IDC Technology Spotlight

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*Becoming **digital platform- and data-driven** is essential for consumer product companies to enable new customer experience–led business models.*

The Business Value of Digitalization and Digital Twins in the Consumer Product Industry

Executive Summary

The consumer industry is undergoing a series of dramatic changes, triggered by consumer demand for personalized experiences and products, continuously increasing time-to-market requirements (from months to days), growing complexity of product design, demand for "size-of-one" lots in manufacturing processes, and emergence of technologies such as artificial intelligence (AI), the Internet of Things (IoT), and blockchain. In this context, consumer product (CP) companies are implementing major digital transformation programs to evolve from productivity-focused approaches to customer experience–led business models. IDC research shows, however, that76% of European CP companies are still distributed among the lower maturity stages of digital transformation.

Embracing digital platforms — and becoming data-driven — is essential for CP companies to enable new customer experience–led business models. The streamed gathering and analysis of customer, product, and process data — unified to facilitate platform-based collaboration across the ecosystem of partners and suppliers — enables CP companies to continuously innovate their offering at speed and scale.

CP companies can plan, manage, and execute this complex set of activities by leveraging digitalization platforms that provide the environment for digital twins of products, assets, and ecosystems. Digital twins are receiving a lot of interest from the CP industry because they promise to improve innovation and design, visually enhance collaboration, and enable ongoing operation of connected products and assets — all in a fast-paced, digitally transforming, competitive environment for manufacturers.

Digital twins, or virtual representations, can be used to manage multiple aspects of a CP business, including product and package design, ongoing optimization of connected products, and manufacturing process modeling, operation, and optimization. IDC data shows that 36% of European CP companies are investing in digital twins in the short term, 50% of North American BOVC (brand-oriented value chain — CP, CPG, retail) respondents say that digital twins are an important technology for their product and service innovation efforts, and 20% of respondents in Asia/Pacific say they will be investing in digital simulation systems in the next two years.

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The benefits of digitalization platforms for **product life-cycle management** resonate with the four core areas of the consumer industry extended value chain:

- At the ideation stage, digital twins enable highly efficient **design and development processes**.
- Digital twins are essential to update and execute at speed and scale **manufacturing and production processes** driven by customer experience requirements.
- Digital twins play a concrete role in **supply chains**, as these can be virtually designed to model risk and optimal execution and to determine the capability required to meet predicted demand.
- They are also an essential support for **commercialization and customer engagement**, as they provide data foundations to execute product personalization at scale, to enable direct-to-consumer commerce services, and to capture customer experiences.

Key Technology Trends Related to Digitalization Platforms

For many years, CP companies have focused their businesses on **fulfilling orders** from their main customers, the retailers. Fundamentally, CPs' guiding principle was calibrating production processes to demand cadence, in a context where the experience was in the hands of the retailers.

However, this was true only for the years during which the retail industry was leveraging asymmetric customer experience strategies, focused on maximizing revenues from rigid customer journeys and standardized offerings that relied on static customer segmentations.

Today, the **customer is in the value chain driver seat**, and retailers are gearing their customer experience strategies toward **real-time contextual personalization**, relying on capturing dynamic customer journeys and segment-of-one customer profiling. Such a dramatic change is leading retailers to make considerable investments to digitally transform their companies. For retailers, the key objective is to become **platform- and data-driven** organizations, integrated into the extended value chain for optimized operations execution and collaboration-based innovation.

In this context, consumer product companies often struggle to really understand consumer needs and wants or even things consumers don't yet know they want. It's part of the reason that **80% of new products fail**. CP companies need to move from being demand- and fulfillment-driven — with a productivity focus approach — to **delivering customer experiences** that rely on streamed data gathering from the extended value chain and on mass customization-oriented processes.

*The combination of innovation accelerator technologies with a **digital transformation strategy** helps CP companies address the challenge of **product obsolescence**.*

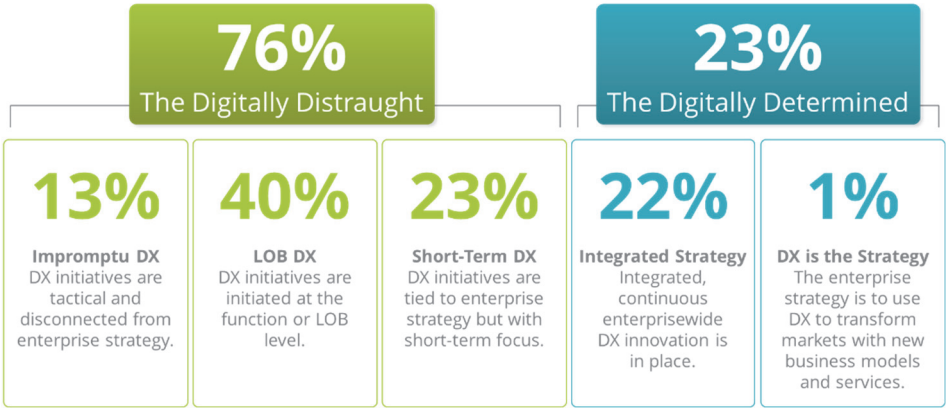
Globally, most of the CP industry is still in the early digital transformation maturity stages, while the more mature and forward-looking companies are investing their efforts in ecosystem-oriented business model innovation.

As a result, the manufacturing industry — and the CP subindustry with it — is changing faster than ever before. Digital technologies like cloud, mobile, Big Data and analytics, and IoT have been drivers in the industry for years, and companies of every size must embrace them. Manufacturers also have high expectations for the business value of technologies that are in earlier stages of adoption, such as edge computing, **cognitive computing/artificial intelligence** (AI), collaborative robots (cobots), autonomous vehicles, 3D printing, **augmented reality/virtual reality** (AR/VR), and even **blockchain**.

The combination of such innovation accelerators within a broader digital transformation strategy will substantially support CP companies in addressing the issue of **product obsolescence**. In fact, the inability of many CP companies to develop and bring to market new products of either acceptable equality or frequency is a big problem. **By 2020, many categories will earn as much as 70% of revenue from products less than three years old**.

Digital transformation is well under way among CP businesses. From a global DX maturity perspective, 30% of the industry is in the "Digitally Determined" maturity cluster, with almost equal distribution across regions — including 23% in Europe. The majority of CP organizations are in the early digital transformation maturity stages, grouped within the Digitally Distraught cluster. The more forward-looking companies are investing their efforts in **ecosystem-oriented business model innovation** (as is also happening in the retail industry). Real differentiation lies in this innovation approach, which sets up digitally transformed manufacturers for success in the short and long term. The results of this shift can be seen across the value chain, in digital transformation initiatives such as the thinking supply chain, connected products and services, **digital twins**, and Industry 4.0/smart manufacturing.

Figure 1
European CP Companies' Digital Transformation Maturity

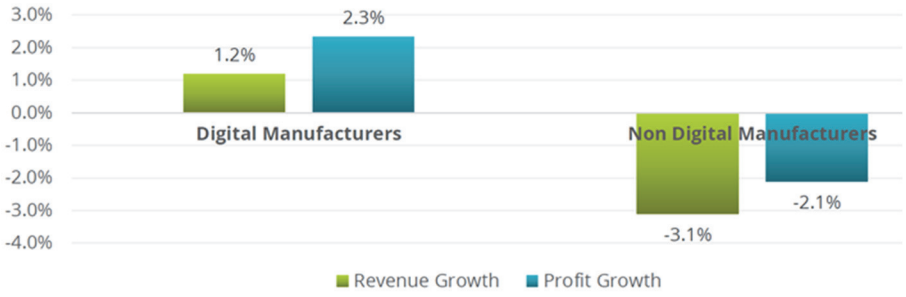


Source: *IDC European Vertical Markets Survey, 2018–2019* (n = 71)

According to IDC research, over the past five years — if we consider the broader manufacturing industry landscape, including CP organizations — companies that have embraced digital transformation have achieved more than 1% CAGR in revenue and more than 2% CAGR in profits. This compares with "non-digital-transformation" manufacturers that have seen a CAGR of more than -3% in revenue and more than -2% in profits.

*IDC predicts that by 2022, driven by rising **customer expectations** and competition from the platform economy, 25% of manufacturers will be engaged in **cross-industry collaboration**, resulting in a 10% **revenue increase**.*

Figure 2
Financial Impact of Digital Transformation (2013–2017 CAGR)



Source: IDC, 2019

Looking ahead, it becomes evident that ecosystem-based approaches will exponentially reward players at the forefront of business model innovation. IDC predicts that, by 2022, driven by rising customer expectations and competition from the platform economy, 25% of manufacturers will be engaged in cross-industry collaboration, resulting in a 10% revenue increase. CP companies that invest their efforts into building and nurturing a consistent base of data, and sharing it with core partners such as retailers, will gain substantial ROI over time.

In CP organizations, concepts, prototypes, and products are the critical assets on which the extended value chain is based. IDC believes it is vital that these assets are conceived, maintained, and iterated through data-driven digitalization platforms.

Digital Twins Are the Communication Vehicle Across Digital Platforms

Digital twins enable data rendering of virtual and real products, and a more agile and ecosystem-oriented execution of complex production processes.

As stated, CP organizations are investing in digital twins in the short term. In the longer term, IDC predicts that, by 2024, 50% of manufacturers will network related product and asset digital twins into digital twin ecosystems, for a systems-level view of their business and a 5% reduction in the cost of quality.

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CP companies' investments in digitalization platforms that enable them to manage digital twins are happening in parallel to retailers' investments in what IDC defines as the retail commerce platform — a cloud- and microservices-based system that includes the core retail capabilities enabling customer experience differentiation and seamless omni-channel commerce, along with the required operational efficiencies for profitability and business model agility.

A retail commerce platform — with open APIs and a microservices architecture — is the primary opportunity that CP organizations have to integrate their systems into retailers' systems. In this context, the streamed sharing of product data coming from digital twins — combined with data coming from the distribution side — is crucial for both CP companies and retailers to collaborate on the joint delivery of value for their common client, the consumer.

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Given CP organizations' specific nature and objectives, one of the key characteristics of digital twins is that they can be used for a broad range of purposes, at various degrees of complexity. CP companies can leverage such tools, starting from low complexity digital visualization tasks, for ideation and innovation, collaboration with customers and suppliers, and visualization of processes.

Then, at intermediate complexity levels, digital twins can be used for digital development tasks (for internal design and development, service, and maintenance at a workgroup level) or as enablers of the "digital twin enterprise" (for enterprisewide, internally focused visibility and collaboration).

At the highest complexity levels, there are two extended value-chain-oriented uses. One is geared around the digital twin ecosystem, for real-time product and asset operation and improvement, extended to customers, partners, and suppliers. The other is focused on digital twin orchestration, for real-time visualization, visibility, and decision support across a complementary network of digital twins for products, assets, facilities, and plants.

The Benefits of Digitalization Platforms

Digital twins offer CPs the opportunity to leverage a visual vehicle that transfers **information and knowledge** across digital platforms. The range of information that digital twins can cover includes new product ideas, manufacturing or service work instructions, sections of a design, or the full fidelity product or asset model. CP companies are actively investing their resources into adopting digital twins, as the value of having a full fidelity twin and networks of related twins becomes clear. The key overall value of digital twins is that they can be the **repositories of multiple data models along the single digital thread** that relate to the product or asset: production, supply chain, service delivery, or customer.

Digital twins offer a number of benefits, as they:

- Improve **speed and agility** from product design to packaging and production. To safeguard efficiency, legacy product life-cycle management processes often rely on rigid and siloed sequences of interactions among the different stakeholders, systems, and data involved in the production stages. This means that any change in the production plan can trigger complex and time-consuming adjustment processes. Digitalization

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platforms, however, are architected to plan and execute production processes by **streaming the collaboration** across CPs' internal and extended value chains. Data generated during the product design phase is **built into the digital twin** and can be accessed and leveraged by any department involved in upstream and downstream processes — and, at the same time, shared with retailers. CP companies using a digitalization platform therefore benefit from faster processes and **time to market** on one hand, and on the other hand from greater agility when it comes to **actioning the feedback** received from the extended value chain through streamed data collection and analysis.

- Support **direct-to-consumer (D2C) business models** and changing consumption trends. A CP's digital strategy that attributes high priority to consumer-driven value generation inherently accounts for the increasing weight of consumer **digital commerce** activities on total revenues. In the past, D2C business models have often been perceived as complex frameworks to build and maintain. Furthermore, this perception is combined with prejudices on the risk of potential conflicts with the distribution industry. Now, D2C business models are essential assets for the **growth** of CP organizations. The models enable companies to **differentiate their offerings** according to the individual downstream stages of the value chain and to substantially increase **control of customer experience**. In this context, digital twins provide CP organizations with the **backbone** to adapt their products and offerings according to the analysis conducted on direct interactions with consumers.
- Enable **personalization and mass customization**. Tightly related to D2C business models, CP companies need to design and realize **size-of-one** lots to serve the "**segments of one**." IDC predicts that, driven by demand for product personalization, 50% of manufacturers will have integrated simulation and configuration tools with **customer profile data** by 2024, achieving up to 2% gains in revenue. Digitalization platforms are the assets that translate individual customer requirements into product specifications.
- Deliver **innovation at speed and scale**. Overall, digitalization platforms offer increased opportunities for CP companies to efficiently and effectively execute innovation strategies that go beyond pure technology and product innovation. Platforms that enable them to manage and streamline the different and complex phases of products realization, leverage collaboration across the extended value chain, and capitalize on customer experience are essential to pilot innovative business models. Once successful pilots are identified, digitalization platforms enable CP companies to scale innovation throughout complex geographical, organizational, and technology structures. This in turn guarantees distributed visibility and access to digital twins and, at the same time, central control of business model execution.

Siemens' Digitalization Platform Offering

Siemens AG is a global technology firm that has been active for more than 170 years. The company has a global presence, focusing on power generation and distribution, intelligent infrastructure for buildings and distributed energy systems, and automation and digitalization in the process and manufacturing industries. In fiscal 2018, which ended on September 30, 2018, Siemens generated revenue of €83 billion and net income of €6.1 billion. At the end of September 2018, the company had around 379,000 employees worldwide.

Within the manufacturing industry, Siemens' Digital Industry Software dedicates considerable efforts to building a digitalization platform offering focused on the specific needs of consumer product companies and providing an integrated environment for digital twins. The vendor's value proposition relies on a clear understanding of the key macro-trends that are impacting the consumer industry, such as globalization, greater regulatory demands, and consumer behavior driven by increasing expectations for experience personalization. The vendor's value proposition for the CP industry is geared around providing a set of technologies to digitally integrate product life-cycle management processes in the extended value chain, offering a backbone for the single digital thread.

To help CP companies to do this, Siemens offers a portfolio of products that increase speed to market and supply chain agility. Siemens offers capabilities for the elaboration and dynamic updating of digital twins from virtual product design, to virtual production, to automation-based real production, and to finalized real product. The overarching digitalization platform is built on several core software components:

- Siemens NX and Solid Edge Digital Product Development suites, which help companies to create the digital twins for their products, combining 3D CAD, electrical, and mechatronics data that can be simulated with Siemens Simcenter.
- Siemens Teamcenter, which is a PLM system that connects people and processes across functional silos. The software manages product data and processes, including 3D designs, documentation, and bill of materials.
- Siemens MindSphere, a cloud-based IoT open operating system. The software connects products, plants, systems, and machines, enabling CP companies to gather and analyze data with advanced analytics. It also enables them to access apps and a dynamic development platform as a service (PaaS).

Siemens also offers software for manufacturing operations management, such as Tecnomatix, Simatic IT, and Comos, which — combined with digital twins — enables retailers to specifically address the efficiency side of manufacturing processes.

Siemens' digitalization platform enables CP companies to collect data from each stage of the product life cycle and to collaborate internally and with partners to drive data-driven improvement of products.

The Challenges Linked to Digitalization Platforms

Digitalization platforms offer the unprecedented opportunity to integrate, manage, and execute complex processes across consumer product companies' extended value chains. However, the organizations that adopt digital twins often face a number of internal and external challenges.

- Integration of **internal legacy systems**. Over the past few decades, CP companies have been building their IT assets around disparate delivery models (on-premise, private cloud, public cloud), often without centralized integration layers and hybrid IT infrastructure management systems. In addition, old isolated processes may still be Excel based, rather than built in a proper platform framework. Digitalization platforms are mostly cloud based, and despite their inherent flexibility, CP companies might find it difficult to integrate old systems and workflows into the new assets. In some cases, adopting a digitalization platform could mean substituting obsolete and irreconcilable IT solutions.
- Overcoming internal **data silos**. The presence of legacy IT systems — characterized by suboptimal integration capabilities — also means that, over time, CP companies have been accumulating isolated data generated in the different departments involved in the product life cycle. Digital twins really work only if CP companies provide the platform with data coming from the entire value chain. Therefore it is possible to reach an optimal capitalization of the digitalization platform only by investing resources in the parallel aggregation and consolidation of data in common repositories.
- Redesigning **organizational schemes**. Reattributing the collection and provision of data to centralized data repositories also entails revising standardized and consolidated organizational roles and functions across the CP company. The key challenge here can be employees' reluctance to cede data ownership and process control to new data-focused roles.
- **Digital skills** development. Directly related to the organizational schemes challenge, CP companies that invest in a digitalization platform will face the short-term need to realign their human resources' digital skills to the new implemented IT capabilities. At the same time, to further develop the organization's overall digital skills level, CP companies might need to hire business-oriented digital-twin experts. This creates a challenge for HR, LOB, and IT departments that look for appropriate people to hire, given local scarcity of talents and competition from other manufacturing subindustries.
- Partners' readiness and openness to **data integration and sharing**. In the same way that internal data integration is a mandatory requirement for digitalization platforms to work properly, the willingness and capabilities of the ecosystem of partners and suppliers to collaborate to dynamically update the digital twins is essential to get maximum value from such platforms. In some cases, however, a CP's partners or suppliers across the extended value chain might be at a lower level of digital transformation maturity, and this can create challenges when it comes to sharing data.

Players at different stages of digital transformation maturity might have highly restrictive data-sharing policies (that could be related to local legislation such as GDPR), and from the outset this would block integration opportunities for digitalization platforms.

- **Budget** constraints. The investment in a digitalization platform requires the financial commitment of many different internal stakeholders, within both lines of business and IT. Due to department-specific short-term priorities, digital-twin promoters could face some resistance when it comes to allocating budget for long-term projects that require considerable resource investment across the internal value chain.

IDC Recommendations for Tech Buyers

IDC recommends that CP companies take the following actions as they plan to implement a digitalization platform, turning product life-cycle management into a customer experience- and data-driven activity.

- **Assess** the current state of your product life-cycle management assets and define your financial and business goals, framing the assessment in terms of new business model opportunities. Perform a gap analysis between your present and expected states and evaluate the capabilities of the digitalization platform.
- **Build** a road map for the short, medium, and long term, prioritizing the updating of key legacy systems that need to be integrated into the digitalization platform.
- **Account** for having to involve at least 50% of your overall IT budget in the digitalization platform project over the following two years. This type of project will require investments in technologies such as cloud, mobile, analytics, IoT, AI/cognitive systems, advanced security, blockchain, AR/VR, and 3D printing.
- **Perform** a cross-industry benchmark by developing internal knowledge of how retail commerce platforms work, of the core services that retailers are leveraging, and how these platforms enable retailers to achieve short-term profitability and long-term innovation goals, at speed and at scale.
- **Promote** an internal customer experience practice that includes stakeholders from lines of business and IT. The objective is to gear the different stages of product life cycle around customer data and to propose parallel investments in direct-to-consumer business models.
- **Allocate** resources to educate the ecosystem of partners and suppliers on the importance and benefits of data sharing for digital twins, and develop an "Ivy league" of forward-looking players that collaborate through the digitalization platform.

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