Connected Product Innovation

Bridging the Divide Between Digital Products and Intelligent Manufacturing

A White Paper by Microsoft and Frost & Sullivan

Microsoft

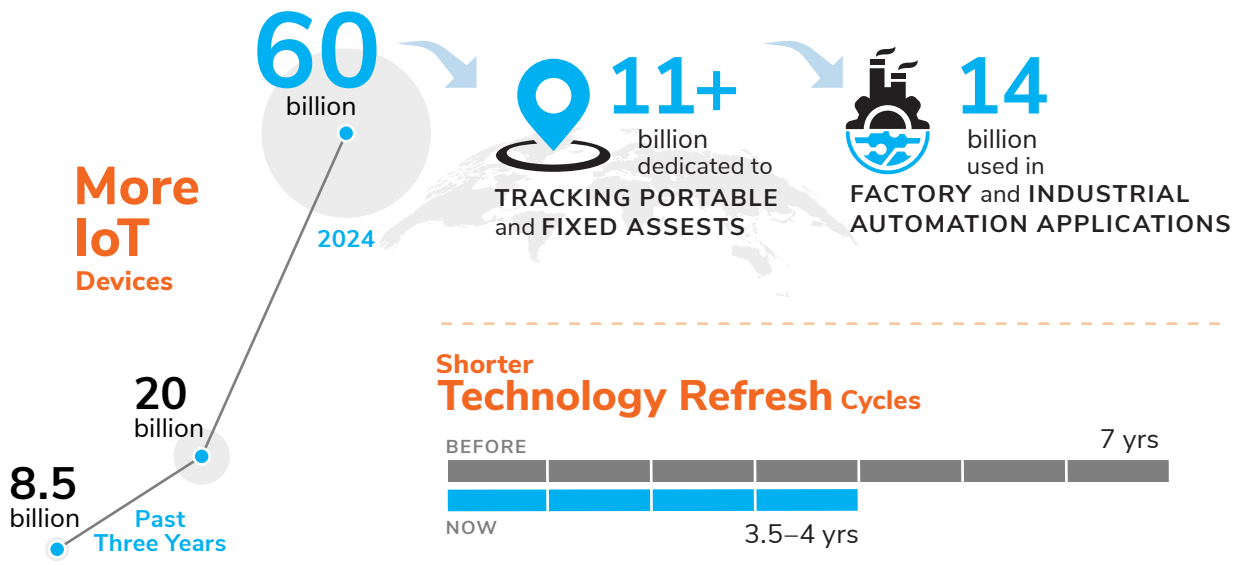
FROST & SULLIVAN

50 Years of Growth, Innovation and Leadership

CONTENTS

1 EXECUTIVE SUMMARY

Digital capabilities are rapidly changing customers' interactions with products and brands, fundamentally shifting their perceptions and expectations of companies. Ubiquitous connectivity, dynamic customer demands, and volatile procurement behavior are poised to cause long-term changes in the way products are designed and managed throughout their life cycles. By 2024, over 14 billion of those devices will be used in factory and industrial automation applications, and an additional 11 billion will be dedicated to tracking portable and fixed assets.[1] This technology advancement has created a pressure that requires manufacturers to shorten product life cycles and development timelines. As an example, major automotive original equipment manufacturers (OEMs) are committed to reducing the number of vehicle platforms by 25% from 2015 to 2022 in order to reduce portfolio complexity and accelerate development cycles.[2]



The technological integration of connectivity into products and the consequent ability of organizations to react faster with enhancements has resulted in an increasing trend of customer preference for subscribership over asset ownership. The emergence of smart, connected products is set to drive industry adoption of life cycle service contracts—subscription to the value-added services offered by the asset manufacturer/OEM.

As digital developments disrupt, transform, and streamline business processes, companies often find it difficult to keep pace. Today, the ability to leverage new technologies sets leaders apart from laggards and facilitates sustainable market growth. New offerings from Microsoft, such as Azure Big Compute, Mixed Reality, Dynamics 365, and Azure Digital Twins, allow organizations to design with foresight, develop products with customer-centricity, and structure a rewarding user experience across the product life cycle. Microsoft's software-agnostic platform approach facilitates a seamless integration of partner software products with process, people, data, and spatial intelligence expertise. The integrated solution portfolio helps organizations capitalize even more on production efficiency gains, and provides avenues to improve existing/adjacent business processes—namely the product innovation process. The ability to quickly convert intellectual capital ideas into new product innovation through a robust foundation of digital technology will improve an organization's competitive advantage.

The shift to connected products and subscription life cycle services is inevitable; therefore, businesses must adopt new technologies and business models to remain relevant in tomorrow's purchase decisions. Recent Frost & Sullivan analysis identifies that at least 25% of all life cycle service contracts, built on smart products, will be subscription based within the next 5 to 7 years.

Traditional product innovation processes will not work in the new digital world. The future will utilize connected, flexible, collaborative, co-creative, and secure digital solutions to drive a symbiotic relationship between new product development and product life cycle optimization. To offer clarity and context on the shifts of product innovation processes, we will address the following topics in this paper:

- Bridging the divide between digital products and intelligent manufacturing
- Traditional product innovation process: pathways and critical issues
- Solution portfolio for connected product innovation process
- Microsoft differentiators: realizing the benefits of connected innovation
- Strategic conclusions

2 BRIDGING THE DIVIDE BETWEEN DIGITAL PRODUCTS AND INTELLIGENT MANUFACTURING

As manufacturing organizations embrace Industry 4.0, a revolution of creative destruction and expansion of traditional business models is bringing forth new challenges. Digital products will require new digital capabilities to be deployed across the manufacturing value chain. Moreover, nearly ubiquitous consumer adoption of smartphones and connected smart devices is changing the way customers are interacting with products and brands, fundamentally shifting their expectations of companies. As customers experience a positive digital interaction with one brand through a smart product, they expect other brands within and even outside of the competitive segment to deliver similar experiences. This presents a challenge for product manufacturers to keep pace with competitors, and also be prepared to quickly incorporate innovations from outside their own sectors.

Despite these hurdles, delivering connected products and services offers two distinct strategic advantages to an organization:

1. Sustainable customer value
2. Feedback loop for continuous product innovation

Sustainable Customer Value

Smart products offer the unique ability to deliver sustainable value to the customer throughout product ownership cycles via software updates over the cloud, advisory services on product utilization, patch management, usage statistics, benchmarks, and feedback on usability issues. This intrinsic capability enhances the customer experience, builds valuable brand equity, and equips the organization to become more responsive to customer needs—ultimately fostering a more loyal customer base.

Continuous Product Innovation

The second strategic advantage of connected products is the wealth of customer and operational use data. Organizations can gain new insights into their products' performance, understand a customer's experience, and gather a myriad of other rich data to form the foundational inputs for new product innovation. This access to user data steers organizations toward an "informed" product innovation cycle, allowing development of increasingly individualized products and services to increase customer retention and intimacy without the need for lock-in contracts.

> Smart products offer the unique ability to deliver sustainable value to the customer throughout the product ownership cycle.

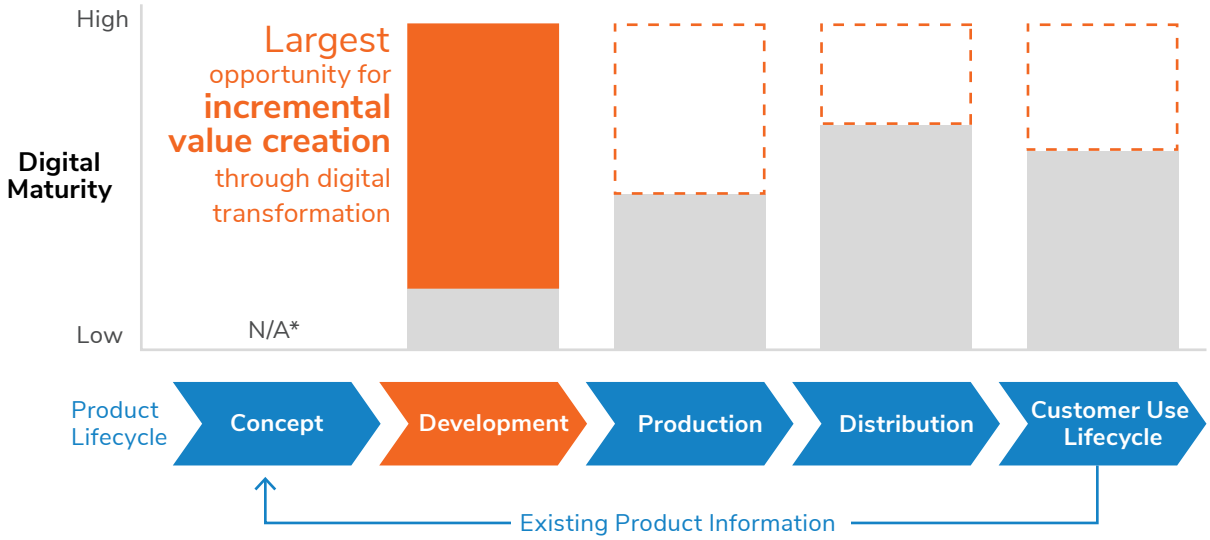
However, heavily individualized customer dynamics have created new challenges for manufacturers. Driven by a desire for the latest innovation and increasingly low barriers to switching, customers desire moving away from an asset ownership business model and towards an asset subscription model. This is epitomized by the sharing economy that is emerging in the automobile market. Historically, the vehicle was one of the largest asset purchases for the average consumer, second only to the home. Now consumers have more than a dozen mobility subscription business models to choose from, allowing them to easily switch from one supplier to another. The shift in fluidity of customer dollars exists in both B2C and B2B markets, creating an imperative for manufacturers to compete faster than ever, and a requirement to re-think the product innovation process to stay relevant.

In addition to connected products themselves, digital technology has also transformed the manufacturing process with a drive towards adopting Industry 4.0, digital factories of the future, and adaptable supply chains. The convergence of embedded sensors on assets with cloud- and edge-based technologies, advanced analytics, and high-performance computing continues to rapidly accelerate manufacturing transformation. By applying machine learning to real-time operational data, manufacturers are now able to transition their operations from reactive operations to predictable environments, ultimately moving towards true automation. This shift delivers two vital benefits with real bottom line impact—optimizing planned downtime and minimizing unplanned downtime. A case in point, JABIL is a leading design and manufacturing organization that incorporated Microsoft Azure Cognitive Services to create a real-time predictive analytics platform. This platform helped JABIL gain

foresight into process failures before they occurred and enabled the company to prevent them. JABIL and Microsoft's joint solution has resulted in a more than 80% accuracy rate in predicting machine process slow-downs or failures, shortening product lead times, and delivering consistent, superior quality.

The world is progressively moving towards digital products and intelligent manufacturing, but the product innovation process is still nascent. Herein lies a major disconnect, as well as the largest opportunity to streamline efforts across the value stream. Below in Exhibit 2.1, we have analyzed the maturity of digital transformation across a product life cycle.

EXHIBIT 2.1—DIGITAL TRANSFORMATION MATURITY ACROSS A PRODUCT LIFE CYCLE



* While there is currently a high degree of digital information used for the formation of a new concept, digital solutions do not have capability of creativity and thus is non-applicable from this maturity representation model.

As outlined, the development process prior to initiating full-scale production is a key aspect of the value chain prime for digital disruption. The product development life cycle has historically been complicated, involves piecemeal solutions, messy iterations, and lengthy associated timelines. Ultimately, this restrains an organization's ability to efficiently compete in a rapidly evolving market place. The next frontier of value creation lies in bridging digitally enabled products with intelligent manufacturing through a connected product innovation process. The fourth industry revolution is also poised to bring the physical and digital worlds together, facilitating a more connected, integrated, collaborative, and flexible manufacturing value chain. Adaptation of the new process aims to help organizations design with foresight, minimize development complexity, and infuse customer-centricity. Before we analyze the benefits of the new process for connected product innovation, it is vital to understand the drawbacks of today's practices.

3 TRADITIONAL PRODUCT INNOVATION PROCESS: PATHWAYS AND CRITICAL ISSUES

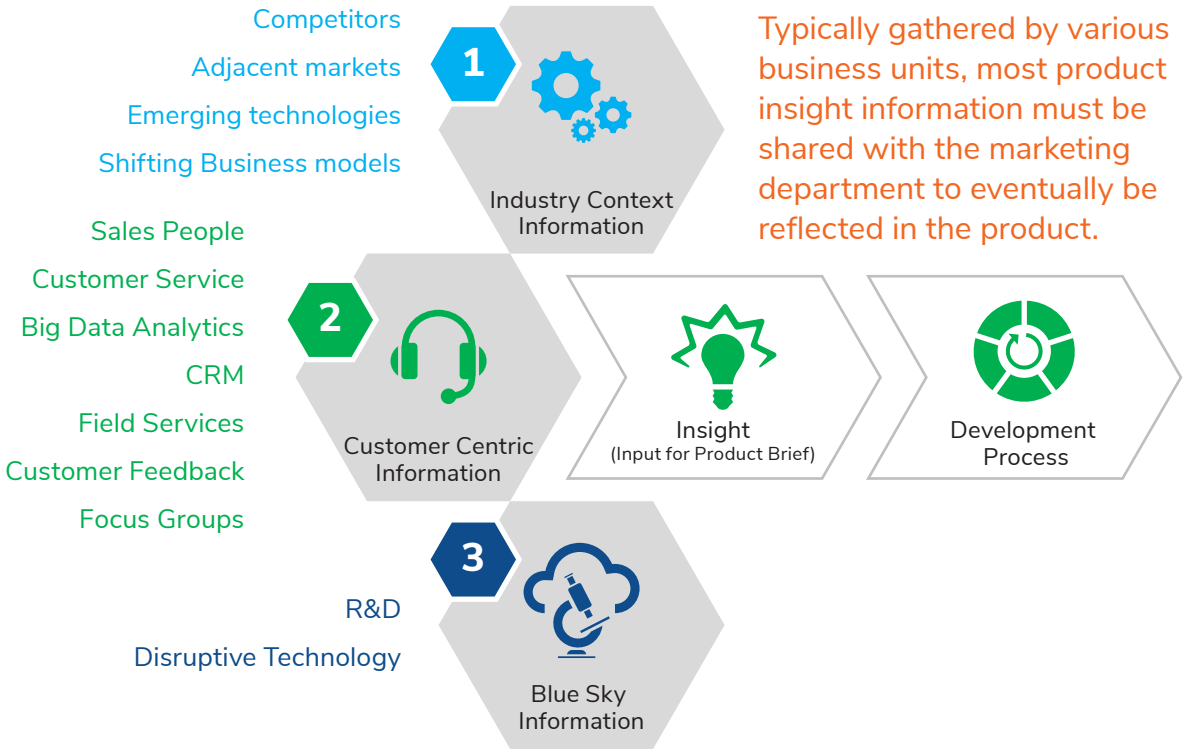
Product innovation is the process through which an organization delivers lasting value to the marketplace. Therefore, innovation should be the central objective of every organization wishing to improve their competitive position. The complexity and requisite timelines for development programs vary based on the product, internal resources, industry dynamics, and regulatory environments in which the organization competes. The development timelines within industries tend to be proximally similar; therefore efficiencies in the innovation process can yield significant competitive advantage over rivals. Two primary factors affect the efficiency of innovation: pathways and process.

Pathways—How Product Innovation Information Is Received

Product innovation at its root is derived from intellectual capital. Employees, through the nature of their work, are inspired with ideas, and then manifest those ideas in the form of better products, services, processes, and business models. Organizations should endeavor to optimize two key elements that contribute to employee inspiration: time and information.

Employees need to have time to think about their products, customer needs, and new trends to develop new ways of thinking to unlock innovation. Similarly, they need clear, accurate, and concise information from which to develop insight. Employees making decisions on poor information will likely make poor decisions. Both time and information can be optimized with digital technology by enabling faster, less cumbersome processes and by organizing and disseminating reliable information from various pathways. Exhibit 3.1 below depicts the three primary pathways for information to enter an organization.

EXHIBIT 3.1—INFORMATION PATHWAYS FOR PRODUCT INNOVATION



Industry Context Information

This data is collected from competitors, adjacent markets, emerging technologies, industry tradeshows, and other sources. Industry context information can drive the novel combination of existing capabilities to inspire new product innovations.

Customer-centric Information

Customer-centric innovation is derived from qualitative and quantitative customer data. Call centers, sales people, and marketing professionals yield valuable qualitative product insights through positive and negative customer interactions, while smart products deliver valuable field service data on use, life cycle performance, and environmental factors. When customer-centric information from multiple data sources can be integrated in a standardized way with unified views and analyzed with advanced computing tools and artificial intelligence, organizations can realize significant improvements in process outcomes and inspiration for product innovation.

Blue Sky Information

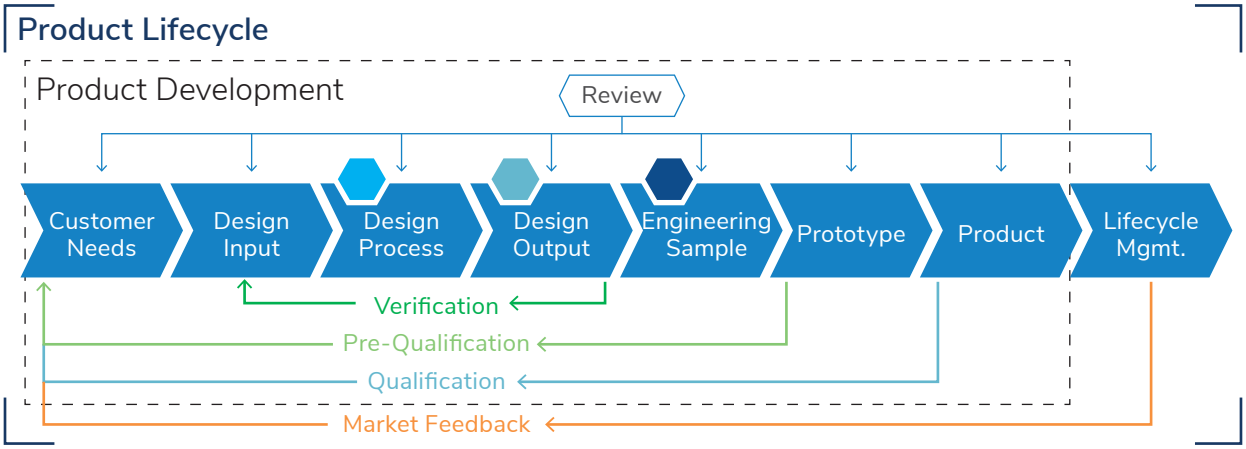
This type of input is almost exclusively derived from an organization's research and development capabilities. While infrequent and unpredictable, blue sky information can lead to transformative innovation and yield tremendous incremental value creation.

Whatever the pathway may be, a key challenge for any organization is capturing and distributing the right information to the relevant stakeholders at the right time to accelerate innovation. Digital technology can increase the volume, velocity, orchestration, accuracy, and fidelity of information from all pathways; thereby increasing sustainable customer value.

Process Challenges

A traditional life cycle and innovation process, as depicted in Exhibit 3.2, presents its own set of challenges to an organization. This section will review challenges experienced by nearly all organizations in their innovation development programs.

EXHIBIT 3.2—TRADITIONAL LIFE CYCLE & INNOVATION PROCESS



Traditional product innovation involves highly iterative process requiring a high number of inputs across various stakeholder organizations

Idea Management and Timing

The pathways of information for new innovation into an organization have historically created their own barriers. Each internal stakeholder organization has a repository of insight related to a product, but it is often siloed into "information islands" in countless, unconnected databases, spreadsheets, or other data storage mechanisms. Many manufacturers struggle to share information across the organization. These "information islands" prevent common understanding and create long, repetitive iteration cycles and duplication of effort during cross-enterprise collaboration as each stakeholder uses piecemeal knowledge to get up to speed.

> Manufacturers can benefit by applying digital transformation on traditional product innovation process to become more nimble in competitive responsiveness, while also shortening the time to market for new generations of products.

The timing and integration of new insight into the development process is similarly challenging. Whether an organization uses a traditional waterfall or agile development methodology (hardware and software), there are time parameters in either process that can result in difficult decision scenarios based on the revelation of new insight. For instance, during design validation an organization could discover the market has shifted due to new technology, indicating the product will underperform to expectations once completed and launched. In this scenario, does the organization scrap the investment made to date and pour more investment into design modification for a better product, or continue development as quickly as possible, reserving the insight for the next generation of the product? Heavily constrained by capital equipment investments and fixed schedules, manufacturers can benefit from digital transformation to the innovation process by becoming more nimble to competitive response while also shortening the development timelines between product generations.

Design Iterations, Testing, and Wasted Resources

As depicted in Exhibit 3.2, the process of moving from customer needs to final product is a time-consuming, error-prone iterative process with multiple internal feedback loops providing information backward and beginning the process anew with each iteration of the product, slowly propelling the entire project forward through a series of repetitive cycles. Design is also increasingly collaborative across multiple product variants between geographically dispersed teams—each change is subject to version management controls and validation via compute-intensive simulation. The steps in this repetitive cycle lead to longer feedback times, more tedious testing, and more redesigns, ultimately resulting in a lengthy journey from concept to launch, and placing a strain on financial, material, and human capital resources.

Communication Channels, Clarity, and Collaboration

Product innovation processes require a multitude of inputs from a significant number of cross-functional teams. Effective communication is key to success, and it is commonly reported by employees that poor communication is a major cause of development delays. Communication issues often stem

from complex cross-organizational relay chains. For example, customer feedback to sales then goes through marketing, and finally to engineering. This "relay chain" scenario represents a time delay, and is also commonly associated with a breakdown of information clarity as an organization attempts to translate abstract customer feedback into specific, quantifiable engineering guidance.

Another example of communication breakdown is caused by concept complexity and the lack of tools to accurately communicate technical matters across the development community, for example, a team of development engineers. Collaboration is crucial but establishing common understanding can be time intensive. An inability to have clear, real-time communication can result in duplicated cycles throughout the design, verification, and validation processes. Repeated iteration cycles are a common phenomenon in development collaboration between design engineers and production engineers who each seek to ensure the end product is aligned with design brief requirements, but also within the bounds of production parameters.

The traditional development process is littered with piecemeal technology solutions, often addressing one niche of a complex process and requiring extensive manual intervention to stitch the pieces together to move forward. Following this type of disjointed innovation process in the age of digital products and digital manufacturing capabilities will undoubtedly ensure disruption by a competitor that implements a streamlined and successful connected product innovation process first.

4 SOLUTION PORTFOLIO FOR CONNECTED PRODUCT INNOVATION PROCESS

Connected product innovation process is an approach through which information gathered from a product's life cycle can be used and distributed to an organization's intellectual capital so that they can properly accelerate the development timeline to market. Catalyzed by Industry 4.0, there are several digital tools available that can streamline and infuse efficiency into the product innovation process.

IoT Platform

A cloud-hosted service that allows organizations to connect, monitor, and manage sensor-enabled assets with bi-directional communication. This type of platform allows organizations to monitor the health and efficiency of equipment by tracking events, operational data, device failures, and other connections.

Digital Twin Capabilities

Built on the foundation of an IoT platform, digital twin is the next-level interpretation of a digital representation of a physical asset. Historically, digital twins have been used to represent industrial equipment such as airplane engines or production robots. This capability can also apply more broadly to represent a physical environment such as a warehouse, office buildings, or even a city. This technology offers new spatial intelligence information to model how spaces and infrastructures are used, allowing designers to take these inputs into consideration. Furthermore, digital twins can be linked together sequentially to create a digital representation of processes such as an assembly line. A process digital twin gives manufacturers a greater understanding of sequential functionality, and empowers them to simulate variation outcomes before implementing a change in the real world.

High-performance Computing (HPC)

Manufacturing, in particular, has four workloads: cloud workstation, cloud rendering, resource-intensive simulation and analysis, and deep learning/AI. Each of these workloads generates data in different ways and requires varying degrees of computing power. As compute requirements dynamically change based on organizational requirements, investing in on-premise infrastructure is not an astute investment. On-premise compute infrastructures are strapped with poor elasticity, crushing overheads, and poor performance scalability, all which severely restrain operational efficiencies.

Furthermore, most multi-physics-related simulation workloads within manufacturing (e.g., CFD, FEA, and NVH)[3] require tightly coupled parallel computing to ensure scalability, short run times, cost-efficiency, and reduction in time to market for new products. Embracing on-demand, cloud-based computing resources will help manufacturers compute at scale, while judiciously mitigating the trade-offs between costs, productivity, and availability.

> On-premise compute infrastructures are strapped with poor elasticity, crushing overheads, and poor performance scalability, all which severely restrain operational efficiencies.

Scalable Intelligent Business Application Platform

Businesses today exist in an ocean of siloed data sources across CRM, ERP, PLM, and other systems throughout the enterprise. For managers to make more informed decisions, these information islands must be integrated. An intelligent business application platform can unify data from various sources, and augment the data lake with artificial intelligence, allowing customers to gain access to prescriptive guidance.

AI Platform

AI infrastructure provides developers with a platform of services and tools with enterprise-level security, availability, compliance, and manageability to build the next generation of smart applications. As edge proliferates across industrial markets, the ability to ingest data from convoluted neural networks (CNN) running on edge devices and simultaneously transfer relevant data to train models in cloud can be easily achieved. This requires a robust infrastructure built on neural networks, graphical processing units (GPUs), algorithms, and an elastic cloud infrastructure.

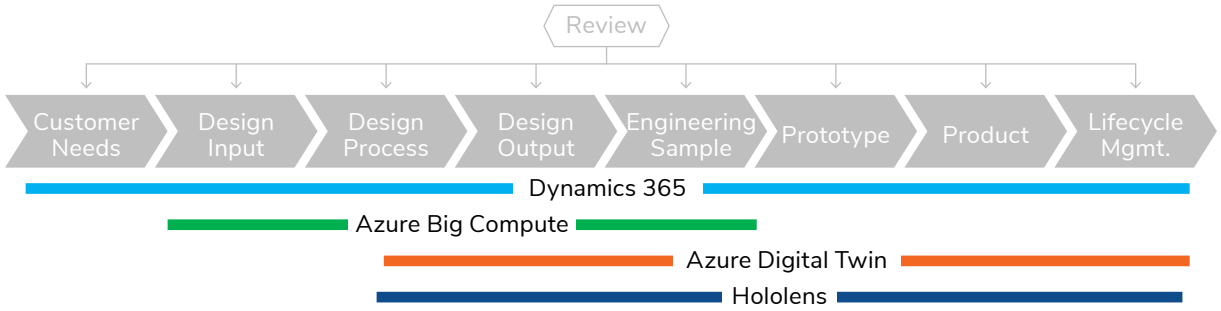
Mixed Reality (MR)

MR tools enable designers and engineers to interact with holograms in a real physical environment. This mixed reality solution can enable individuals to review 3-D models, visualize layouts, and create other experience designs at scale and in context. MR devices equip designers to iterate in real time, making edits to a model and understanding its relationship to the real world. Further, the product's digital twin can be communicated via MR devices to demonstrate to prospective customers, or used instructionally during installation, maintenance, and repair by trained technicians.

5 THE MICROSOFT DIFFERENTIATION: REALIZING THE BENEFITS OF CONNECTED PRODUCT INNOVATION

The previous chapter provided an overview of the myriad of digital solutions to facilitate a connected product innovation process. This chapter will introduce Microsoft solutions and provide examples of how implementing these technology applications across the traditional development process can generate efficiencies. Exhibit 5.1 below depicts an illustrative example of the process domains that can be augmented by Microsoft's digital solutions.

EXHIBIT 5.1—DIGITAL SOLUTIONS TO AUGMENT THE LIFE CYCLE & INNOVATION PROCESS



Digital Solution Benefits

Dynamics 365

Cross-enterprise business platform with tools for intelligence and information sharing across the product lifecycle and throughout the organization to help all emplolees make more informed decisions.

Azure Big Compute

Scale up HPC power as needed for quicker rendering times, faster and greater number of simulations, and easier collaboration across geographies.

Azure Digital Twin

Replicate and simulate products in a digital environment to understand performance outcomes before committing time, material, financial, and human capital resources.

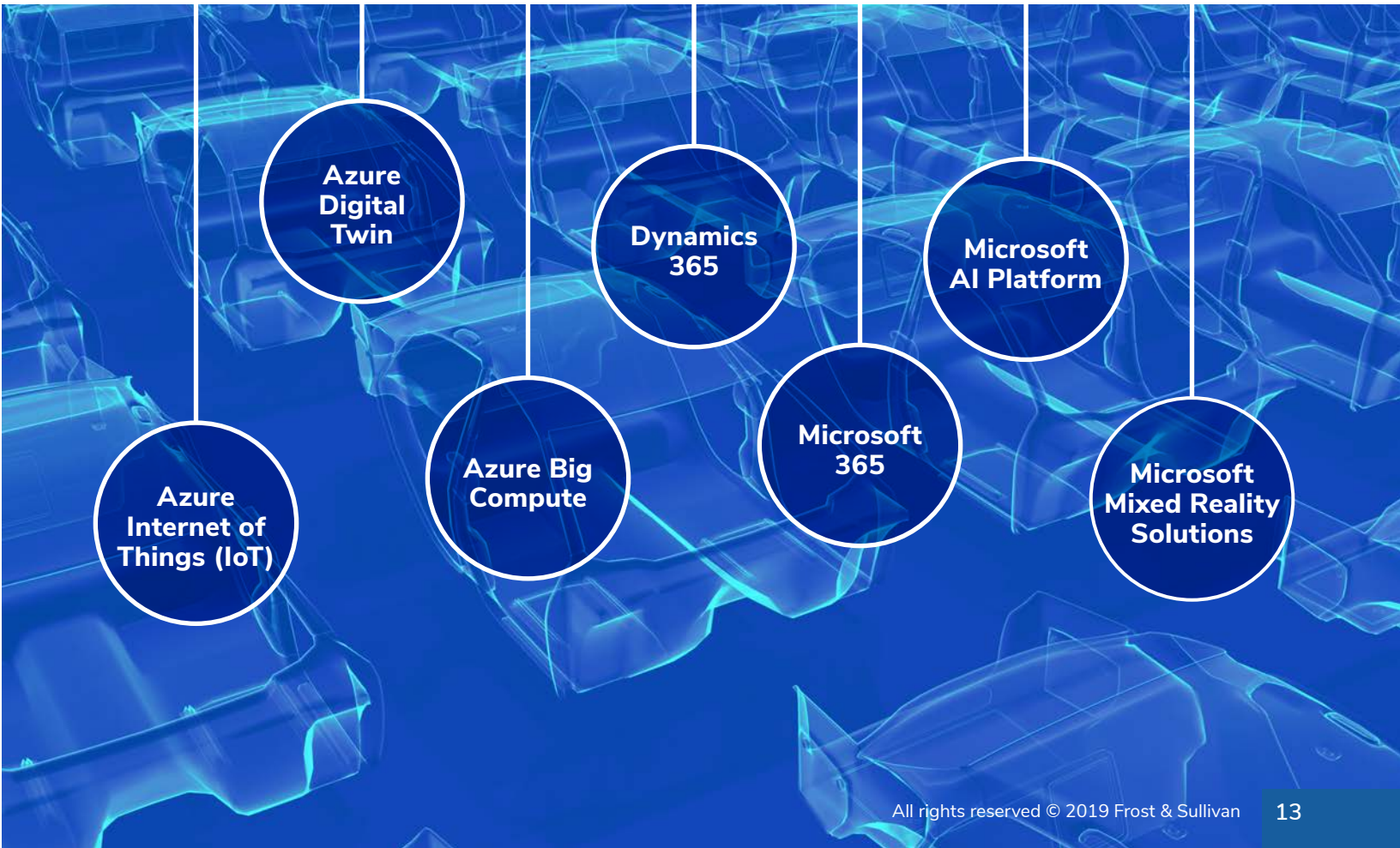
Microsoft Hololens and Mixed Reality

Enhance common understanding across the enterprise and across borders to make better decisions. Help designers iterate faster, customers understand outcomes, and technicians service a product.

Established as the software foundation for most small, medium, and large enterprises through its Office Suite, Microsoft has focused on becoming a leader in connected product innovation, leveraging Industry 4.0 principles with the following digital solutions:

- Azure Internet of Things (IoT): This is a flexible, cloud-based IoT platform that comprehensively covers business requirements from device operating systems, cloud-based connectivity, security, advanced analytics, and responsive decision making.
- Azure Digital Twin: Digital twins are used for assets and processes that combine people, data, and spatial intelligence with the product to enable a higher degree of fidelity, simulation, and PLM performance. Pre-defined data schemas allow customers to accelerate creation of digital twins, saving on development costs. Furthermore, instead of interacting with discrete devices, customers can query data in the context of space to control fleets of devices efficiently.

- **Azure Big Compute:** On-demand, cloud computing power offers true HPC capabilities based on need. Azure Batch can also be leveraged to run scheduled jobs to run on nodes.
- **Dynamics 365:** This is an enterprise business platform that enables organizations to develop business applications (PowerApps), automate processes/tasks (Flow), share information, combine disparate systems (Common Data Services), and increase transparency (Power BI) throughout the organization and across existing software solutions.
- **Microsoft 365:** Comprised of cloud-based productivity software solutions (Office 365, Windows 10, Enterprise Mobility + Security) that nurture creative collaboration securely, this suite is often regarded as the foundation to most small, medium, and large enterprises.
- **Microsoft AI Platform:** These are AI services that include pre-built APIs such as cognitive services, conversational bots, and Azure customizable machine learning tools. Microsoft leverages the latest frameworks such as Tensorflow, MXNet, Chainer, CNTK, and others to provide an open and flexible platform.
- **Microsoft Mixed Reality Solutions:** A full portfolio of offerings that spans from Hololens (self-contained, holographic computer) to partner-based augmented realty/virtual reality applications (AR/VR) tools, it provides fully immersive, high-definition, and interactive experiences. These tools, fully supported by best-in-class D365 mixed reality applications (D365 Remote Assist, D365 Layout, D365 Guides), have been widely adopted for model interaction and visualization by various PLM solution providers.



Microsoft Differentiators

The biggest advantage of Microsoft solutions is the breadth and depth of digital productivity solutions that can help organizations drive efficiencies throughout product development, transform processes, enable collaboration across teams, and automate business processes. The following are core differentiators:

- **Enabling organizations to simplify businesses:** The Open Data Initiative is a non-proprietary enabling software feature that facilitates seamless information exchange between all solutions across the value chain, eliminating incompatibility and data integration issues. This feature also allows organizations to use existing investment in domain-specific PLM ecosystems and enhance these capabilities on demand and at hyperscale.
- **Innovative approach to digital twin:** Microsoft's integrated common platform approach pulls in the power of manufacturing partners to nurture building of new classes of solutions. The platform brings together partners, products, and process expertise with people, things, and spatial intelligence.
- **Augment and leverage existing investments:** Manufacturers can augment their existing PLM investments with Microsoft's industry-leading collaboration tools (Microsoft 365) and globally recognized cloud business application platforms (Microsoft Flow, PowerApps, Power BI, common data services, Logic App Connectors).
- **Commitment to excellence:** Microsoft has committed to investing $5 billion in IoT, AI, and quantum computing, and have proven edge and cloud IoT infrastructure. Its market-leading mixed reality solutions are cutting-edge in helping organizations overcome traditional challenges in a digital world. Microsoft's ability to run at highest scale across 50 regions worldwide and true collaborative approach sets it apart from its peers.

Leveraging the aforementioned differentiators, customers can experience similar outcomes by working with Microsoft:

Shorten Design Iteration

Developing a new product requires engineering teams to spend a considerable amount of time iterating on the product's design. Many organizations are limited in their computing infrastructure, either in scale or in obsolescence. Engineers often look for flexibility in having access to on-premise computing, as well as the elasticity of the cloud. Microsoft Azure Big Compute alleviates this bottleneck by enabling organizations with the capability to scale up or down their computing need from the cloud. Customers can utilize their existing investment in compute capabilities, and leverage Microsoft's proven cloud infrastructure on-demand for increased capacity. This cost-effective solution provides flexibility in infrastructure investment decisions, while still enabling engineers to iterate faster, from any location, and in real-time depending on complexity.

> Engineers often look for flexibility in having access to on-premise computing, as well as the on-demand compute elasticity of the cloud.

Simulate Design Outcomes

Most often, the product innovation process starts with the foundation of an existing product that is reconfigured for the next generation. This foundational element provides a source of existing system and component performance knowledge that will live on in the next-generation design. With a large amount of historical performance data on existing systems and combined with Azure Digital Twin and AI capabilities, designers can simulate real world outcomes of their product designs without having to commit resources to prototyping and building of molds. Engineers can use this digital twin representation to iterate and improve their designs in various environmental condition simulations (e.g., high/low humidity, high/low altitude, high/low temperature) and efficiently allocate resources by understanding performance outcomes before prototyping. Azure Digital Twin platform allows manufacturers to enhance existing independent software vendor (ISV) digital twin solutions with spatial intelligence, IoT data, and the ability to engage people in process flows.

With process digital twin, production engineers can simulate outcomes of proposed product design changes in a quantifiable manner before committing to any modifications. This can be used to improve and validate designs for production to prevent bottlenecks and production challenges.

Process digital twins can be utilized to model the impact of a design change on the production process. In every development cycle, there is collaboration between design and production engineers to create and validate the feasibility of any new design. With process digital twin, production engineers can simulate outcomes of proposed product design changes in a quantifiable manner before committing to any modifications. This can be used to improve and validate designs for production to prevent bottlenecks and production challenges.

Communicate, Collaborate, and Iterate More Accurately

Creating common understanding is challenging within any organization, particularly across functional teams that have different skillsets and knowledge bases. Microsoft's Hololens and mixed reality solutions provide tools to facilitate collaboration and last mile of understanding across global teams. These immersive and interactive experiences can be used to communicate product designs, communicate product features for price quotes, or even be leveraged to facilitate asset/facilities maintenance needs and outcomes. Whatever the application, the combination of these tools can also be used to simulate contextual environments, allowing users a more robust understanding of the concept.

In the application of product design, the Hololens can be used to iterate and communicate design changes quickly across teams and borders, enabling multiple design reviews in a single day versus the alternative of creating a prototype reflecting new changes. Consider, for example, the interior of a vehicle, the field of view given to the driver based on the size and location a rearview mirror, or even the interior of a building like a production plant. With Microsoft Hololens, designers and engineers can cycle through iterations more quickly to arrive at a final direction decision.

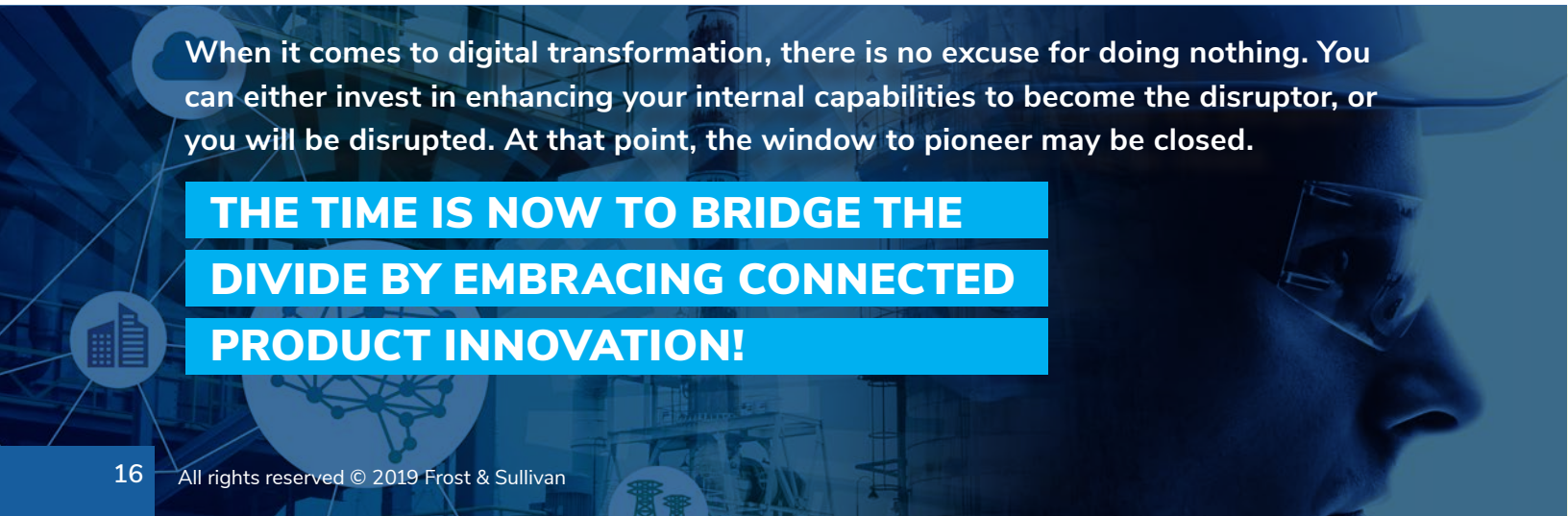
Further, the investment in digitizing the design of a product can be leveraged during the product's life cycle. When communicating to a potential customer, sales professionals can leverage Hololens and its immersive experience with the digital twin to demonstrate dynamic user experiences for large complex products. Boeing used immersive, mixed reality experiences to communicate airplane features and design to prospective customers at the Paris Airshow in 2017. These tools can be used to give real-time configure price quotes (CPQ) as customers visualize and trial different requested configurations. Once the product is sold, Microsoft's mixed reality solutions can also assist in product installation, maintenance, and repair because technicians are able to view real-time or historical performance data.

6 STRATEGIC CONCLUSIONS

Products have already undergone a significant digital transformation, leading to an incredible wealth of customer data and operational data. This capability has dramatically increased an organization's granular ability to address specific customer needs with new products/solutions. Similarly, Industry 4.0 and digital technology are revolutionizing the efficiency of global supply chains and manufacturing optimization. These are low-hanging fruit in the digital evolution and have contributed to incredible value creation.

However, as technology refresh cycles shorten across industries, equipment/product manufacturers are pressured to introduce new products at a much more rapid pace than before. The current product innovation process is disjointed, complex, messy, and involves substantial wasted expenditure in time and resources. Traditional product innovation processes are unlikely to work in the new digital world. The next frontier of competitive advantage lies in the successful implementation of a connected product innovation process.

Microsoft's technology portfolio (Azure Big Compute, high-performance computing, Azure ML, M365, D365 applications, and Azure Digital Twin) along with its Open Data Initiative provides a comprehensive portfolio of cutting-edge tools that helps organizations to create a truly connected product innovation process. Increasing data/system connectivity will facilitate better collaboration, more access to information, enhanced communication across the organization. On-demand computing resources will drive an efficient use of resources. With Microsoft's digital solutions, manufacturers can augment existing PLM and design investments to adapt more quickly to the changing landscape and accelerate time to market. Each digital platform solution provides incremental value to an organization; however, the real value is generated by leveraging Microsoft's entire portfolio ecosystem, enabling organizations to truly transform every aspect of the manufacturing value chain.



When it comes to digital transformation, there is no excuse for doing nothing. You can either invest in enhancing your internal capabilities to become the disruptor, or you will be disrupted. At that point, the window to pioneer may be closed.

THE TIME IS NOW TO BRIDGE THE DIVIDE BY EMBRACING CONNECTED PRODUCT INNOVATION!

APPENDIX

1—Sourced from Frost & Sullivan's Global Internet of Things Device Market Forecast to 2024

2—Sourced from Frost & Sullivan's Platform Strategies of Global Passenger Vehicle (PV) Automotive OEMs study. NF72-01.

3—CFD (Computational Fluid Dynamics), FEA (Finite Element Analysis), NVH (Noise, Vibration, Harshness)

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NEXT STEPS ›

- **Learn more** about Microsoft solutions and the growing number of manufacturers innovating with them.
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