Smart connected manufacturing
New models for a data-driven world
Advanced digital technology is transforming manufacturing in profound ways. Smart sensors, digital twins, 5G, machine vision, the industrial internet of things (IIoT) and other technologies are swiftly changing the way products can be designed, manufactured, delivered and maintained. Increased digitalization is leading to improved customization — resulting in a better customer experience. Additionally, analytics and artificial intelligence (AI) are taking a wider role in the manufacturing life cycle, as companies leverage data to reduce downtime, increase productivity, improve quality and gain other efficiencies such as supply chain transparency.

Despite these advances, however, the traditional technology paradigm at manufacturing companies has largely remained the same: The IT side of the business focuses on networks and core back-office functions, while the operational technology (OT) side keeps the production lines going. Business units operate in silos, and customers may or may not have similar experiences when dealing with engineering, sales and services teams in the same company.

Many manufacturers are discovering that this traditional way of doing business no longer supports success. To keep their leading positions, companies are looking to transform their business models and build new value chains through smart manufacturing.

They want to drive innovation and multiply knowledge sharing through improved partnerships and collaboration. They want to shift their focus from simply selling and producing products to also delivering a full array of connected after-sales services throughout the product life cycle. They may even seriously consider transforming to a “multisided platform” that generates more value by acting as a multiplier at a lower cost.

But implementing these changes won’t be easy. In addition to technical know-how, change requires a cultural shift that includes being receptive to collaboration and an outside-in view.

Business drivers for industrial digitalization

Creating value through smart connected manufacturing involves establishing ecosystems of connected products and services to transform operations, value chains and customer experiences. This typically means modernizing and extending the digital platform to facilitate collaboration with internal and external partners, suppliers, customers and other entities in the ecosystem, and automating processes.

Industrial digitalization produces numerous benefits that help manufacturing companies remain competitive, including:

- **Greater productivity and lower costs.** By optimizing how they use physical and financial assets, companies can reduce costs across the manufacturing process. Greater automation increases efficiency and quality, and digital business platforms can boost scale and speed. This can be accomplished by deploying modernized infrastructure and operational platforms as well as by gaining better insights through analytics.
• **New revenue streams.** Advanced, customized products combined with connected after-sales services — or even a full subscription-based services approach — attract new customer groups, enhance customer experiences, improve competitive differentiation and drive new sources of revenue.

• **Improved customer experiences.** Customer experience has become the ultimate battleground for many companies and brands. Integrating customer data across silos and understanding customers by using machine learning are enabling highly personalized interactions and making it possible to deliver accurately focused, proactive customer services, such as “next best offer,” to drive loyalty.

**Smart manufacturing requires digital mastery**

While the potential benefits of smart manufacturing are clear, the path is filled with challenges, both technical and cultural. It requires that companies become “digital masters.” This calls for new mental models to take on these challenges — models crafted to achieve a fully integrated environment, better collaboration, an Agile approach and data-driven capabilities. To start down the path, we recommend focusing on the following priorities.

**Break down the silos.** Smart manufacturing goes well beyond the factory floor and includes digitalizing design, engineering, marketing, sales and service, finance, as well as production. Traditionally, barriers exist between the various functions, and companies need to break down the silos in the manufacturing value chain to foster improved internal and external collaboration. Today’s manufacturing companies must stand up value networks that include customers, suppliers, partners and providers. It’s all about sharing, cooperating and, most importantly, breaking down the barriers to allow interconnectivity and ignite innovation.

AI-powered autonomous factories allow companies to engage differently with the outside world. Traditional supply chains become value networks that enable ecosystem participants such as customers, manufacturers, suppliers and independent software providers to interact in more collaborative, Agile and ad hoc interaction models.

The transformation to the digital factory is not just a business or technological transformation; it’s also a cultural change in the way organizations are set up and led. Functional thinking centered on specific areas such as production, engineering and sales doesn’t work anymore. The new digital world of smart manufacturing breaks down those borders and integrates the various aspects of the industrial life cycle for a seamless experience.

A more effective flow of information must be established by assessing the existing state of systems and processes that enable cross-functional efficiencies and repurposing them to be more fluid. This requires a more finely grained service architecture that allows collaboration both within the enterprise and with outside companies, as well as mature data management approaches and data governance processes.

Learning by fast iterations and improving collaboration as a company is also important for trying new processes and technologies that can benefit the life cycle.
An organization can encourage development of Agile projects with short-term initial outcomes that can be learned from and used to inform and feed next steps. This gets a company from the initial exploration stage with a dedicated team to rapid scaling and deployment of a solution that spans suppliers and customers.

**Provide a seamless customer experience.** Seeing the business from the outside in, from the customer’s perspective, is a necessity. While compelling experiences are easy to recognize, they are hard to design and deliver. Applying a human-centered approach — such as using customer-journey mapping to design, build and launch omnichannel experiences and experience-led products and services — is critical for customer loyalty.

Today’s customers expect a seamless experience when engaging with a manufacturing company. If a customer wants to make a purchase, customize a product or explore after-sales services to enhance a product’s functionality, that customer wants the same or a similar experience no matter what part of the company is being dealt with.

To provide this consistency, front-office technologies and processes need to be seamlessly integrated with back-office operational infrastructure to instantaneously deliver an uninterrupted service experience across the entire manufacturing life cycle.

Integrating customer data across silos and understanding customer behavior have become table stakes in customer experience. Applying machine learning enables highly interactive, personalized customer interactions and services.

**Adjust the business model.** Business model transformation doesn’t always require disrupting a company or its product life cycle. Many manufacturers are shifting from pure product-based business models to as-a-service offerings. This requires capabilities such as analyzing data feeds from the products sold to enable things like predictive maintenance, but it can also mean implementing a more advanced subscription-based pricing platform that enables consumption-based billing.

It requires an end-to-end design and tight integration with the customer’s devices and business processes, as well as an Agile software engineering capacity to deliver new, incremental product functionality through regular software updates. Those who succeed will benefit from better, stronger relationships with their customers and new sources of revenue for themselves.

Manufacturers also must evaluate emerging manufacturing-focused digital platforms that can disrupt the industry, as they provide a central point to consume services, direct customer access and connect manufacturing capabilities with demand at scale. Companies that cannot create their own multisided platform can still use platform economics to transform their business model or play a vital role in a platform operated by others.

**Modernize operations with digital thread.** For smart manufacturing to become a reality, manufacturers need to integrate various systems and processes into a single cohesive ecosystem that encompasses all aspects of the business, including the wider value chain. Single units such as product development, production, sales and services, and supply chain must be combined into an integrated digital ecosystem that drives insight and innovation. This digital thread enhances the future of manufacturing and delivers the agility and antifragility required in today’s volatile, uncertain, complex and ambiguous world.
Combining isolated islands into a digital thread via inexpensive sensors, IIoT and the cloud will allow people, machines and components to constantly communicate with each other and provide a single source of truth to manage, optimize, enhance and automate processes end to end.

Digital thread requires complete data integration from the machinery on the production floor through all production-relevant systems, up to the management decision level and any relevant, external data sources. Building on IIoT concepts, smart manufacturing production systems can take advantage of the massive amounts of data being produced by connected devices. Successful integration of the data will enable manufacturers to master the shift from backward-looking reports to real-time, data-driven decision making.

Part of building a cohesive ecosystem is bridging the gap between the IT and OT factions of a manufacturing company. Both sides need to move out of their comfort zones and learn about the other side to achieve the IT/OT convergence required to enable the smart factory.

In this area, however, one aspect of IT/OT convergence that needs to be addressed is the lack of standards on the operational technology (OT) side. While the IT side has detailed practices in place such as ITIL, this type of framework largely does not exist on the OT side. Once a framework of standardized processes is introduced into the OT environment, the OT business can be run like the IT business, and it will be easier to merge the two worlds.

Industry leaders that effectively implement OT service management benefit from consistent architectures that are easy to scale and maintain while allowing for local innovation and flexibility.

Build the foundation: a digital platform. Every company ecosystem needs a digital platform to power business processes and to enable and integrate transactions, innovation and evolution capabilities — and smart connected manufacturing follows the same principle.

Traditional companies are often hampered by legacy technology, which is complex, not fully integrated, hard to change, costly to maintain, and has many overlapping systems and business processes.

Advances in technology and methodology in recent years have made it easier to build a solid digital platform or modernize an existing one. Agile development methods, external code libraries and easy-to-use development tools enable developers to build new functions rapidly and in line with new business requirements.

A modern digital platform needs to provide the operational and transactional services that power a company’s key processes. Digital platforms support the externally facing services that connect to customers and ecosystem partners and the data-driven services that provide the ability to perform intense analytics. Improved analytics upgrade the customer experience and internal operations by constructing combinations that were not feasible before.

Such platforms are based on the cloud, use open APIs that orchestrate the exchange of data across the ecosystem, and follow Agile application architectures powered by consumption-based, as-a-service components using microservices or containers. The platform needs to embody a foundation for digital trust through identity, vulnerability and threat management across all services.
Digital platforms are centered on an intelligent core to analyze and generate actionable insights from the data flowing through the platform and its participants. Over time, they become increasingly automated and autonomous, often powered by machine learning and AI.

Together, they help to build data fluidity — the flow of high-quality, trusted data and hence the lifeblood of platforms and ecosystems — ensuring that data is accurate, accessible and actionable (see Figure 1). Improving data fluidity is a key purpose for the digital platform’s owner.

When defining a digital platform roadmap, make sure you consider how to include legacy systems, since integration of both worlds is key when developing the future architecture.

**Protect information with the right security balance.** Protecting information in a manufacturing organization is very different from protecting information in other industries. As smart manufacturing companies strive to improve integration, sharing information places a sharper focus on security. From manufacturing processes to design secrets, IP assets are the crown jewels of manufacturing. Companies must find a balance between sharing information with partners, suppliers and other third parties, and protecting their IP assets.

Connected devices, sensors and smart things must be secured. IT/OT convergence is driving organizations to develop a holistic and harmonized approach to security in order to minimize business risk.
Stand out from the competition

Most manufacturers hope to stand out from the competition through faster response times, higher-quality products and excellent customer service. To do this in a digital world, companies need the flexibility to innovate and the ability to compete with manufacturers that are already taking advantage of technology — and are consequently lowering their cost of entry, increasing their speed to market, and generating more and different forms of value. It’s hard to think like a nimble startup when your company needs to modernize systems and processes.

The fully integrated smart manufacturing enterprise focuses on the horizontal flow between vertical functions — with an emphasis on collaboration — and implements systems to improve communication and support a more efficient flow of information.

Smart connected manufacturing relies on innovation, wise choices and well-planned integration. As the competition for experienced talent rages on, companies can benefit greatly from an independent services provider such as DXC Technology that can tap into its experience with mission-critical core systems and partnerships to deliver the optimal solutions that meet specific needs.

About the authors

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About DXC Technology

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