opportunities tomorrow.

Guidance

- **Stay focused on creating business value.** Digital transformation (DX) is not ultimately about the technology but about the outcome — how manufacturers can invent products and services and, consequently, business models, as well as more strongly engage with customers and consumers, drive process automation, and maximize their tangible and intangible assets.
• **Invest in key digital transformation scenarios.** Digital transformation is the continuous process of applying digital technologies to adapt to or drive disruptive business changes. Strategic asset management, the enterprise digital twin and enterprise quality, product and service innovation, and omni-experience customer engagement are the scenarios that will yield the most benefits for companies in the automotive, aerospace and defense, industrial machinery, and high-tech industries.

• **Integrate new technologies into your products and processes now.** Technology investments, most notably in IoT, are a critical component of DX, with manufacturers that have invested already seeing advantages such as greater visibility into actual product/asset performance. Today’s investments are the stepping-stones to future scenarios.

• **Build on your existing assets.** Manufacturers will require their new and existing business applications to support new, advanced ways of operating that are built on top of new capabilities enabled by IoT. Take a holistic view of your assets and ensure your people are prepared for change, including cooperation between IT and the line of business.

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**SITUATION OVERVIEW**

Discrete manufacturers in automotive, aerospace and defense, high tech, and industrial machinery and components are facing unprecedented pressures on their ability to innovate, engage with customers and consumers, and maximize return on their assets. They can only adapt to these pressures and succeed through digital transformation with smart manufacturing and Industry 4.0. The change in their industries will force dramatic shifts in business and technology investment strategies. The reality is that the status quo and today’s business performance, even best in class, are unlikely to be good enough in the future (see Figure 1).
The impact is on all areas of the business — in manufacturing and supply chain operations, research and development (R&D), design and engineering, the back office, and sales, marketing, and service. Discrete manufacturers are incorporating smart manufacturing and Industry 4.0 to drive greater efficiencies in the plant and higher-quality outputs. New products are smarter and more complex with more embedded sensors and software that support capabilities such as remote monitoring and predictive maintenance.

Discrete manufacturers are exploring the use of the digital twin — a digital representation of “as designed,” “as built,” and “as serviced” products and assets — to create new services or facilitate strategic asset management. And most importantly, they are working to better serve and understand their customers and consumers and engage with them and drive future sales through cross-sell and upsell opportunities. The foundation for these changes includes new technologies, such as IoT, big data and analytics, machine learning, cloud, and mobility. And the technologies will be woven into the products, assets, and processes, and that’s why we call this transition DX — or the continuous process of applying digital technologies to adapt to or drive disruptive business changes.
Through digital transformation, manufacturers may create new business models, new customer experiences, or new products and services that seamlessly blend digital and physical. They will also improve operational efficiencies and organizational performance.

**Business Drivers in Discrete Manufacturing for Digital Transformation**

IDC has identified drivers that have the greatest influence on technology buying in 2017. For discrete manufacturing, the most relevant drivers for DX include the following:

- **The DX delta — industry leaders widen performance gap.** The best-performing companies are pulling away from the rest, creating a landscape where DX leaders are the most profitable because they successfully adopt new technologies and deliver winning products and services more efficiently. The DX delta will continue as leaders successfully incorporate customer feedback to keep adapting and transforming how they operate, and those manufacturers that want to remain competitive will make innovation as high, if not higher, a priority as productivity. We identified only 5.8% of manufacturers worldwide as DX leaders, which means that only a small number of manufacturers have reached the optimized stage of our DX maturity model.

- **Revolutionizing industrial and commercial processes.** Digital technologies such as IoT, robotics, and 3D printing are rapidly becoming mainstream and transforming productivity, quality, and efficiency in industrial applications. For example, the continuous sensing capabilities of IoT is enabling companies to move into new markets and provide new products, services, and processes, not just modified ones. IDC forecasts that by 2025, 80 billion IoT devices will be online, creating 180ZB of data.

- **Data as digital capital.** IDC estimates that less than 10% of data is effectively used. Data must be treated as a digital asset, or digital capital, to improve experience, provide insight, influence decisions, and set directions. Today, in the manufacturing industry, increasing access to data is already in play through networks or industry clouds that hold asset performance data for benchmarking performance, predicting maintenance, and driving the initiation of existing services or the creation of new ones.

- **The rise of computer-based intelligence.** Many technologies — big data and analytics, cognitive computing and machine learning, robotics, IoT, and augmented reality/virtual reality — are converging to mimic and enhance human intelligence in real time. This will significantly impact manufacturers’ products and processes over the next decade, especially in terms of greater automation and autonomous capabilities.
The platform economy and the ecosystem battle for scale. We are entering a platform economy in which cloud platforms provide access to partners, tools, and information. This concept is familiar to most manufacturers that recognize value chain or supply chain “captains,” which establish the industry’s priorities, whether it’s innovation, quality, price, or just schedules. What’s new is the level of technology required to participate or hold that “captain”-type role and enable the platform.

Are Discrete Manufacturers Ready for Change?
The digital mission for discrete manufacturers is to transform what they design, build, sell, and service. Complex products evolve into product platforms that change how manufacturers engage with customers and consumers, create new revenue sources, and recognize revenue from services, information, and applications. The challenge today is to accelerate innovation and ultimately deliver technology in the form of new capabilities and as a service, profitably and at scale.

To transform, manufacturers will require even more integration and collaboration within the value chain. And in the transition, manufacturers must constantly strive to improve their productivity throughout operations, expand their capabilities in the plant and in their portfolio, and increase customer profitability.

Continuous improvement and disruption in the industry are the reasons why it’s becoming increasingly apparent that IoT and other technologies are simply an integral part of discrete manufacturers’ products (and services) and processes going forward. According to IDC research, IoT’s role in both operations and products and services is essential:

- **Updating operations with IoT.** By 2019, 75% of large manufacturers will update their operations and operating models with IoT and analytics-based situational awareness to mitigate risk and speed time to market.

- **Creating new products and services with IoT.** By 2018, 60% of large manufacturers will bring in new revenue from information-based products and services, while embedded intelligence will drive the highest profitability levels.

IoT is supporting business change that is both evolutionary (for efficiency and effectiveness) and revolutionary (transformative and potentially disruptive).
Some of the questions that manufacturers should ask themselves about their own capabilities in terms of updating operations include the following:

- Is manufacturing execution connected with engineering for design or tolerance optimization if necessary?
- Am I able to predict manufacturing downtime and maintenance needs and ensure enterprise quality objectives are achieved at all times?
- Can I provide real-time updated maintenance instructions and spare parts availability to field engineers?
- Can I track the energy efficiency and equipment effectiveness of my manufacturing machines, lines, and processes?
- Have my continuous improvement initiatives hit a plateau?

When it comes to capabilities for creating new products and services, manufacturers should ask themselves the following questions:

- Can I collect information about my existing products and processes with ease?
- Am I able to use the information to generate new revenue opportunities and increase profitability?
- Am I responding to service requests or product quality issues as quickly as I should?
- Am I able to respond to my customers’ demands for personalized products?
- Am I using quality, performance, and usage data from connected products to spark future innovation?
- Do I have visibility into customers’ actual product usage to drive new service offerings?

**Value Generation Scenarios in the Discrete Manufacturing Industry**

Discrete manufacturers are investing in scenarios now that leverage the capabilities of IoT and take them along the DX journey. At their core, these scenarios generate business value through cost savings, efficiencies such as asset effectiveness and process automation, or revenue generation through new services and greater customer loyalty. These scenarios may vary within each industry segment but are fundamentally as follows:
- **Product and service innovation.** Manufacturers are using actual product performance data from sensors to inform product design of future products and support service delivery, such as remote monitoring and predictive maintenance. This closed feedback loop between the product “in use” and design/engineering creates an opportunity to more quickly iterate on product design to improve performance or satisfy customer needs. Over time, this scenario evolves to incorporate service-related capabilities that can be built into the product. Services move well beyond IoT-enabled remote monitoring to more strategic management of the customer’s assets to predictive and even prescriptive maintenance, whereby the product itself identifies and calls for corrective action, either through a remote fix or by scheduling a service call. Ultimately, the confluence of product and service innovation creates new offerings.

- **The enterprise digital twin and enterprise quality.** In recent years, quality has become a strategic initiative, according to IDC’s research. Quality information needs to be embedded throughout business processes, whether product development, supply chain planning, manufacturing, or service, and there needs to be a visual way to manage and optimize the quality of products during their life cycle. This is why increasingly manufacturers are leveraging simulation and visualization technology across their enterprise in the form of digital twins of products — not only within design, engineering, and R&D but also across the business to track product performance, sales, customer interaction, and service. The digital twin is created from multiple data sources, including design files as well as IoT data. Essentially, the enterprise digital twin becomes the vehicle for quality information throughout the organization.

- **Strategic asset management.** One of the places digital twins have become established today is to manage the performance, effectiveness, and quality of a manufacturer’s fixed assets such as manufacturing machines, lines, and plants. Advanced visualization, IoT, and analytics applied to these assets enable manufacturers to take a strategic approach to asset management, where potential problems and service are predicted, leading to a reduction in downtime, greater productivity, and improved customer satisfaction.

- **Resilient lean.** Most manufacturers are familiar with continuous improvement methodologies such as Lean and Six Sigma. Some companies label these initiatives as smart manufacturing or Industry 4.0. As returns on these approaches diminish, companies must accelerate with the application of new technologies, including IoT. Essential components are real-time scheduling, energy management, and materials optimization. Where, when, and how products are produced are also factors in this scenario. For example, manufacturers may opt to use additive manufacturing (with 3D printing) in facilities located close to the customer for some portion of their production.
Omni-experience customer engagement. Manufacturers are seeking greater engagement with the ultimate users and consumers of their products, understanding the imperative for greater customer centricity across business functions. This requires engaging with customers and understanding customer requirements from the earliest interactions, customizing the products to deliver value, and then providing the customer with a seamless experience across all touch points throughout the product ownership cycle. A 360-degree view of the customer exists across sales, marketing, product management, production, and service to ensure that the omni-experience persists from the first interaction to product retirement and replacement. IoT-enabled products provide manufacturers with a valuable source for customer information and engagement.

Defining the Business Value — Company by Company
Calculating the business value manufacturers will receive for each of the scenarios varies significantly from manufacturer to manufacturer. However, consider that over the past few years, the major automotive OEMs have spent billions on recalls. These costs have trickled down through the supply chain. Even a small percentage improvement or even greater predictability of enterprise quality could result in millions of dollars of savings.

Most manufacturers already recognize that new products and services create significant revenue opportunities. The more advanced manufacturers are already working to increase their services to boost revenue and profitability. IDC estimates that manufacturers that can successfully use service quality measures to enhance customer experience will have 20% more aftermarket revenue than their peers.

Similarly, increasing productivity on the plant floor quickly translates into business value. Decreasing or eliminating downtime on the plant floor is a top priority for most manufacturers, and for good reason. The cost of downtime ranges from $8,000 to $22,000 per minute, depending on the industry segment.

Finally, manufacturers that can increase customer loyalty and customer satisfaction can translate these benefits into financial outcomes. For example, our research shows that manufacturers that can deliver customer-centric experiences have two times the revenue growth compared with the overall market.
Taking an Industry Approach

Of course, not every industry segment within discrete manufacturing interprets the scenarios in the same way. Furthermore, many business initiatives combine scenarios, such as service innovation and customer engagement. In the following sections, we highlight some of the most important value generators for the automotive, aerospace and defense, high-tech, and industrial machinery industries (see Figure 2).

**FIGURE 2** IoT in Discrete Manufacturing

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**Automotive**

**Design and Ideation**

*Value Drivers:*

- Faster product engineering cycles and quicker time to market
- Improved customer satisfaction with products that better address real performance requirements
- Reduced manufacturing cost by removing non-value components
Thanks to the IoT, it’s possible to truly manage the life cycle of products. However, processes are not yet in place at most automotive manufacturers to easily leverage performance, quality, and usage information for design improvement and ideation.

Enabling a connection of this information from products in service back to engineering will result in faster engineering changes (and service delivery) to existing products. This will also result in a smarter approach to the next round of product design and development. An even smarter approach in the future: when machine learning technology can be applied to a library of past product performance information to augment the design and ideation process.

### Service Enablement

**Value Drivers:**

- Improved customer satisfaction via aftermarket quality assurance and upgrades
- Increased revenue from aftermarket services

The enablement of services is the most common scenario for IoT in the automotive market because the technology allows manufacturers to more easily track product defects and maintenance needs and communicate service updates and notifications proactively. And with 10 million lines of mission-critical software code or more in many cars, there’s a need for ongoing management and servicing of this code — the IoT gives car manufacturers the luxury of pushing out software updates or even software upgrade offers.

### Resilient Lean

**Value Drivers:**

- Faster manufacturing cycles and quicker time to market
- Less working capital and reduced excess inventory levels

Continuous improvement of manufacturing and product quality has always been a focus for automotive companies, and now these initiatives are in hyperdrive. Shorter time-to-market timelines, rapidly changing demand, highly complex products and processes, and increasing material considerations around lightweighting and 3D printing are all factors leading auto manufacturers to a resilient lean manufacturing approach.

This approach enables real-time scheduling to meet changing demand; efficient, flexible manufacturing processes; and optimization of materials, powered by IoT and analytics for...
ongoing decision support. IDC research finds that process automation is one of the top areas manufacturers seek to improve with IoT data and analytics.

**Platform Revenue**

**Value Drivers:**
- Increased aftermarket revenue via upgrade and content monetization
- Improved customer satisfaction via enhanced experience

The next great opportunity for IoT in the automotive space is leveraging usage and engagement information to effectively send content—such as software upgrades and infotainment—that a driver is willing to pay for. In fact, many car companies are building retail teams to explore and enable this opportunity. In addition, IDC research indicates that creating new insights for revenue-generating services and improving marketing relevancy based on consumption patterns and preferences, demographics, and location data are top areas where manufacturers want to apply analytics.

**Aerospace and Defense**

**Service Coordination**

**Value Drivers:**
- Increased asset uptime and reduced cost via enhanced coordination
- Improved customer satisfaction via equipment performance improvements

The complex supply chain that supports an aircraft comprises up to 4 million parts and thousands of suppliers globally. With an industry imperative to reduce aircraft-on-ground time, service providers ranging from airline operators to maintenance, repair, and overhaul (MRO) providers must coordinate their service efforts.

Using a digital twin of an aircraft in operation can provide both visibility across major components and a centralized, up-to-date source of information to all members of the value chain, from the OEM to operators to suppliers and service providers. This results in higher availability, the ability to quickly share service bulletins and important notifications, and greater transparency into equipment performance. Ultimately, costs can be reduced and customer satisfaction improved.
Predictive MRO

Value Drivers:

- Increased asset uptime and reduced cost via predictive maintenance
- More profitable contracts based on historical and predictive performance data

Given the long life cycle of aircraft, a significant portion of operating costs are related to maintenance, repair, and overhaul activities. Managing a widespread global network of spare parts, technicians, and services that are calibrated to minimize aircraft downtime is critical to success. Using sensors and IoT for key components such as engines and wing flaps enables maintenance providers to anticipate a part failure. They can then locate the parts and skill set necessary to perform the repair and have both waiting at the depot when the aircraft arrives to speed repair and get it back in the air.

Service providers can control costs by combining repairs, understanding parts failure patterns, and optimizing spare parts inventory across the entire network of aircraft. They can also use actual product performance data to design future contracts that balance customer service and contract value.

3D Printing Service Parts

Value Drivers:

- Increased asset uptime and reduced cost by spare parts management
- Improved customer satisfaction via improved asset uptime

The mobility of a fleet of aircraft, makes it difficult to anticipate when and where a particular part may be needed. Although IoT helps manufacturers track inventory more easily, that isn’t always the solution. Not having the right part in the hangar when an airplane touches down at the airport can cause aircraft-on-ground delays that impact flight schedules, fleet coordination, SLA compliance, and ultimately customer satisfaction. In addition, the costs to the bottom line add up quickly, with an industry average cost of $60,000 for a commercial airline grounded during a typical “B check” maintenance series, not including replacement parts. The costs increase if the parts need to be shipped to the hangar.
Adding 3D printing capabilities is a resilient lean approach that can greatly reduce the costs that an MRO provider or the airline experiences from aircraft-on-ground situations. Locating the 3D printer at the hangar or a partner’s distribution warehouse for an MRO network can significantly improve the response time for parts needed as well as reduce costs related to holding excess inventory in multiple locations.

**High Tech**

**Technology-as-a-Service Innovation**

**Value Drivers:**

- Faster product engineering cycles and quicker time to market
- Improved customer satisfaction via products that better address customer requirements

A big challenge this industry segment faces is how to accelerate the delivery of new technology and new technical capabilities at scale. The smart, connected high-tech product is essentially a platform that can easily be modified through the delivery of new content and capabilities that in turn can be delivered seamlessly “as a service.” Manufacturers will rely on IoT to acquire information about the product and how customers are using it and to deliver customer-relevant updates wireless. In effect, technology updates and enhancements are available to customers as a service on demand.

The result brings technology innovation to market faster, at scale, and seamlessly enhances customers’ experience. For example, many high-tech IoT-enabled products are used in the datacenter. Relying on actual performance data and performance requirements, manufacturers can more easily upgrade and tune equipment based on customer demands.

**Strategic Asset Management**

**Value Drivers:**

- Increased asset uptime and reduced cost by more holistic plant and equipment monitoring
- Expanded margins via reduced waste with improved, real-time quality controls

Accelerating the delivery of new technology at scale is this industry’s priority. It’s critically important that manufacturers ensure all productions can run at full capacity to ramp to volume quickly. Strategic asset management is a top priority, collecting data from IoT in the plant to ensure that equipment is available for the production schedule.
Enterprise quality is also critical because quality controls for high tech must be extremely unforgiving. With IoT data, manufacturers can ensure their processes are harmonized and continuously improving.

**Industrial Machinery**

**Predictive Service**

**Value Drivers:**

- Increased customer satisfaction from improved asset uptime
- Expanded service revenues via after-market service contracts

With tens of thousands of machinery manufacturers in the world today that serve industries as diverse as food and beverage, high tech, and automotive, the market for industrial machinery is highly competitive. And industrial machines have a long shelf life — 20+ years on average, with some industries double or triple this lifetime. The need to increase service revenue is paramount. Machines fitted, or retrofitted, with condition-monitoring sensors, combined with IoT, cloud technology, and analytics, enable these manufacturers to offer ongoing service packages to their customers that ensure machine uptime and productivity and on-time delivery of products to the end consumer.

**Resilient Lean and 3D Printing**

**Value Drivers:**

- Increased customer asset uptime and reduced cost via spare parts management
- Expanded customer revenue via customized part and product design

Industrial machinery manufacturers need a flexible, lean manufacturing approach that meets customized demand for a diverse set of industries, initially and aftermarket. One of the key ways these manufacturers can enhance their service offerings is through 3D printing — initially for slow-moving, out-of-production spare parts and then additional, more complex machinery parts as 3D printing technology speed and efficacy improve. Connected machinery alerts the OEM about a 3D-printed part need; the manufacturer can respond quickly, producing the part in a local 3D printing facility for the same or next day delivery. The enablement of digital collaboration with customers for customized part and product design as well as ensuring a high level of quality for 3D-printed parts is a future opportunity.
Design Flexibility

Value Drivers:

- Faster product engineering cycles and quicker time to market via data-refined model-based systems engineering approach
- Increased customer satisfaction with improved configure-to-order options

Industrial machines are incredibly complex. Ideally these machines need to be built with a model-based systems engineering approach where designs and approaches can be reused for a variety of customers. Every machine is customized, and time-to-market demands are critical, so machinery manufacturers need to move quickly and efficiently. Having a network of sensor-rich machines enabled by the IoT helps enhance the systems model of their machines as well as the configure-to-order options that exist for new customers.

IoT’s Critical Role in Digital Transformation for Discrete Manufacturing

IDC predicts that the worldwide IoT market will represent upward of $1.3 trillion in 2020, supporting 30 billion connected endpoints. With IoT, manufacturers are making significant progress with DX.

Connected devices now provide the potential to generate and access data that businesses couldn’t previously obtain with ease, and the cost of these technologies has fallen radically in recent years, allowing for increased connectivity between physical and digital objects in an unprecedented way. Consequently, manufacturers are now able to respond to changing market conditions with speed and agility. Manufacturers can also engage the business and its partners and customers with real-time information that can be turned into actionable insights. Manufacturers use these insights to formulate new products and services, change processes, and engage with their customers differently. All of this adds up to digital transformation.

IDC believes that IoT is a key element driving DX. At the heart of IoT-enabled digital transformation is not only the connection of devices or the use of digital technologies but also the generation and analysis of data that can be used to derive meaningful intelligence across the business. Today, many companies across a range of industries are turning IoT-generated data into actionable ideas, often combined with machine learning, to enhance business processes and customer experiences as illustrated in Figure 3.
Across industries, many businesses are confronting the potential for digital disruption. As more businesses begin to explore the ways in which the IoT can bring about transformation to their operations, IT and line-of-business executives will view and act on digital transformation threats and opportunities with urgency. The IoT will be instrumental to enable successful digital transformation. The companies that are most successful will employ vastly different business models and strategies leveraged by IoT technologies to gain competitive advantages in their markets.

Industry disruption from IoT technologies is clear and present. Enterprises will need to adapt quickly to compete in a digital world or risk being left behind by their competitors. Businesses need to assess their digital maturity and readiness for the enterprise to undergo IoT-enabled digital transformation. This requires strategy formulation and investment from key stakeholders in the executive suite, IT, and lines of business. Each group of stakeholder needs to collaborate to define practical scenarios in which connected devices and IoT-generated data can help create value for the business. IoT investments must be linked to specific business needs — such as products, processes, or customer experience — and should avoid simply being “patched in” in a piecemeal manner. Key performance indicators and estimated returns

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**TABLE 3** IoT Changes the Paradigm across the Business Organization

<table>
<thead>
<tr>
<th>Before IoT</th>
<th>Today</th>
<th>Next Gen IoT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asset Management</strong></td>
<td>Break/fix maintenance</td>
<td>Condition-based maintenance</td>
</tr>
<tr>
<td><strong>Design &amp; Engineering</strong></td>
<td>Reactive product changes</td>
<td>Faster Engineering Change Orders, more product launches</td>
</tr>
<tr>
<td><strong>Product Management</strong></td>
<td>Manual customer feedback</td>
<td>Product portfolio optimization</td>
</tr>
<tr>
<td><strong>Production &amp; Quality Control</strong></td>
<td>Overall equipment effectiveness</td>
<td>Asset utilization, quality assurance</td>
</tr>
<tr>
<td><strong>Sales and Marketing</strong></td>
<td>Segment-based message/offer</td>
<td>Location-based offers</td>
</tr>
<tr>
<td><strong>Customer Service</strong></td>
<td>Customer-driven contract</td>
<td>Product alerts, customer-driven</td>
</tr>
<tr>
<td><strong>Finance &amp; Accounting</strong></td>
<td>Product sales</td>
<td>Consumption-based billing</td>
</tr>
</tbody>
</table>

Source: IDC, 2017
on investment will be key to demonstrating the value of IoT deployments. Through discussion with trade organizations, industry peers, and IoT vendors and service providers, enterprises should also seek to become more knowledgeable about the IoT and how it can enable digital transformation.

The technologies that relate directly to an IoT project are shown in Figure 4. Manufacturers often work with multiple suppliers for these technologies.

**FIGURE 4** IDC’s IoT Technologies

Source: IDC, 2017
The Underlying Role of IoT Technology

When considering IoT within a specific industry, it’s easy to think about it from the business and operational impact it has. However, for an IoT project to maximize its effectiveness, manufacturers will need to bring together a larger set of technologies, including many existing IT assets (see Figure 5), not just those in Figure 4. In most cases, the cloud and analytics play the biggest role as they allow scalability and interpretation of the data, respectively.

Simply put, the IoT encompasses all the attributes of the 3rd Platform, which includes big data, cloud, social, and mobile. Big data enables real-time decision making and provides the engine for powering new data sources. The cloud allows for variable workloads from connected endpoints as well as the scalability and flexibility that are crucial for the deluge of data expected from the numerous IoT endpoints. Mobile enhances field processes and connects endpoints from a variety of (often remote) locations, and social provides an outlet for automated responses from the connected endpoints to interested end users or decision makers.

IDC sees data generation from any source (whether traditional ERP, social, or IoT) as significant. Initially, this data will originate on-premises, but then decline over time in favor of cloud.
FUTURE VISION FOR THE DISCRETE MANUFACTURING INDUSTRY

Discrete manufacturers are among the most advanced in using IoT today. The IoT has already become an integral component in many manufactured products and increasingly in their introduction of new services. Many of the capabilities shown in Figure 6 will be assumed and part of everyday business.

To achieve this reality, discrete manufacturers must have a bold vision and begin to invest in IoT now — both to experiment for the future as well as achieve real value today. Companies need to create a comprehensive, holistic plan for digital transformation that includes IoT and many other technologies referenced in this white paper. This plan should begin with an aspirational digital mission that articulates how critical technology is to the company’s future. The mission should help shape a set of strategic priorities for each line-of-business function in the organization that, in turn, will frame a programmatic approach to investment over time. These programs will be made up of projects or scenarios, like the ones discussed in this white paper (also refer to Figure 6).
The key point is preparedness. Whether a scenario is implementable today or on your road map for the near future, begin by getting the right technology and IT infrastructure in place.

Thus, companies should:

- Get started now, so they won’t be left behind as the DX delta grows.
- Focus on the scenarios that are most relevant to the industry — strategic asset management, the enterprise digital twin and enterprise quality, product and service innovation, resilient lean, and omni-experience customer engagement.
- Align efforts with key business goals today and possible market disruptions in the future.
- Conduct a digital-readiness audit. Be ruthlessly objective in self-assessments of digital preparedness and readiness.
- Begin or continue the process of systems and business process modernization, and make sure the organization is ready for change.
- Identify the ecosystem of partners in the digital transformation journey. They should help speed the way forward.

We recognize that selecting a partner is no simple matter, especially for IoT. However, taking a holistic approach requires a partnership with a provider that can satisfy many important criteria:

- **Integration.** At a minimum, the vendor should show the ability to integrate business systems, the digital platform, and industry clouds. In the best-case scenario, the vendor would provide a common foundation for all three. In this case, there are substantial cost-of-ownership and agility benefits.

- **Scale.** The vendor should be able to scale digital activities as they grow.

- **Ecosystem.** A rich third-party developer community will be necessary to achieve all the possible scenarios.

- **Trust.** The vendor should be willing to co-innovate and tie its compensation to project success.

Use this framework to build your digital plan and identify the scenarios that have the most impact on your overall goals. Time is of the essence; activity in the discrete manufacturing industry is well under way, and there is tremendous risk of falling behind.
Glossary of Key Terms

- Digital transformation (DX): The use of 3rd Platform technologies — big data, analytics, social, and mobile — to create value and competitive advantage through new offerings, new business models, and new relationships

- Digital twin: A digital representation of “as designed,” “as built,” and “as serviced” products and assets to create new services or facilitate strategic asset management

- Internet of Things (IoT): A network of networks of uniquely identifiable endpoints or “things” that communicate without human interaction using IP connectivity