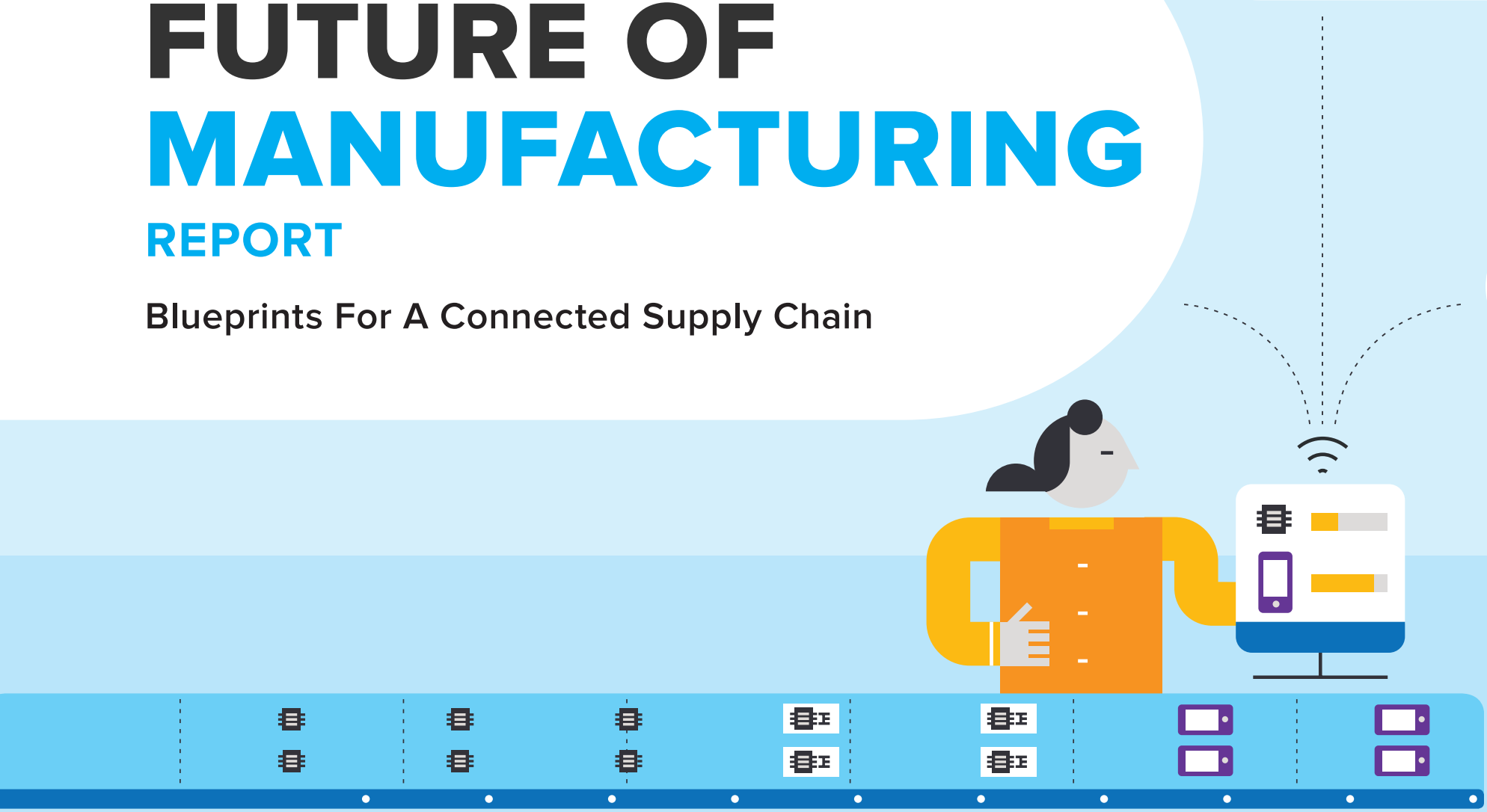
Microsoft with psfk

# THE FUTURE OF MANUFACTURING REPORT

## Blueprints For A Connected Supply Chain



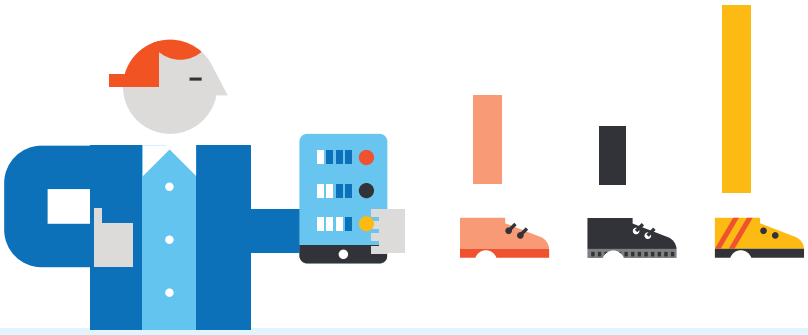
# Introduction

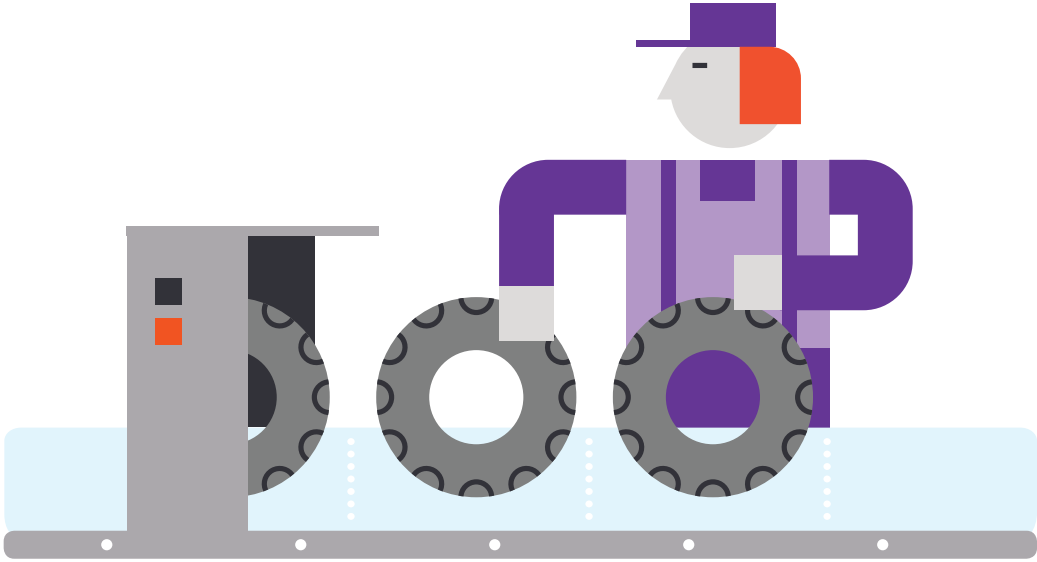
Digital forces are affecting operations within nearly every industry, presenting manufacturers with a renewed opportunity to drive efficiency throughout every link in the supply chain—from strategic research and development, agile factory operations and ongoing maintenance capabilities. With the availability of IoT and other connected sensors, manufacturers are pivoting towards new business models focused on providing continued services to their customers, even after the purchase. Guided by end-to-end transparency, collaborative knowledge platforms and cloud-based production lines, a new manufacturing vision ensures total operational agility and efficiency.

Major Shifts On The Path To Digital Transformation In Manufacturing:

- From Reactionary Models To Predictive Models
- From Information Silos To Information Networks
- From Production Lines To Production Ecosystems
- From Linear Supply Chains To Circular Supply Chains
- From Manufacturing Products To Manufacturing Services

**Piers Fawkes**
President, Founder
PSFK





## ABOUT THIS REPORT

**The Future of Manufacturing** is a report by business intelligence platform PSFK in partnership with global technology and service provider Microsoft. We present the future state of the manufacturing industry through five forward-looking scenarios that highlight global collaboration, data-driven operations and digitally enhanced ecosystems. Illustrating various opportunities to drive digital-first manufacturing strategies, the Future of Manufacturing report will guide organizations of all sizes as they develop seamless, dynamic product and supply chain innovations in a mobile-first, cloud-first world. With expert insights and detailed case studies, industry professionals will learn how to navigate this new cloud-based frontier and drive efficiency throughout every part of the manufacturing journey.

**psfk.com/report/future-of-manufacturing**

# Microsoft Introduction

Today's world is undoubtedly powered by advanced artificial intelligence. From music recommendations on our favorite streaming platforms to cars that alert us if we're too close to the curb, humans are more capable, informed and prescient thanks to modern digitization and AI-enabled software.

Beyond its obvious impact on society and culture, nearly every global industry is being disrupted by the pervasive, ubiquitous connectivity of digital technologies. By connecting people, enabling cross-industry collaboration and bringing holistic, end-to-end value to product and service innovation, entire business models are being transformed to serve evolved global needs and shifting demands.

Within the manufacturing industry, the name of this wave of massive technological proliferation has been coined the Fourth Industrial Revolution—and it's no longer just a catchy buzzword. Global industry leaders are quickly learning that the accelerated pace of change enabled by digitization is resulting in cheaper services and enhanced operations. But a digital ecosystem isn't just about predicting maintenance needs or connecting machines, it's about restructuring entire business models to become customer-first organizations and transforming insights into relevant, dynamic innovations.

With a new connected customer, changing demographics and complex regulations, manufacturing refers to more than a production line, but an intricate organizational hierarchy that is based on services and an elevated state of responsiveness—all centering around what the customer wants and needs. Internet of Things, cloud infrastructures and a reliance on big data are crucial for manufacturers to compete in this state of heightened competition and will allow consumers to experience ongoing support for their products or services, even beyond the checkout line.

Though a digital transformation certainly has monumental economic impact, in order to fully capitalize on the opportunity of digital transformation, industries will need to fully examine and analyze their company culture in order to equip employees with the elevated skillset needed for a more strategic role in the manufacturing supply chain.

**The keys for actualizing a successful digital business transformation revolve around 4 key pillars:**

1. **Engaging customers with deeply personalized experiences throughout every step of the customer journey.**
2. **Empowering employees with intuitive tools that can provide accessible information at their fingertips.**
3. **Optimizing operations with synchronized processes.**
4. **Transforming products by leveraging usage data and real-time collaboration with market needs and development team.**

From enabling preemptive maintenance needs to remote product telemetry, manufacturers are enriching their market operations from the ground up. With digital transformation, manufacturers can fully optimize their business outcomes with the ability to transform products into services that can help meet customer's dynamic needs. By connecting people, processes, things and data securely across entire company operations, colleagues and partners will be empowered to deliver their absolute best.

Microsoft is committed to supplying its customers with the security, cloud infrastructures and vast partner ecosystem of its digital-first solutions, empowering businesses with the tools needed to revitalize their operations and fully engage their customers with transformative products. Microsoft is partnering with a range of global industries and helping them drive end-to-end digital transformation through concrete, secure and efficient systems of intelligence.

Digital transformation forces us to deconstruct what we know about manufacturing. Let's reimagine our products as services, reconceive our operations and transform our customers' lives.

**Colin Masson**
Director of Manufacturing Industry Solutions,
Microsoft Cloud & Enterprise

# Forces Driving The Future Of Manufacturing

## ACCELERATED MARKET SPEEDS

Because today's consumers have a wealth of products to choose from, they are actively searching for high-quality items that are certain to bring value into their lives. Amidst this increasingly competitive environment, manufacturers are facing an increased pressure to output new, innovative creations at scale, which means that every stage of product development needs to be quick, agile and research-informed.

## MODULAR PRODUCTION EXPECTATIONS

Modern manufacturing networks have been partially automated for some time, helping accelerate production lines and manufacturing processes. However, with an influx of bespoke designs and customizable parts, manufacturers not only need to enable mass production, but also mass customization.

## DATA-DEPENDENT OPERATIONS

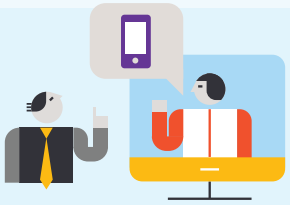
Manufacturers with an intimate knowledge of their operations are far more capable of refining or adjusting their operations than those who don't. With an influx of cloud-connected technologies, manufacturers are switching their approach from reactive to active solutions.

## PROLIFERATION OF E-COMMERCE PLATFORMS

The monolithic rise of digital purchasing channels has disrupted typical fulfillment and delivery logistics. Now, manufacturers must take into consideration a new node of production factors—from additional fulfillment channels to alternative warehousing distributions.

# Mapping The Trends Along The Networked Supply Chain

To accelerate and scale R&D, production and logistics capabilities, while ensuring end-to-end collaboration, transparency and quality, manufacturers can leverage connected technologies to unite traditionally siloed components of the supply chain.

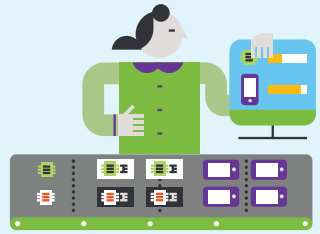


## REMOTE TEAMS/PARTNERS

Digital Prototyping
Onboard Collaboration

## MARKETPLACE

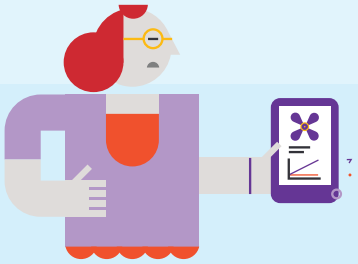
Agile Development
On-Demand Customization



## FACTORY FLOOR

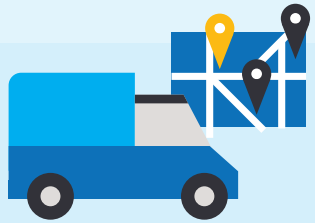
Responsive Operations
Multi-Task Production Line

## MANUFACTURING MANAGEMENT



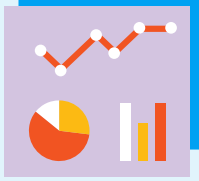
## CUSTOMERS

Near Predictive Analytics
Pre-emptive Troubleshooting



## SUPPLIERS/DISTRIBUTORS

Transparent Supply Chain
Dynamic Logistics



# 10 Key Trends Shaping The Manufacturing Industry

## DIGITAL PROTOTYPING

New visualization technologies allow manufacturers to build scaled models or simulate revisions to the production line process, all in a virtual space. These tools allow developers to revise digital solutions early in the development phase without the added cost or time associated with physical production.

## AGILE DEVELOPMENT

Traditional supply chains make it difficult for development teams to incorporate feedback into R&D until after a product is finished, which can slow down time to product and unnecessarily waste resources. Thanks to cloud-connected platforms, developers are now able to seamlessly incorporate feedback from the marketplace into the design process.

## ON-DEMAND CUSTOMIZATION

Automated systems are turning away from siloed behavior towards intelligent processes that are supporting skilled labor in enabling at-scale personalization. Because manufactures are no longer limited by the economics associated with custom orders, the ability to offer quality, personalized products at a reasonable price is becoming the path to differentiation for a number of brands.

## RESPONSIVE OPTIMIZATION

Actionable insights can now be drawn from IoT devices or cloud-connected software at the speed of business, giving key decision makers the ability to make meaningful operational adjustments in real time. Tech-enabled refinements encourage a continuous improvement methodology and allow for a quicker implementation of production line and staffing efficiency.

## MULTI-TASK PRODUCTION LINES

Manufacturers are shifting away from rigid production lines and opting for connected, data-sharing factories with equipment that is able to conduct a variety of tasks. This allows manufacturers to quickly adjust production capacity needed for custom orders, which can all be monitored and controlled through a centralized dashboard.

## PREEMPTIVE TROUBLESHOOTING

Real-time analytics and aggregate performance data inform manufacturers or third-party services of past and present conditions with the goal of accurately forecasting maintenance issues before they occur.

## ONBOARD COLLABORATION

Real-time streaming devices and platforms are allowing employees to quickly disseminate visual information to coworkers in different departments or who are offsite. By allowing remote teammates to seamlessly share viewpoints with one another, manufacturers and suppliers can quickly accelerate the implementation of new ideas.

## TRANSPARENT SUPPLY CHAINS

Suppliers and manufacturers are leveraging data from connected solutions, such as RFID sensors and blockchain that allow them to track the minute details of their entire supply chain—from sourcing of materials to factory production and warehouse distribution. This transparency not only ensures end-to-end product quality, but empowers operators to more quickly respond to potential issues throughout the manufacturing lifecycle.

## DYNAMIC LOGISTICS

New inbound and outbound logistics platforms provide manufacturers with insights and tools to discover cost-effective and efficient ways to move goods throughout all points of the supply chain.

## NEAR PREDICTIVE ANALYTICS

Rather than adopting a reactionary approach to operational planning, manufacturers are turning to aggregate data pools that allow production managers to forecast and predict trends that will affect inventory, staffing or production needs.

# Connected Manufacturing: Understanding The Opportunity

## PHYSICAL AND DIGITAL FUSION

Manufacturers have been aware of the impeding force of the fourth industrial revolution—the fusion of physical and digital manufacturing processes— for some time, but have nonetheless been hesitant to introduce their supply chains to digital frameworks. Thanks to advancements in cloud connected technologies and a reduced implementation cost, these technologies are more accessible and impose less of a risk for today's industrial leaders to adopt.

Discrete manufacturers are doubling the percentage of connected products in the next three years.

*IDC MaturityScape: Manufacturing Service Innovation, 2016*[1]

Cloud computing for the supply chain will be worth $4.4 billion by 2019.

*"Supply Chain Management In The Cloud." Accenture, 2016*[2]

By the end of 2020, 50% of manufacturers will derive business value from the integration of supply chain, plant operations, and product and service life-cycle management.

*"Why IDC Manufacturing Insights for Digital Supply Chain." International Data Corporation, 2017*[3]

## CONNECTED AND RESPONSIVE

With today's accelerated market pace, increased supply chain complexities and new patterns of consumer engagement, manufacturers need to replace traditionally siloed manufacturing practices with active, forward-thinking solutions. By leveraging connected manufacturing technologies, like IoT sensors and real-time communication software, in their supply chains, manufacturers can achieve better understanding of their operations and quickly respond to the needs of their customers and partners.

Enhanced sensing and monitoring, seamless transmission of digital information and advances in analyzing data and trends have potential annual benefits greater than $10 billion per year.

*Smart Manufacturing. NIST, 2016*[4]

73% of manufacturers state that cloud solutions had improved their level of insight into their businesses.

*2016 State of Manufacturing Technology Report. Plex, 2016*[5]

72% of manufacturing enterprises predict their use of data analytics will substantially improve customer relationships and customer intelligence along the product life cycle.

*Industry 4.0: Building the Digital Enterprise. PWC, 2016*[6]

Manufacturing costs will be reduced 10-20% by advanced robotics, cobotics, better OEE and staff flexibility.

*Digital Factories: The Renaissance of the US Automotive Industry. Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Roland Berge, 2016*[7]

# Why Invest In The Digital Transformation

## INSIGHTS FROM MICROSOFT EXPERTS

"Every company is a software company. You have to start thinking and operating like a digital company."

*Satya Nadella. CEO, Microsoft*

"In this massively networked world, you have to pick your technology partners carefully—making sure they not only have the capabilities you need, but that their approach empowers your agility, efficiencies and differentiation."

*Rocky Blanton. CVP, Enterprise & Partner Group, Microsoft*

"The real digital transformation that I see is that manufacturers are putting the customer at the center of everything they do with product and service innovation. What's enabled this 'customerization' and 'servitization' is the ability to get deeper customer insight and to provide service at a scale because of technologies like the Internet of Things, and the ability to remotely monitor those things."

*Colin Masson. Director of Manufacturing Industry Solutions, Microsoft Cloud & Enterprise*

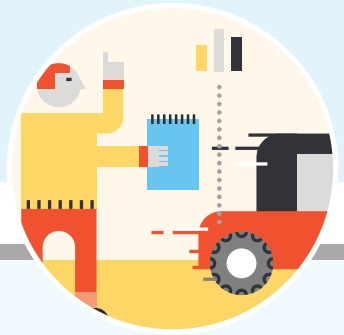
"Within the current manufacturing industry there is a shift from simply focusing on building products as standalone offerings. Now, manufacturers are looking to provide services that enhance existing products. These services offerings open up new customer outcomes and relationships. What you are getting is not only a product that works, but now you are nurturing a relationship—a partnership that is built on feedback and trust."

*Bill Moffett. Global Industry Senior Product Marketing Manager, Microsoft*

"As manufacturers transform into digital businesses, they are moving to new types of business models that include rich capabilities to deliver advanced services like predictive maintenance and product-as-a-service."

*Sanjay Ravi. WW Managing Director of Discrete Manufacturing, Microsoft*

# 5 Scenarios That Frame The Connected Supply Chain



## Connected Product Research And Development

Because customers' needs and preferences can change dramatically alongside competing market forces, product developers and designers need to work across teams in real time to maximize speed and efficiency. To ensure products have the greatest impact, the development cycle must be a fluid process, allowing feedback from customers and quality assurance tests to be integrated during prototype stages or even after a product has reached the market.

p 11

## Agile Production With Smart Equipment

As consumers are increasingly looking to assume the role of creator, manufacturers need to seek ways to introduce customization to their supply chains—without disrupting standardized, mass production. In order to deliver an affordable, custom product with quick turnaround times, manufacturers must have production lines that are flexible enough to handle multiple variations on a product type, while ensuring the right mix of materials and components are always on hand.

p 15

## The Data-Driven Factory

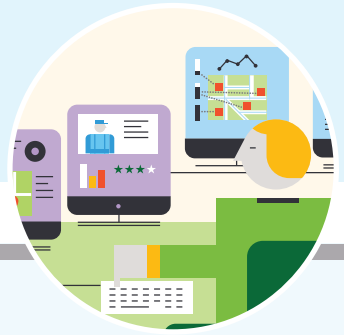
Siloed factory operations can lead to the inefficient expenditure of resources and delay the path from raw material acquisition to order distribution—or worse, compromise the safety of employees. In order to ensure efficient and safe operations throughout the factory, all components must be seamlessly interconnected, relying on data from previous operatives to inform daily operations and future tasks.

p 21

## The Transparent Manufacturing Journey

In order to optimize production to meet the constantly fluctuating demands of their customers, manufacturers must work diligently with suppliers, buyers and distributors to create a flexible logistics network that offers an accurate picture of inventory, from raw materials to finished products, and helps move products efficiently to the desired destination.

p 25



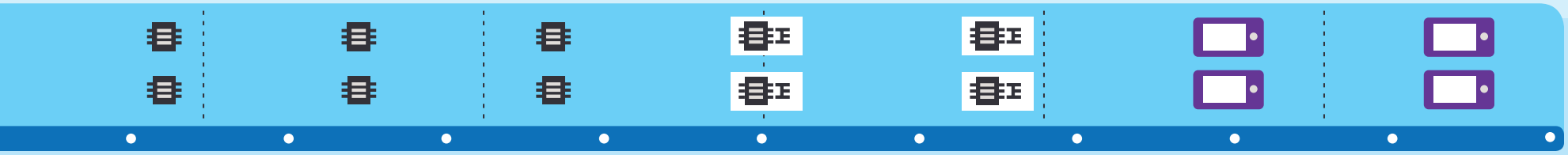
## Uninterrupted Operations Through Responsive Maintenance

Large-scale manufacturers that deliver goods or services to a variety of locations need to leverage software that can sync to multiple field employees who are servicing a range of assets. By outfitting their products with the ability to communicate diagnostics, repair management or service statuses back to a cloud server, the manufacturer's central team will be able to predict the impact of external forces on service or staffing needs.

p 29

# SCENARIOS

## FRAMING THE CONNECTED SUPPLY CHAIN



# Connected Product Research And Development: The Opportunity

**For Research and Development teams, the road to creating a successful product means communication with both ends of the supply chain—from raw material vendors to customers purchasing the finished product. Insightful ideation begins with in-depth consumer knowledge, but to enable at-scale product creation, manufacturers must open communication channels with their global supplier teams and engineers.**

With enhanced collaborative tools and real-time communication softwares, development teams have the ability to collaborate on product designs while reducing time to market and improving product longevity through actionable insights. For brands and manufacturers, this means reduced product development costs and creations that are assuredly robust.

## TRENDS DRIVING THIS

- Digital Prototyping
- Agile Development
- Preemptive Troubleshooting
- Dynamic Logistics

## HIGHLIGHTING THE OPPORTUNITY

"Whether it's changes in packaging or even various forms of product innovation, timely and quality feedback is core to the overall ability of a manufacturer to not only provide what the market wants, but also to anticipate market changes."

*Bill Moffett. Global Industry Senior Product Marketing Manager, Microsoft*

IndustryWeek IW

45% of manufacturers have not set a specific goal for reducing new product development cycle times.

*The Future of Manufacturing: 2020 and Beyond. IndustryWeek, 2016*[8]

Forbes

"Companies must align R&D with strategy and ensure that they have robust innovation management processes in place to take products to market."

*"Why R&D Spending Is Not A Measure Of Innovation." Forbes, August 2016*[9]

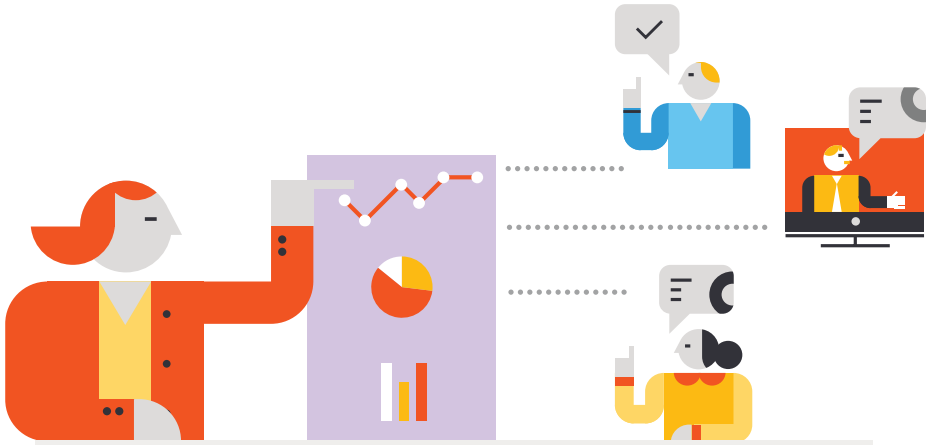
strategy&

"A focus on innovation additionally requires that companies establish a multidisciplinary R&D department that is sufficiently agile to adapt to changing market tastes and regulatory constraints."

*"Metals Industry: Growth Strategies to Outlast Commoditization." Strategy&, February 2017*[10]

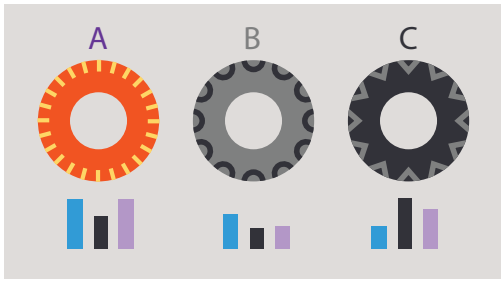
# **SCENARIO:** At The Drawing Board: Easing The Path From Concept To Creation

**Katelyn, the lead product developer of a tire manufacturer, has been tasked with designing an all-weather tire that utilizes the company's latest material formulation. As this will be the first of its kind in the marketplace, she wants to gather insights from their targeted consumer base to create a successful launch. At the same time, she will need to collaborate with a new set of partners throughout the development process to ensure they have the necessary material, production and testing in place.**



1. Katelyn and her team work with their network of retail and automotive partners to gather information about customers' driving and purchasing habits. They also employ social listening tools to gather commentary from the marketplace with the goal of identifying unmet needs.

2. The results from these initiatives are analyzed using an AI-powered platform that extracts key insights around pricing, service and usage. These metrics can be visually compared to a competitive set of offerings that can be leveraged by the R&D team to inform important design decisions.

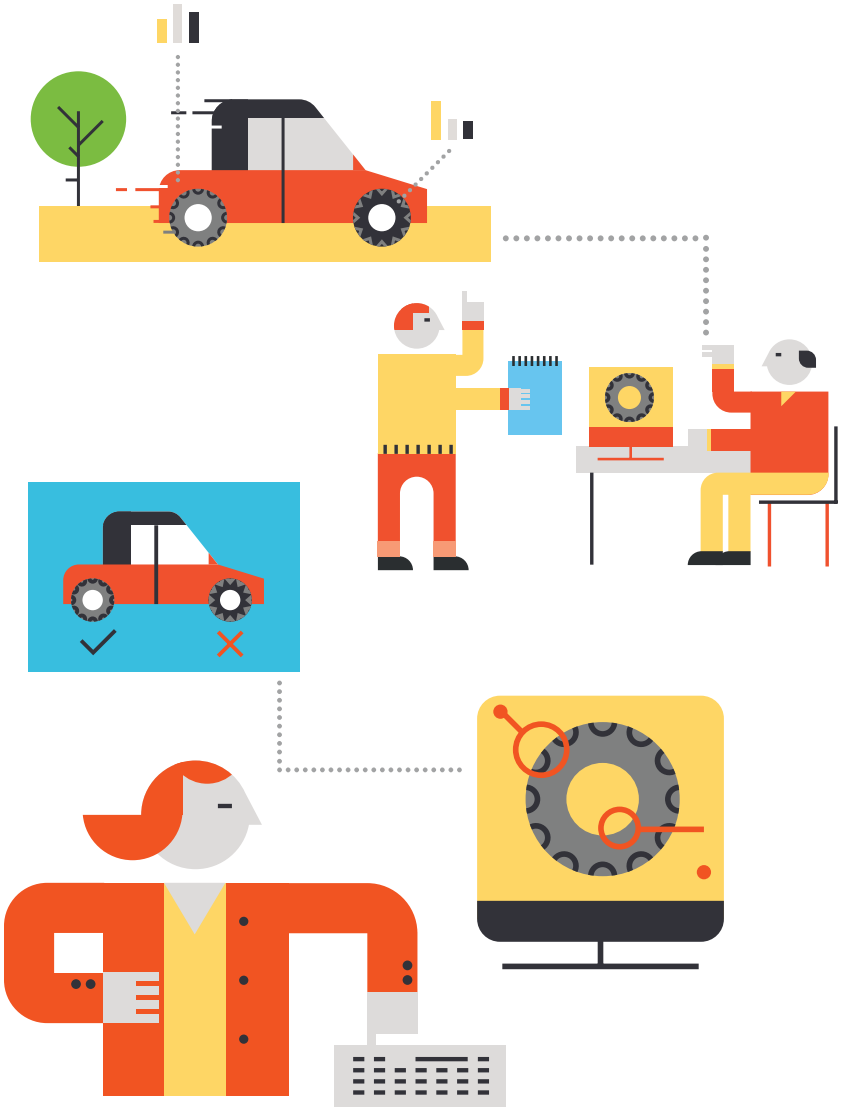


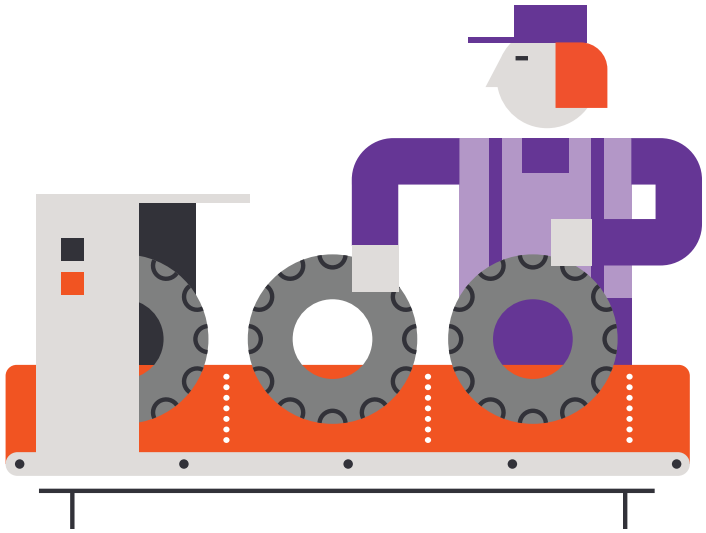

3. Using these inputs, Katelyn and her team develop a digital prototype that takes the qualities of the new composite formulation into consideration, allowing them to virtually test the performance of a number of different tread patterns, tire widths and weights on a variety of road conditions.

4. Once the team has selected three potential models, Katelyn runs a remote meeting with her international engineering and supply teams to conduct a cost benefit analysis of material sourcing and decide which new vendors to bring onboard.

5. Katelyn orders a short production run of each of the three different tire models so that the Quality Assurance team can perform a series of real world tests that will influence the final design. By leveraging a flexible manufacturing line, the plant can quickly turn around prototypes without impacting ongoing production.

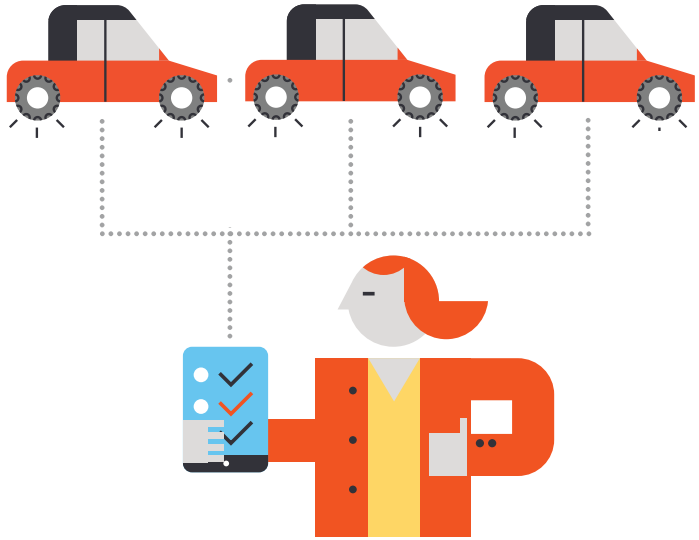
6 While conducting the tests, QA can send the R&D team a real-time analysis of how the tires perform under various levels of stress. While one prototype clearly outperforms the rest, feedback from the test group suggests further refinements to the final design. Based on this input, Katelyn and her team revise their tread model and deliver an updated prototype to Quality Assurance.





7 After QA tests and approves this final design, the digital prototype is delivered to the production team, who readies it for full-scale production.

8 The production team implements a telemetry system into the tire which allows Katelyn's R&D team to implement ongoing insights or produce updated components that are derived from usage data.



# **The Impact Of** Connected Product Research And Development

## BUSINESS DECISION MAKERS

- Identify time consuming or inefficient communication methods and replace them with real-time knowledge sharing platforms
- Enable the development of products or services based on market insights or innovative thinking
- Redesign product development processes based on collaboration and agility

## INFORMATION TECHNOLOGY DECISION MAKERS

- Develop and implement reliable network solutions that connect remote parties and enable seamless idea sharing
- Improve and democratize data processing analyses that support development team ideation
- Analyze real-time product development metrics for advanced decision making and visibility
- Integrate solutions into end-products that enable the ongoing monitoring of usage and performance to inform refinements and future product development

# Microsoft Spotlight

## INNOVATION IN ACTION

The motorsport racing team **Renault Sport Formula One** partnered with Microsoft to accelerate the development time and implementation of state-of-the-art racing technology. Using **Microsoft Office 365 E5** suite, team members were able to securely share information, collaborate on crucial intra-race adjustments and seamlessly track moving parts throughout their supply chain. Because the development team leverages large amounts of data from its car building processes, they utilize **Microsoft's Power BI** dashboards to make this data readable for all team members and ensure thorough, insightful analyses. Additionally, Microsoft's **Azure Machine Learning** technology allows the team to derive actionable understanding from their ongoing races or experiments with new technologies.

**bit.ly/2nPV44k**

## POWERING TRANSFORMATIONS

**Insight** via **Microsoft Power BI** enables technical support teams to detect issues, track usage and diagnose crashes on mobile and web apps, allowing them to continually improve direct communication channels between customers.

**Azure IoT Suite** allows R&D teams to place IoT data in the context of service data, enabling the creation of products that build upon the success of previous iterations and correct erroneous manufacturing decisions.

**Power BI** provides enterprises with a suite of analytics tools to deliver data-derived insights company wide, enabling enterprises to truly become fluent in their data consumption.

**Organization Insights** powered by **Microsoft Dynamics 365** allows organizations to derive crucial information about their customers' patterns of use, while its customizable dashboard offers easily accessible, crucial information about enterprises.

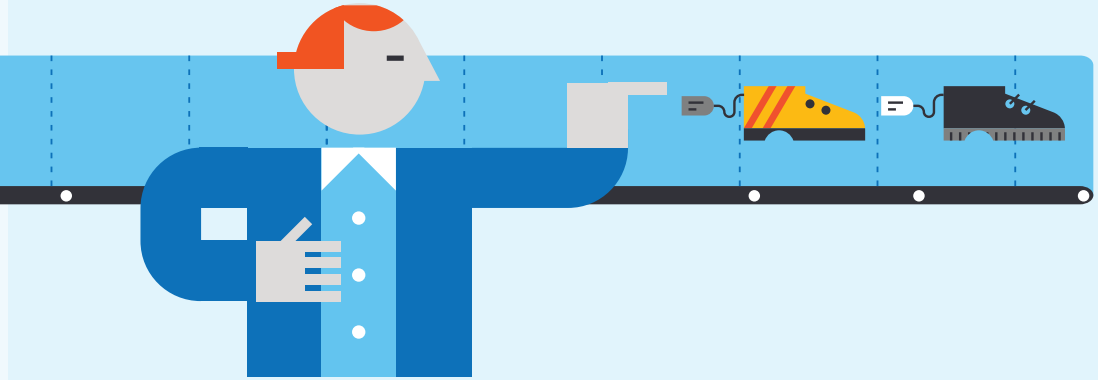
# Agile Production With Smart Equipment: The Opportunity

**Rigid production lines excel at crafting uniform, standardized products—but more often than not, customers are expecting to have the option to customize their products or request something different than what is offered to them. As a result, manufacturers are needing to develop one-off, tailored creations for their consumers. To effectively accomplish this without disrupting mass production, suppliers need to leverage cloud-based tools that allow them to seamlessly create personalized products at scale.**

Emerging Industry 4.0 technologies, such as intelligent robotics applications or product neutral equipment, can connect to a cloud server that directs them to actions dependent on specific bespoke production actions. By implementing versatility into the production line, manufacturers can eliminate the limitations typically associated with mass production lines.

## TRENDS DRIVING THIS

- On-Demand Customization
- Dynamic Logistics
- Multitask Production Lines
- Predictive Analytics
- Supply Chain Transparency



## HIGHLIGHTING THE OPPORTUNITY

"Manufacturers are able to deliver mass customization to a segment of one with the flexibility offered with capabilities like IoT, machine learning and advances in 3D printing. These capabilities are enabling new profitable mass customization business models that were not possible in the past."

*Sanjay Ravi. WW Managing Director of Discrete Manufacturing, Microsoft*

"Manufacturers anticipate that innovations in flexible automation will experience 4% to 10% growth leading up to 2020."

*The Future of Manufacturing: 2020 and Beyond. IndustryWeek, 2016* [8]

"Manufacturing production has recently grown at its fastest pace in more than a decade, creating more economic value per dollar spent than any other sector. Adding to this surge is customization -- the ability to quickly and efficiently make what you want, when you want it."

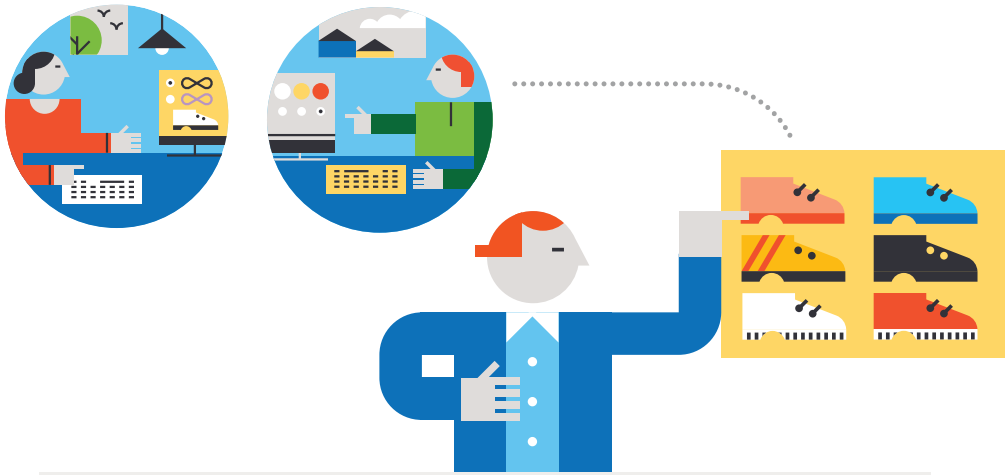
*"Advanced Manufacturing: Made To Order." National Science Foundation, 2016* [11]

"{The digitization of products and services] not only greatly increases the ability to respond flexibly and more rapidly to customer demands, but also to anticipate demands, helping customers get ahead of themselves in a range of predictive ways."

*Industry 4.0: Building the Digital Enterprise. PWC, 2016* [12]

# **SCENARIO:** Consumer As Creator: Exploring The Creation Of Custom Products At Scale

**David, the supply chain manager of a shoe manufacturer, must account for custom orders created by customers on the brand's website. In order to meet the demands of bespoke product creation while ensuring minimal time to fulfillment, David must be able to manage a flexible inventory of raw materials to handle multiple shoe variations, while ensuring enough supplies are on hand to support mainstream production runs.**

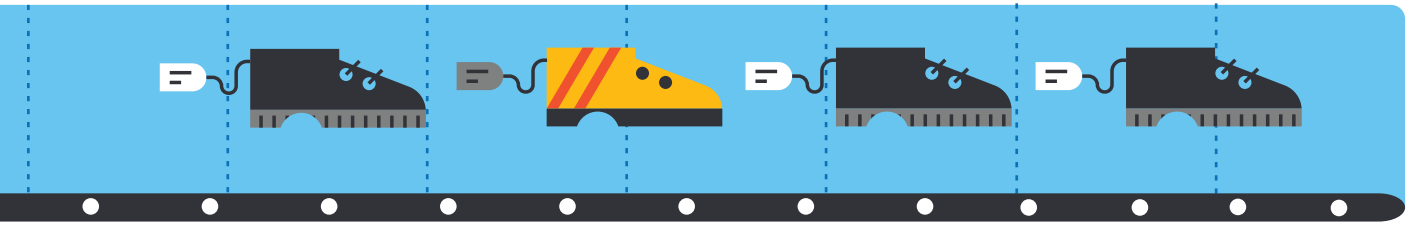


1. A group of customers submit their bespoke sneaker designs using the brand's digital creation software that enables them to choose from a variety of styles, materials and colors.

2. These custom designs are communicated directly to the manufacturing plant, where an AI-powered platform manages the custom requests as they come in, constantly updating the production flow to maximize efficiency and communicate necessary instructions to the factory floor. Thanks to service-oriented hardware, manufacturing operations are able to seamlessly produce one-off creations, alongside their mass production lines.

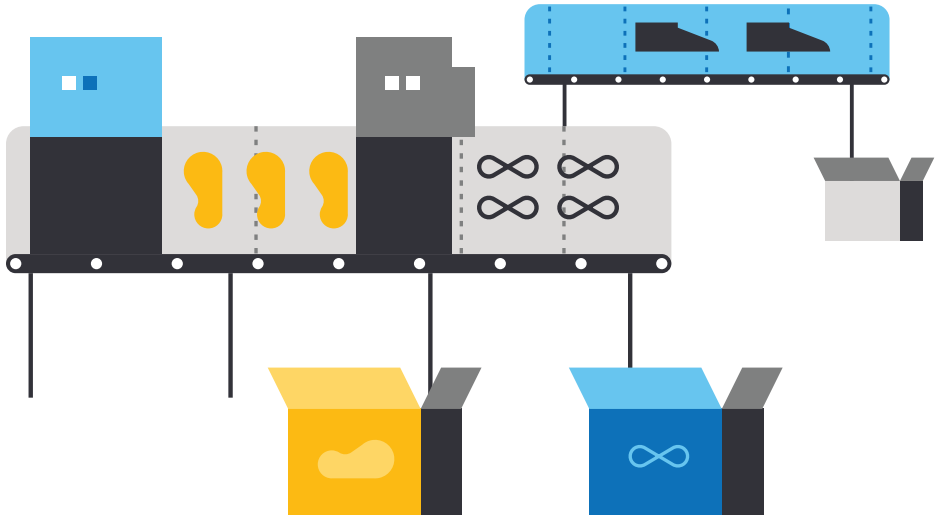
3. As these customer orders come off the production line, they are packaged with RFID tags and sent to a packaging center. This generates an automatic email for each customer that includes a link to view the status of their shipment and a picture of the finished product.

4. To keep shipping costs to a minimum, a backend logistics software is used to track the custom orders, ensuring they make it onto bulk shipments that are heading to distribution warehouses that are in closest proximity to the final delivery address.



5 As custom orders come in, an AI-program tracks all styles, materials and color choices, weighing them alongside key trends from the worlds of fashion, sports and entertainment to produce an aggregate data model that predicts which supplies will be in high demand in the near future.

6 With an anticipated spike in the demand for yellow suede, the platform analyzes current material inventory and incoming shipments, alerting David and suggesting he revise his most recent order to avoid shortages.



7 This same data is also sent to the company's R&D teams to influence their ongoing innovation pipeline, ensuring they stay ahead of the most popular style trends and capitalize on consumer demand.

# **The Impact Of** Agile Production With Smart Equipment

## BUSINESS DECISION MAKERS

- Identify areas where it is appropriate to invite the consumer into the creation process, and provide them with necessary tools to mold products accordingly
- Leverage real-time customer insights to predict demand within the marketplace, ensuring necessary materials are stocked and available for production needs
- Be transparent with customers about where their products are in the manufacturing process and provide them with accurate delivery times

## INFORMATION TECHNOLOGY DECISION MAKERS

- Develop and implement reliable network solutions that connect remote parties and enable seamless idea sharing
- Improve and democratize data processing analyses that support development team ideation
- Analyze real-time product development metrics for advanced decision making and visibility
- Integrate solutions into end-products that enable the ongoing monitoring of usage and performance to inform refinements and future product development

# Microsoft Spotlight

## INNOVATION IN ACTION

The garment manufacturer **Crystal Group** partnered with Microsoft to meet the challenges imposed by differentiated orders and an increased market speed. By deploying **Microsoft Windows 10 Enterprise** operating system, Crystal Group's employees are empowered with better connectivity and can quickly react to customers' diverse needs. Employees use three Windows 10 applications—the **Style Library, Quotation Approval** and **Sales Hub**—to automate certain tasks and expedite sales cycles to meet high quantities of custom orders. The **Microsoft Enterprise Mobility Suite** optimizes end-to-end security and allows Crystal Group's employees to share files, without compromising security.

**bit.ly/2nQ7V6J**

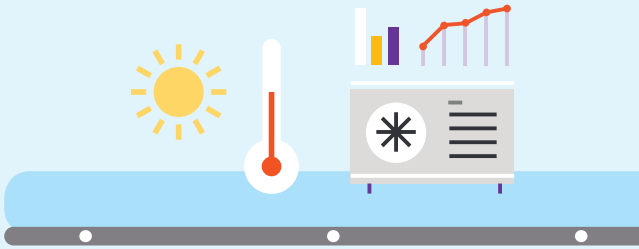
## POWERING TRANSFORMATIONS

**Predictive and Perceptual Intelligence** via **Cortana Intelligence** helps dealers better infer customer needs and behavior, gain insights and create more meaningful customer experiences at a reduced cost.

**Dynamics CRM** powers customer sales and relationship management, helping companies deliver exceptional customer experiences and create long-term relationships based on knowledge and trust.

**Office 365** is an integrated solution that allows entire work teams to collaborate more effectively with team chat features and online meetings, while allowing remote team members to co-author and share files securely—enabling real-time collaboration without inhibiting customer interactions or company operations.

# Forecasting Demand Trends



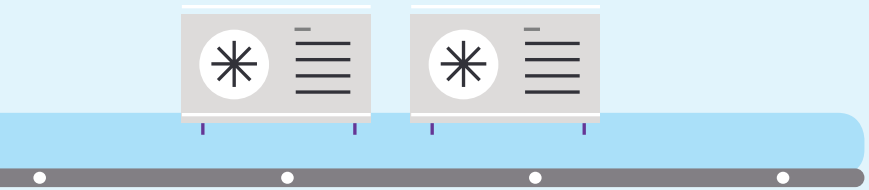
Arçelik A.Ş. is a leader in most of the 135 countries in which it does business, manufacturing and selling everything from major kitchen appliances to televisions, air conditioners, even gourmet tea dispensers and hair straighteners. It owes much of that sales success to something that happens months and even years after each sale.

That "something" is post-sales customer service. Arçelik A.Ş., like most manufacturers, knows that it's now in the service business. Providing great customer service is the key to customer satisfaction. And customer satisfaction is an engine of business success.

**Arçelik A.Ş.'s customer service operation is first rate—and it intends to keep it that way. "We're known for the availability of fast, expert service," says Suat Celebi, IT Manager for Supply Chain at Arçelik A.Ş.. "Customer service is crucial to our reputation."**

And it can be a challenge. Arçelik A.Ş. sells thousands of product SKUs—and maintains an inventory of hundreds of thousands of spare-part SKUs to service them. Having the right spare parts available whenever and wherever in the world they're needed is key to getting customers back up and running quickly with their products. When parts aren't available, customers have to wait for them, driving down satisfaction. Or Arçelik A.Ş. has to replace the product, driving up costs. But when too many parts sit in inventory, costs go up again.

It seemed as though Arçelik A.Ş. needed a crystal ball to forecast its spare parts requirements across the growing number of markets it serves. What it had was 10 systems for data collection and a series of spreadsheets it managed by hand. With a catalog of 350,000 spare parts growing at a rate of 10 percent a year, that system simply couldn't scale to maximize customer satisfaction while minimizing inventory cost.



To remedy this situation, Arçelik A.Ş. became a leader in another global trend: digital transformation. With the help of solution provider BilgeAdam, it revolutionized its spare-parts demand forecasting with a solution based on Microsoft Cortana Intelligence Suite, a fully managed big data and advanced analytics suite in Microsoft Azure that transforms data into insights for action—exactly what Arçelik A.Ş. was looking for.

Celebi and his colleagues made their first move to the public cloud with this solution and the decision to adopt the Microsoft cloud delivered benefits even before the impact on inventory management. For one, the company went live with the Microsoft solution in just three months—avoiding 83 percent of the 18-month development schedule it anticipated with another solution.

**"We needed the right solution, but we also needed it quickly to ensure we stayed ahead of our business requirements," says Celebi.**

**"With Cortana Intelligence Suite, we got both. We wanted a quick win with forecasting and we got it. We are very happy."**

They also got a highly cost-effective solution. Arçelik A.Ş. pays only for the cloud resources it uses, when it uses them. It can scale up cost-effectively as the business grows and easily integrate external data—such as weather and location—to enhance its forecasts. By basing its solution on Cortana, Arçelik A.Ş. avoided the large infrastructure investments, scarce and high-priced talent, and high implementation and maintenance costs that it would have incurred with that other solution.

Here's how the solution works: Each month, the solution uploads spare-parts demand data for the last month -adding it to the previous three years- into an Azure SQL Database. Azure Machine Learning tests four algorithms to identify the most accurate one based on the current data set and uses that algorithm to forecast the needs for spare parts 12 months out. The next month, the solution updates the data set and repeats the experimenting and forecasting. The testing is automated by Azure Data Factory and the algorithms are based in part on time-series R code developed for Arçelik A.Ş. by BilgeAdam.

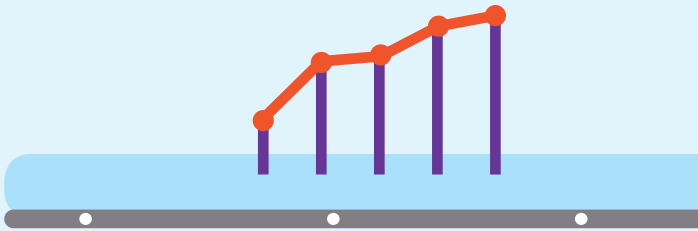
**"With Azure, we found it very easy to use both open source and Microsoft tools to develop the R code and integrate it into the solution," says Mustafa Acungil, Director of Data Management Solutions at BilgeAdam.**

**"After we packaged our R codes, it was drag-and-drop and we were ready to test the algorithms."**

Here's how well the solution works: After six months in production, the spare-parts forecasting solution has a 80 percent accuracy rate, up from about 60 percent before. Moreover, the solution produces forecasts for all 350,000 spare parts SKUs, compared to just 100,000 SKUs covered previously.

Taken together, Arçelik A.Ş. expects the solution's performance to boost inventory turnover by 10 percent by 2019. Faster turnover means that spare parts are put to use faster and the costs of storing, managing, and financing them are reduced. Arçelik A.Ş. is also better able to thin out its inventory of seldom-used parts.

**"With more spare parts in our warehouse, we needed a way to respond to customer needs quickly," says Burcu Aksoy, Spare Part Team Leader, Customer Care, Arçelik A.Ş. "We achieved that by using Azure Machine Learning to increase forecast accuracy."**

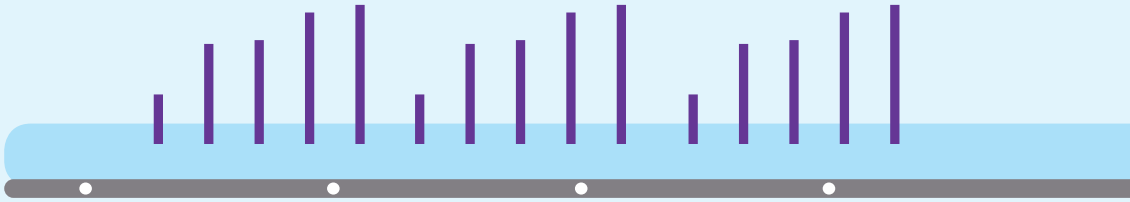


By reducing the risk that it will be out of stock for requested spare parts, Arçelik A.Ş. can schedule and complete service calls sooner, so customer issues can be resolved without having to use the more expensive option of replacing entire products. That in turn leads to happier customers.

**"We're already seeing regular improvement in spare parts forecast consistency, reducing stock levels, and improving on-time demand coverage," says Cagatay Ozak, IT Manager for Purchasing, Logistics, and Business Relations at Arçelik A.Ş.. "And that's having a positive effect on customer satisfaction."**

As a bonus, the more accurate and more useful forecasts are also faster and easier for Arçelik A.Ş. to produce. The 12-month forecasts used to take two or three weeks to produce. Now, Arçelik A.Ş. produces them every week—and, as mentioned, the forecasts cover three times as many SKUs.

**To Celebi, the spare-parts forecasting solution is much more than a technological innovation. "This Microsoft solution is part of a digital transformation that enables us to service our customers even better than before," he says. "Companies that can do that will thrive in the market. Companies that can't will disappear. We intend to thrive."**



# The Data-Driven Factory: The Opportunity

**From Internet of Things sensors to cloud infrastructures, it's easier than ever for manufacturers to gather information about their daily operations. With this knowledge at hand, production managers can obtain ongoing analyses to identify bottlenecks in their factories or inform them of inefficient operations. Over time, this data collection can help manufacturers accelerate output by allowing them to introduce real-time adjustments to their production lines.**

## TRENDS DRIVING THIS

- Preemptive Troubleshooting
- Dynamic Logistics
- Responsive Optimization
- Onboard Collaboration
- Predictive Analytics

## HIGHLIGHTING THE OPPORTUNITY

"The use of IoT sensors on manufacturing assets is a game changer, especially when you consider the impact of asset maintenance. Devices can now be monitored in real time and compared to their optimal operational settings. This means that we can see, with a mathematical degree of certainty, when a part is worn down and needs servicing. With Predictive Maintenance on the manufacturing floor, you've just enabled a much more effective manufacturing planning cycle, improved your ability to respond to customer needs and prevented costly problems before they happen."

*Bill Moffett. Global Industry Senior Product Marketing Manager, Microsoft*

IndustryWeek IW

"Manufacturers anticipate that enhanced data availability will account for more than 10% revenue growth leading up to 2020."

*The Future of Manufacturing: 2020 and Beyond. IndustryWeek, 2016*[8]

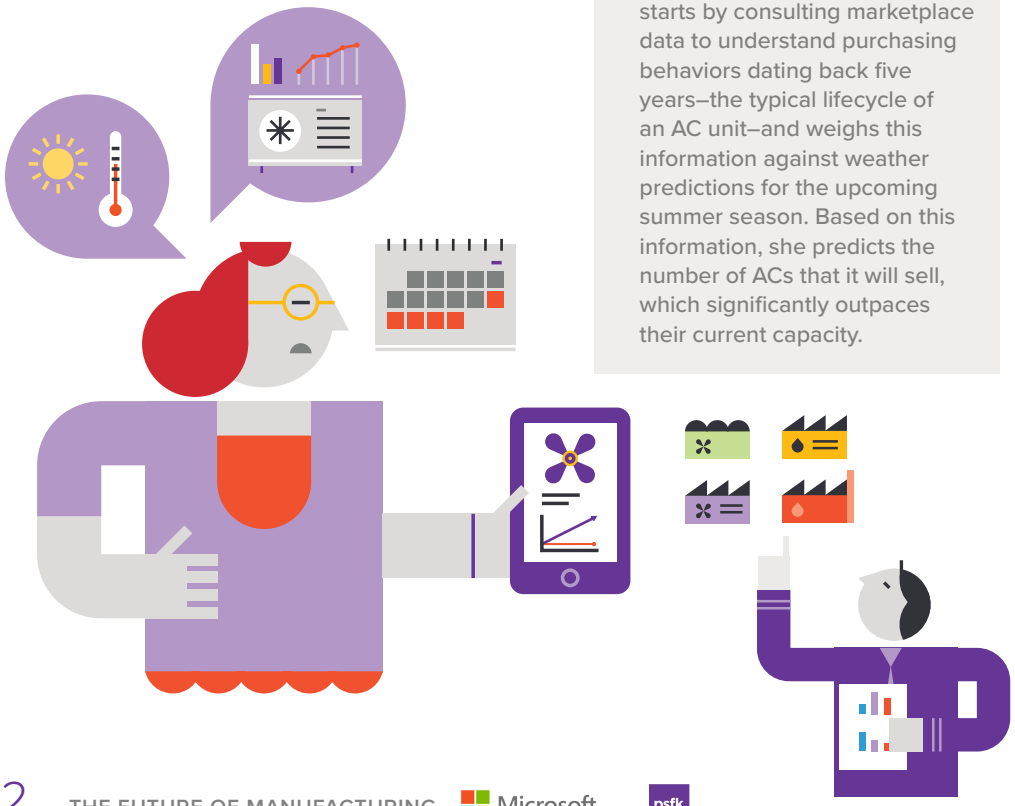
Roland Berger

"Manufacturing costs reduced by 10-20% by advanced robotics, cobotics, better OEE and staff flexibility."

*Digital Factories: The Renaissance of the US Automotive Industry. Fraunhofer Institute for Manufacturing Engineering and Automation (IPA). Roland Berger, 2016*[7]

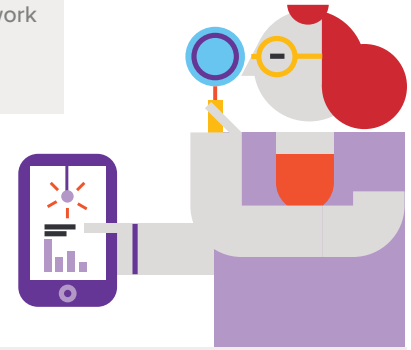
# **SCENARIO:** On The Factory Floor: Omniscient Operations

**After being named an industry leader across a number of publications for its newest model, an air conditioner manufacturer expects a spike in demand for its products, but doesn't have the resources to significantly expand manufacturing beyond its current footprint. Martha, the manager of the manufacturer's North American operations, must review and adjust the production flow of multiple factories in order to accommodate expected demand shifts.**



1. In order to understand the true impact on production, Martha starts by consulting marketplace data to understand purchasing behaviors dating back five years–the typical lifecycle of an AC unit–and weighs this information against weather predictions for the upcoming summer season. Based on this information, she predicts the number of ACs that it will sell, which significantly outpaces their current capacity.

2. With a target number in place, Martha and her team perform a data-audit of ongoing operations across their network of factories to identify and troubleshoot inefficiencies.



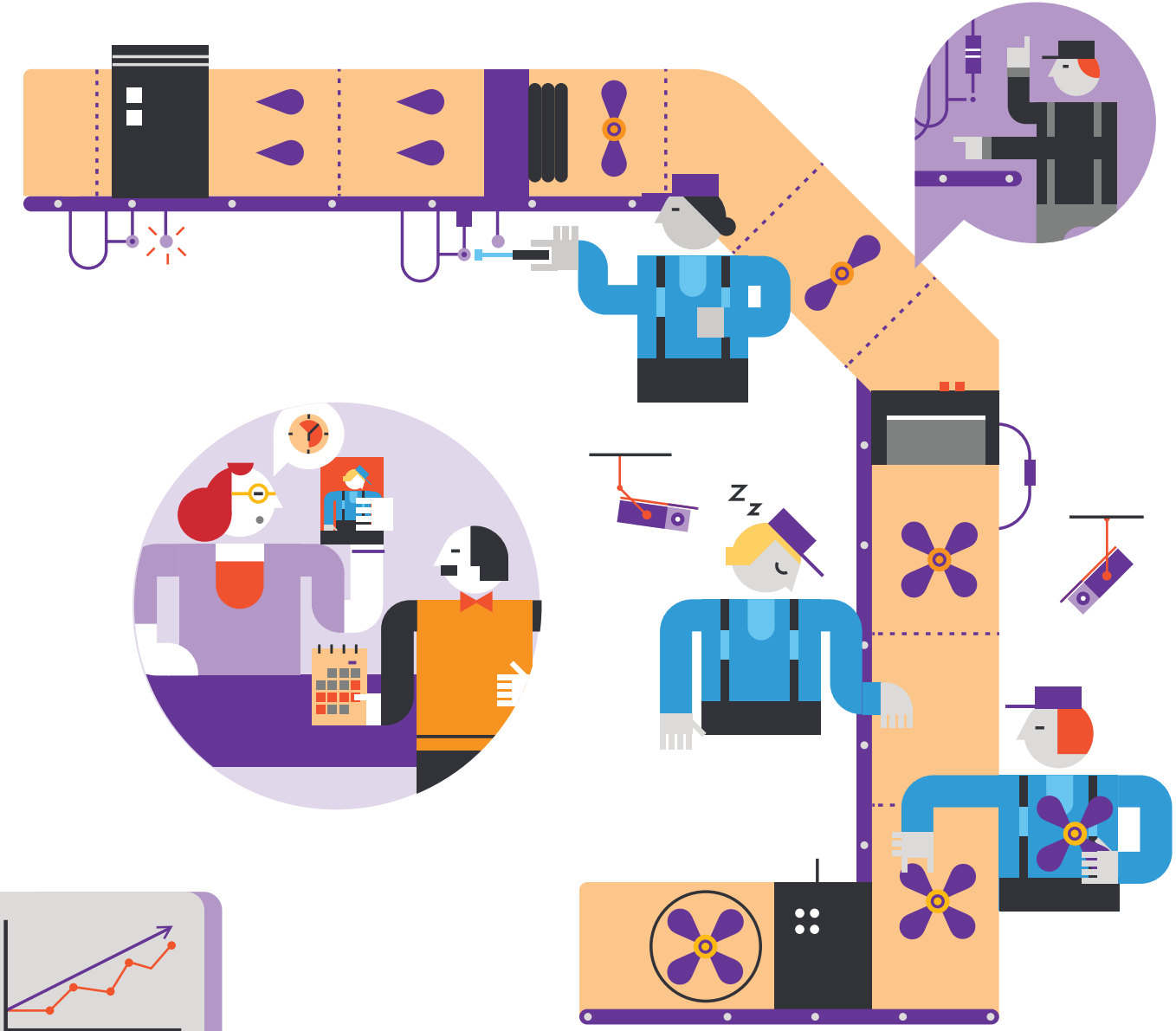
3. Using data collected from sensor-enabled equipment, Martha notice that a key piece of machinery within the production line at each of their factories is consistently underperforming, slowing down overall operations by 22%

4. She schedules a virtual meeting with the OEM's client representative, along with the main service technicians on her factory floors to discuss the issue and figure out the best solution. They determine the problem to be improper calibration, which causes the equipment to occasionally reset.

5. While this typically requires a specially-trained technician to adjust, the OEM is able to offer remote guidance through an AR service manual that overlays key steps in the calibration process onto the equipment, enabling Martha's team to temporarily fix the issue until one of the OEM's technicians can perform on-site diagnostics.

6 While the factories are already operating on a continuous schedule, Martha analyzes worker data from connected cameras and wearable devices to understand performance metrics over the course of a typical eight-hour shift. After identifying productivity drop-offs after six hours among certain skilled assembly positions, Martha determines that it's best to flex workers around these jobs to improve overall performance.

7 Using an AI-powered platform, she can quickly make adjustments to worker scheduling to account for the changes and ensure proper deployment across the production line. She also shares her findings with the COO, suggesting that the company invest in cross-training employees on multiple pieces of equipment.



8 Martha makes note of these two major changes along with smaller refinements identified during the audit to the backend operational software platform to receive regular updates on their ongoing impact. She also is able to simulate production over the next six months and see that they should be on track to meet the increased demand.

# The Impact Of
# The Data Driven Factory

## BUSINESS DECISION MAKERS

- Weigh sales data from the marketplace alongside consumer sentiment and contextual factors like weather, media response etc. to better plan for demand
- Leverage data-driven insights to identify operational inefficiencies as they occur, enabling continual optimization without disrupting production and other essential processes
- Make infrastructure and technology investments with flexibility in mind, ensuring operations can quickly scale up or down based on market demand

## INFORMATION TECHNOLOGY DECISION MAKERS

- Deploy VR/AR technologies to the production floor to assist with the diagnosis, assessment and solution of problems
- Create an ecosystem of sensor-enabled equipment, wearables and other connected devices to gain a holistic understanding of operational health or drill down to analyze specific components
- Employ AI assistants to automate certain aspects of operational decision-making, ensuring small adjustments and refinements can be made on an incremental basis without requiring unnecessary time and effort

# Microsoft Spotlight

## INNOVATION IN ACTION

Race Winning Brands (RWB), a leading manufacturer of engine parts for racecars and powersports machines, built a business-intelligent solution using **Microsoft's SQL Server 2016** and **Microsoft's Power BI**. This hybridized BI platform allowed RWB to consolidate in-house data and provide on-demand, comprehensive reports and dashboards about customer and product data from disparate systems. By streamlining its data collection and analyses process, RWB's employees are able to focus on more high-value tasks.

**bit.ly/2nQ5l0w**

## POWERING TRANSFORMATIONS

**Data Analytics** and **Machine Learning** via **Cortana Intelligence** allows manufacturers to leverage and process cloud data to inform new automated services.

**Cortana Intelligence** helps to create a smarter factory environment through predictive and proactive maintenance, helping team members address problems before they arise. Service teams can capture and analyze data across their fleets to set up a maintenance schedule, eliminating operational downtime and costs while delivering an improved customer experience.

**Microsoft's SQL Server** provides enterprises with the ability to analyze data of any size or type for optimal data warehousing, and allows them quickly make informed decisions through unlimited processing power and instant access to BI on any mobile device.

# The Transparent Manufacturing Journey: The Opportunity

**The manufacturing journey is comprised of a breadth of locales and requires communication between multiple suppliers and partners. With higher expectations to meet market demands with faster delivery times, manufacturers need to identify opportunities to implement agile supply chain practices without sacrificing the quality of their products.**

By leveraging technologies that provide them with real-time insights to logistics, delivery or fulfilment systems, manufacturing coordinators can monitor their inventory flow and respond to any hazardous disruptions in real time.

## TRENDS DRIVING THIS

- Dynamic Logistics
- Transparent Supply Chain
- Responsive Optimization
- Agile Development
- Predictive Analytics

## HIGHLIGHTING THE OPPORTUNITY

"64% of manufacturers cite cloud and IoT solutions as a key factor in improving connectivity and communications with suppliers."

*2016 State of Manufacturing Technology. Plex, 2016*[5]

'The digital factory will have important ramifications on product quality levels and related processes, as manufacturers are expecting that 10-20% of cost savings can be found in this area."

*Digital Factories: The Renaissance of the US Automotive Industry. Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Roland Berge, 2016*[7]

"What we are trying to do is derive insights which are both more predictive – they allow us to see what is going to happen, going forward – and prescriptive – now we know something, what should we do about it?"

*Suresh Acharya, Head of JDA Labs*

Cloud-based platforms for manufacturing are expected to grow more than 20% between 2017 and 2018.

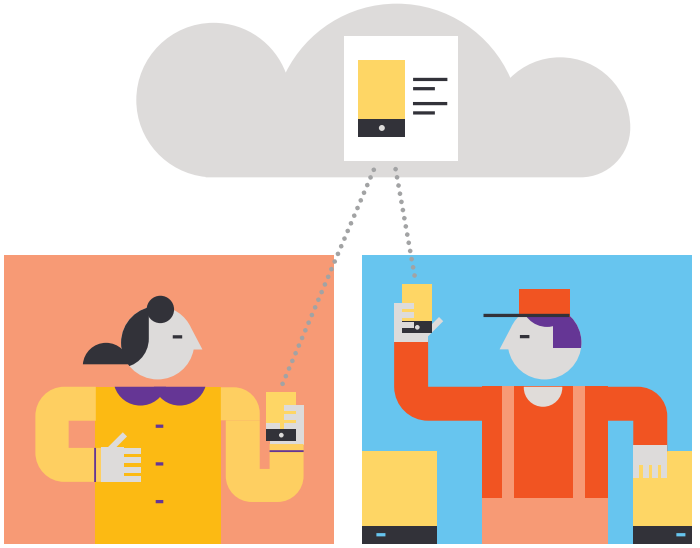
*2017 Top Ten Trends in Modern Demand-Driven Manufacturing. Synchrono, 2016*[13]

"Supply chain transparency continues to grow in importance for shippers and third-party logistics providers. This is driving significant technological change for third-party logistics and shippers alike as they collaborate and share more real-time information to enable data-driven business decisions and meet the growing needs of consumers."

*Marc Althen. President, Penske Logistics*

# **SCENARIO:** On The Road: Meeting Supply Chain Demands With Flexible Logistics

**For the highly anticipated launch of their latest smartphone, a mobile device manufacturer is integrating new microchips with faster processing power and a brand new form factor. To make this happen, the company's development coordinator, Cheyenne must work across her global production and distribution centers to bring new vendors into their supply chain and work with existing partners to implement changes.**

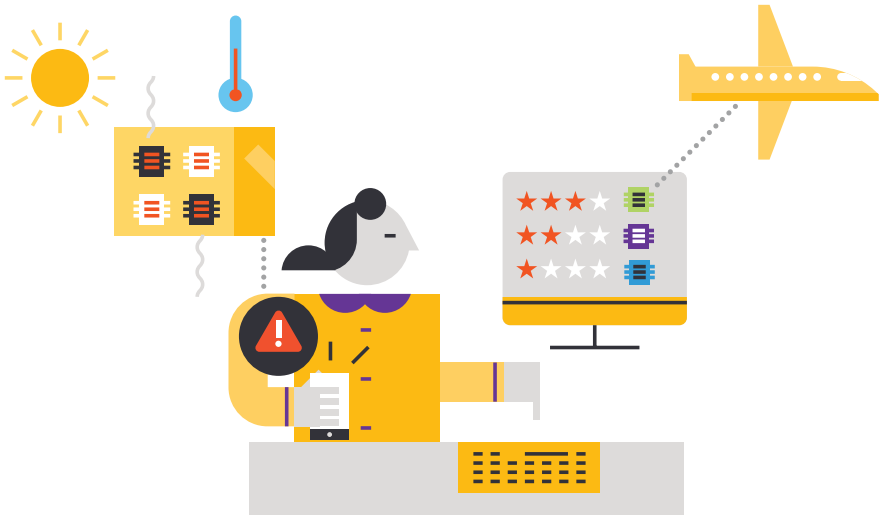


1. Phil is the supply chain manager for a vendor that will be supplying the new microchips. To better track their shipments, the company tags each packaged box with RFID technology, which allows Cheyenne to use a blockchain ledger to track their progress in real-time.

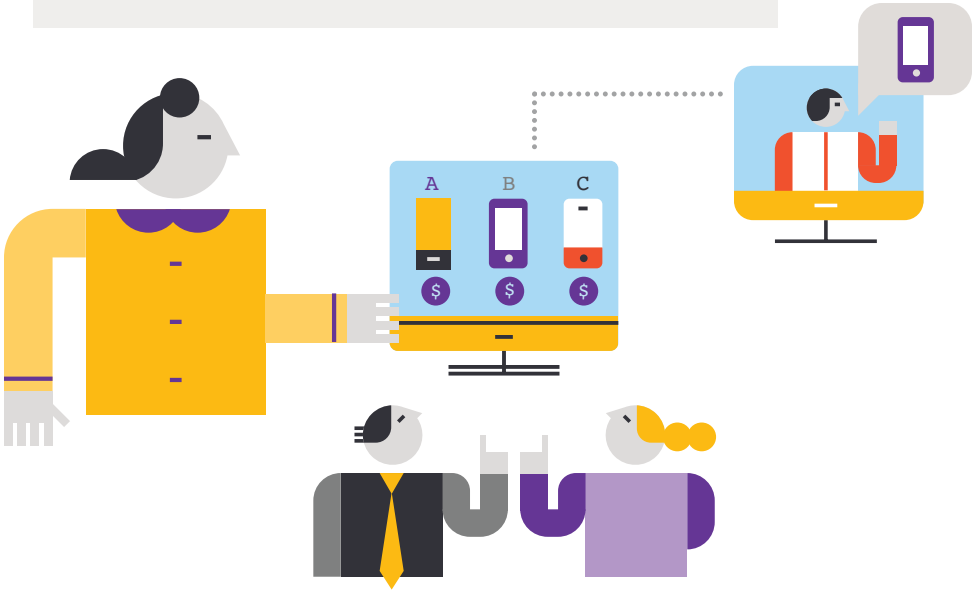
2. To accommodate the new form factor for the phone, Cheyenne must be able to securely share files with her vendors over the cloud. She posts the device's schematics to a private server so the screen manufacturer can create a test run using various materials and thicknesses. She receives alerts anytime the files are accessed along with user credentials.

3. During the shipping process to Cheyenne's factory, several pallets of microchips are exposed to extreme temperatures, which will likely impact their viability. Phil and Cheyenne are immediately alerted to the issue with the number of units affected.

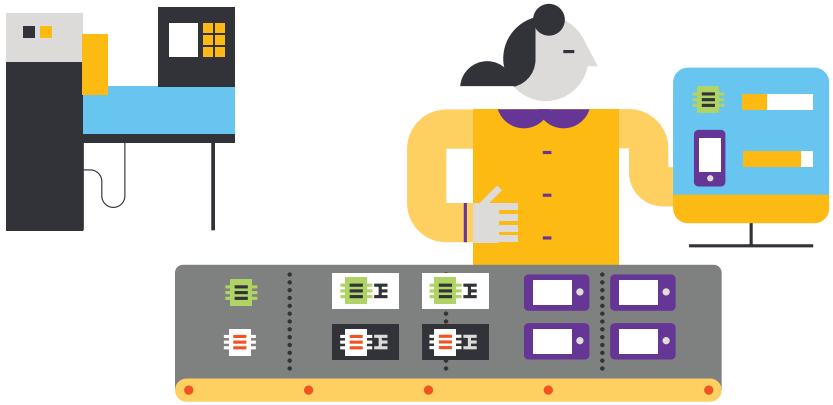
4. While Phil's company is unable to replace the lost units in the necessary time, Cheyenne is able to turn to her supplier quality analysis platform to find an alternate provider who is able to fulfill the rush order.



5 When the screen prototypes are completed, the manufacturer is able to remotely sync with Cheyenne and her company's design teams so they can preview mock-ups of phones equipped with the various screens, and review the impacts on total cost and weight and place their initial order.

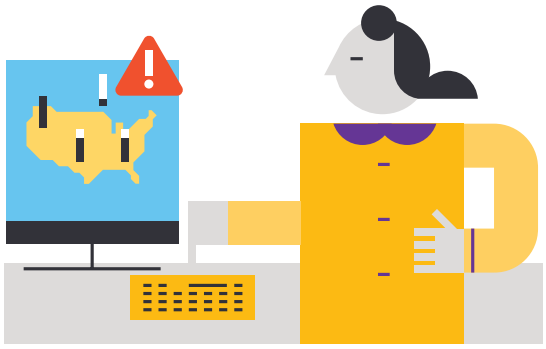



6 As material shipments are received at the factory, they are allocated to the production line with the goal of holding limited inventory in the warehouse to keep costs at a minimum. Through a single interface, Cheyenne can see where particular materials are in the supply chain in real-time and how this impacts production targets.



7 As finished phones come off of the production line, they are automatically distributed to retail partners with additional stock directed to regional warehouses where demand is highly forecasted at launch.

8 A month after launching the initial production run, real-time sales data informs the manufacturer that demand is greater than expected in the Northwest region. Cheyenne is able to adjust her supply orders to account for the spike and automatically reroute outgoing shipments of finished products to meet the demand.



# **The Impact Of** The Transparent Manufacturing Journey

## BUSINESS DECISION MAKERS

- Outfit products and shipments with RFID or other low-cost sensors to track location, condition and quality as they move through the supply chain
- Diversify supply chain partners to enable greater flexibility and minimize interruptions in production should issues occur during sourcing or shipping
- Utilize virtual prototypes and simulations wherever possible in the development and build stages to eliminate the time and costs of associated with physical mock-ups, enabling teams to create multiple iterations at speed

## INFORMATION TECHNOLOGY DECISION MAKERS

- Utilize blockchain ledgers to provide a secure, seamless method for tracking products as they move through the supply chain
- Allow for fluid collaboration between production and design teams by employing encrypted cloud-based solutions that enable access and accountability
- Develop platforms and interfaces that parse data into intuitive visuals to provide both at-a-glance insights and granular level detail to key decision-makers

# Microsoft Spotlight

## INNOVATION IN ACTION

Leader in cargo transport **Mediterranean Shipping Company** teamed up with Microsoft to improve the coordination of its global fleet transportation. To improve collaboration capabilities and respond to unexpected situations, employees use **Microsoft Office 365** to ensure real-time communication between employees, agencies and partners, and also ensure productivity and accessibility for all parties.

**bit.ly/2noc9iQ**

## POWERING TRANSFORMATIONS

**Power BI** allows enterprises to share data across multiple teams, connect to hundreds of data sources, simplify data prep and create personalized dashboards with valuable knowledge of consumer relationships and intra-company operations.

**Azure Machine Learning** is a fully managed cloud service that enables developers to build, deploy, manage and share predictive analytics in cloud-based application.

**Sharepoint** via **Microsoft Office 365** is a cloud-based solution that empowers organizations to share and collaborate with partners and colleagues throughout their organization in real time. With SharePoint Online, team members can access internal sites, documents and other information from anywhere, across multiple platforms.

# Uninterrupted Operations Through Responsive Maintenance: The Opportunity

**When large-scale manufacturers take a reactive approach to maintenance—only servicing equipment after a breakdown—it leads to increased operational costs and raised cost of lost opportunity. By leveraging big data analytics from their equipment and using global management dashboards, manufacturers will be able to not only respond to emerging situations, but eventually lead repairs that occur before systems malfunction.**

## TRENDS DRIVING THIS

- Predictive Analytics
- Preemptive Troubleshooting
- Responsive Optimization
- Onboard Collaboration

## HIGHLIGHTING THE OPPORTUNITY

The ability to predict failures and be able to offer an initial level of service, and at the same time, being able to think about how to build a better experience in the future.

*Colin Masson. Director of Manufacturing Industry Solutions, Microsoft Cloud & Enterprise*

"This ability to see what's happening in real time, storing the data, and then analyzing that data gives manufacturers an opportunity to predict potential outcomes. With this kind of information, they can then put in safeguards and plan more effectively for problem resolutions."

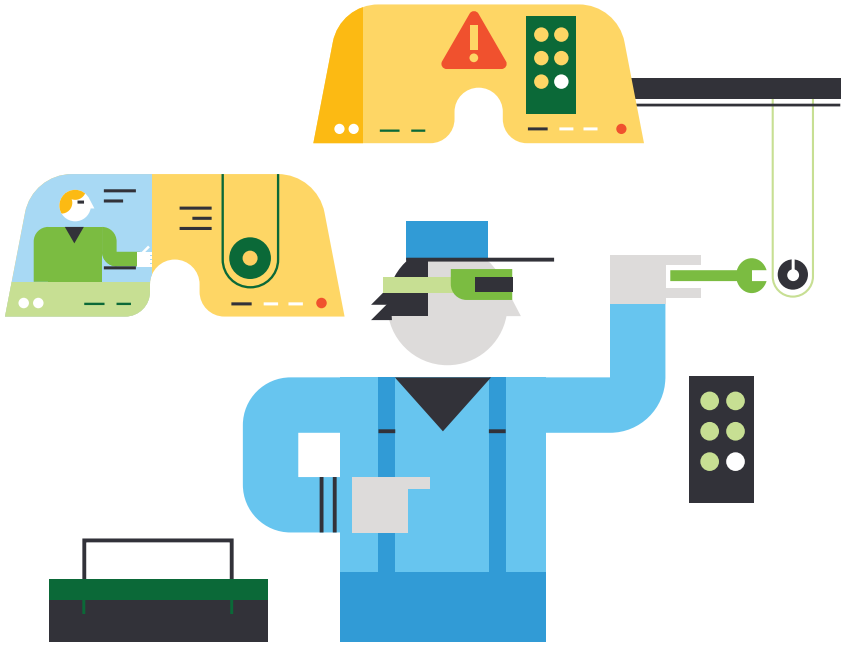
*Bill Moffett. Global Industry Senior Product Marketing Manager, Microsoft*

"Maintenance profits, through optimized spare parts inventories and dynamic prioritization, may result in gains of 10-20%."

*Digital Factories: The Renaissance of the US Automotive Industry. Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Roland Berger, 2016*[7]

# **SCENARIO:** On The Field: Remote Synchronous Field Maintenance

**Rob, the maintenance manager for a large-scale commercial elevator vendor, oversees service and operations over a densely populated metropolitan area. The elevators in his network are equipped with internet-enabled sensors, allowing them to transfer specific service data and analytics to Rob's dashboard at headquarters. With remote access to the elevators' KPIs, maintenance history, service needs and other aggregate data analyses, Rob can efficiently deploy his team to ensure continuous and safe operations.**

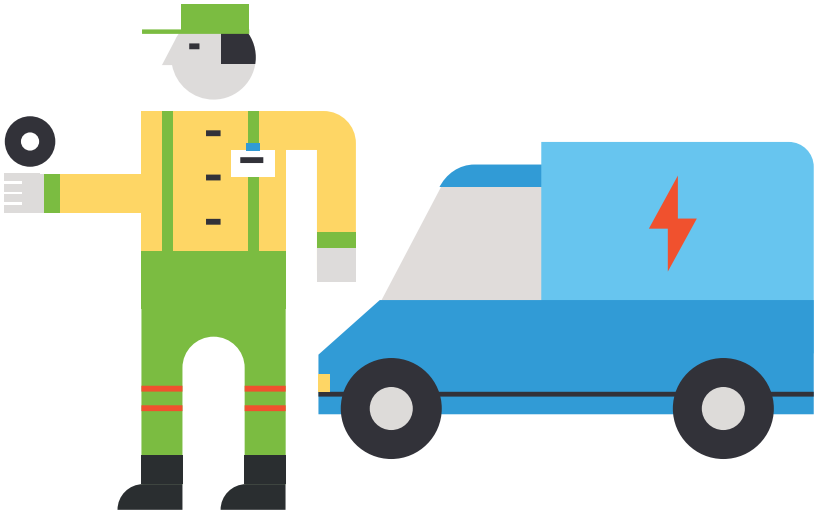


1. Rob's KPI dashboard informs him that several elevators across the city are due for maintenance. One elevator alerts Rob that it is experiencing unusual amounts of noise during normal operations.

2. The elevator dashboard assigns a field worker, Nico, to perform a service check on the elevator based on his appropriate skill level, equipment and current location. This not only conserves fuel efficiency out on the field, but ensures a quick, frictionless maintenance experience—effectively reducing costly downtime.

3. When Nico arrives, he connects with Rob via a pair of voice-enabled smart glasses. Working in tandem, the two determine the problem is with the elevator's thrust bearings.

4. Rob can see that Nico doesn't have an inductive absorber on his truck, which is required to fix the issue, but that another technician who is in the area has the part on hand. Kassidy receives an alert and is immediately dispatched to Nico's location.



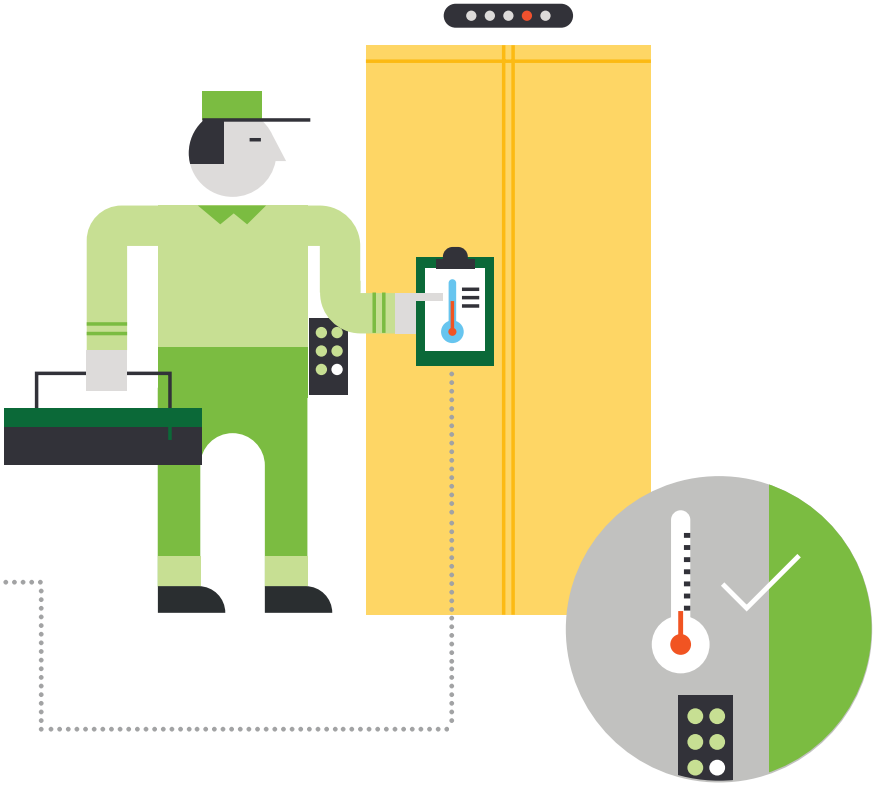
7. Back at HQ, Rob is alerted to another elevator that has signaled it is due for maintenance based on a repeated pattern of service behavior.

8. Seeing that this particular elevator has had a history of overvoltage, Rob conducts a remote power quality survey to view a visual thermography of the elevator's current heat expenditure. According to this survey, the elevator is experiencing rising temperature in its motor as a result of a vulnerable fuse. Rob sends a service notification to Paul, who is servicing a nearby elevator.

9. With the diagnostic knowledge in hand, Paul is able to quickly replace the fuse before it leads to a tripped circuit.

5. Both Rob and Nico can view her progress in real time on a map. Nico is able to begin the initial repair work in anticipation of her arrival using the AR function on his glasses to guide him through the necessary steps.

6. After installing the new inductive absorber, the elevator recommends that Nico secure the elevator grounding to prevent any additional electrical noise that may contribute to improper elevator diagnoses.



UNINTERRUPTED OPERATIONS THROUGH RESPONSIVE MAINTENANCE

# **The Impact Of** Uninterrupted Operations Through Responsive Maintenance

## BUSINESS DECISION MAKERS

- Identify how customers are using key product or system features to identify patterns and pinpoint potential impacts on performance or operations
- Consider areas where maintenance would be more effective by introducing a centralized, remote approach to servicing multiple pieces of equipment or assets
- Access service trends and operational behavior to better predict where and how maintenance employees should be deployed and scheduled and what tools and parts might be necessary for troubleshooting and repair

## INFORMATION TECHNOLOGY DECISION MAKERS

- Invest in real-time communications technologies that not only enable voice communication between distant parties, but provide off-site workers with visual instructions and specialized analytics
- Integrate sensors capable of monitoring mechanical equipment and systems 24/7 to identify performance anomalies at any early stage and suggest necessary calibrations or minor repairs before they escalate
- Use analytics to understand customer and client usage, scheduling routine maintenance and repairs during typical downtimes

# Microsoft Spotlight

## INNOVATION IN ACTION

Multinational electronics manufacturer **Samsung** partnered with Microsoft in order to develop a remote energy management solution for its air conditioning units. Using **Microsoft Azure IoT Hub** and **Azure SQL Database**, Samsung was able to develop a service-oriented platform that allows optimizes energy efficiency by tailoring cooling and heating operations based on an integrated sensor, operation data and environmental factors. By using Microsoft's IoT software platforms, Samsung is able to service all of its global units and is able to derive real-time insights from its units to analyze and adjust energy efficiency.

**bit.ly/2omDTW4**

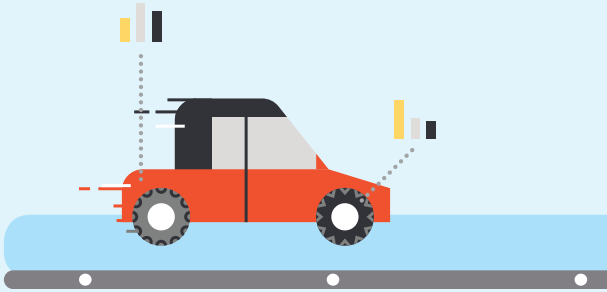
## POWERING TRANSFORMATIONS

**Machine Learning** via **Cortana Intelligence** enables manufacturers to capture customer data in order to predict issues and design better solutions.

**Connected Field Service** via **Microsoft Dynamics** helps enterprises move from a break-fix mode of maintenance to a proactive, highly efficient servicing model by allowing technicians to remotely monitor or perform troubleshooting to a fleet of assets.

**Remote Monitoring** powered by **Azure IoT Suite** implements an end-to-end monitoring solution for businesses to manage multiple machines running in remote locations, while allowing organizations to modify solutions to meet their own needs.

# How Rolls-Royce And Microsoft Collaborate To Create New Digital Capabilities



## LEADING THE INDUSTRY WITH SERVICES

Across its history, Rolls-Royce has manufactured some of the world's most respected aircraft engines—from its first Eagle engine in 1915 and the Merlin engines that helped Allied aircraft fly to victory in World War II, up to today's top-of-the-line Trent series engines that power aircraft including the Boeing 787 and Airbus A380, A350, and A330neo.

Yet in the commercial airline industry, it isn't just Rolls-Royce's premium engines that customers value. About 20 years ago, Rolls-Royce went from manufacturing and selling engines to extending comprehensive maintenance services to the airlines that use its engines. The company's TotalCare® Services employ a "power by the hour" model in which customers pay based on engine flying hours. The responsibility for engine reliability and maintenance rests with Rolls-Royce, which analyzes engine data to manage customers' engine maintenance and maximize aircraft availability. This model has been very successful for Rolls-Royce and has created relationships in which airline customers increasingly rely on the company to provide information that optimizes the costs and scheduling related to engine maintenance.

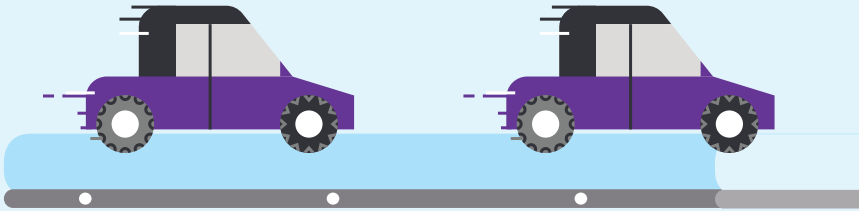
Now, Rolls-Royce has recognized an important opportunity to expand the services it offers by providing meaningful insights across more of the airlines' operations. "The market and the customer need have become much broader as aircraft and engines have gotten more talkative and the scope of our services has increased. There are terabytes of data coming from large aircraft fleets, with gigabytes per hour—rather than kilobytes—to process and analyze," says Nick Farrant, Senior Vice President, Rolls-Royce. "Just managing all this data is driving us into different areas, but it also gives us opportunities to solve different problems through machine learning and analytics. We can use data and insight in new ways to refine our customers' operations to add more value to them and allow them to do more with less."

## FILTERING THE SIGNAL FROM THE NOISE

To bring its vision of a powerful and scalable data analytics system to life, Rolls-Royce chose to build it on the Microsoft Azure platform. "We realized early on, as customer and engine data volumes increased, that we were looking at a big-data problem," says Richard Beesley, Senior Enterprise Architect Data Services, Rolls-Royce. "We quickly concluded that a cloud platform like Azure was a ready-made solution for us."

Beesley explains, "With Microsoft, it isn't just about the infrastructure, it's end-to-end and global. There are the skills, the capabilities, the service offering, the development environment, the security. It all just fit together." Once Rolls-Royce started to collaborate with Microsoft, it began to develop a number of new capabilities using an expansive set of Azure platform services.

Starting with Azure IoT Suite, Rolls-Royce will be able to collect and aggregate data from disparate and geographically distributed sources at an unprecedented scale. "With the increase in the volume and velocity of data that we're looking at, Microsoft Azure IoT Suite will have a key part to play in our ability to reliably aggregate data across our customers' fleets," Beesley says. Initially, the types of data being processed include snapshots of engine performance that the planes send wirelessly during a flight, massive downloads of comprehensive "black box"–type data, technical logs, and flight plans as well as forecast and actual weather data provided by third parties.



Using Microsoft Cortana Intelligence Suite, Rolls-Royce will be able to analyze a rich set of data and perform data modeling at scale to accurately detect operational anomalies and help customers plan relevant actions. Farrant says, "Microsoft Cortana Intelligence capabilities are helping us filter the signal from the noise across large data sets so we can focus on finding the real value in the data. Our vision of future digital capability will need to aggregate many sources of data and provide a platform for collaboration with customers."

Michael Chester, Product Manager Data Services, Rolls-Royce explains, "By looking at wider sets of operating data and using machine learning and analytics to spot subtle correlations, we can optimize our models and provide insight that might improve a flight schedule or a maintenance plan and help reduce disruption for our customers."

For example, aircraft and engine components, such as a fuel pump, often have a "soft life"—the point at which it is recommended to remove it for maintenance based on its time in operation. By analyzing detailed data from each specific pump and comparing it to data models and other pumps in the fleet, it is possible to provide an alert that indicates that a specific pump might not be performing well and should be replaced sooner than its soft life. Conversely, if a pump is close to its soft life, but monitoring and analytics show that the performance is normal, a decision could be made to defer until a later, routine maintenance window. Moving to an approach based on components' actual condition could potentially add up to tremendous savings across a fleet by minimizing the disruption and cost of maintenance. "We see emerging digital technologies and robust prognostic analytics allowing us to work with customers to realize these types of opportunities" Farrant says.

In expanding the scope of services Rolls-Royce offers its customers, fuel efficiency is one of the first and highest-yield areas that the company is targeting. By analyzing new data against existing forecasts, reference tables, and historical trends, Rolls-Royce will be able to help airlines understand exactly which factors—including flight plans, equipment maintenance, weather, and discretionary fuel—have the most impact on fuel performance. "By blending all these data sets, we can provide more targeted and actionable insights at the point of need to inform the decisions that optimize how the airlines go about doing business," says Chester.

All of this requires a massive level of scalability that is greatly facilitated by employing a wide range of Azure platform services. From using Azure Data Factory for orchestration and Azure HDInsight for high-level data aggregation and summarization, to using Azure SQL and Azure Blob Storage to handle all the different types of storage needs, Rolls-Royce is taking full advantage of the integrated Azure platform services. Beesley explains, "The Microsoft Azure platform makes it a lot easier for us to deliver on our vision without getting stuck on the individual IT components. We can focus on our end solution and delivering real value to customers rather than on managing the infrastructure."

# Final Takeaways: Core Technologies Shaping Manufacturing

The always-connected consumer and popularization of ecommerce platforms has resulted in increased supply chain pressures, with manufacturers needing to output goods faster and more efficiently to meet elevated demands. Consequently, manufacturers are turning to implement end-to-end digitization within their own supply chains to ensure agility and faster processes. Evidenced in these five scenarios, the path towards this digital supply chain is no longer locked in manufacturers' imaginations, but achievable by adopting a new generation of intelligent, connected equipment. The five leading technologies identified below will help guide manufacturers into digital supply chain transformation, essential in optimizing efficiency, agile operations and increasing total production output.

**CLOUD CONNECTIVITY & IOT TECHNOLOGIES** are the backbone for a new generation of connected manufacturing and prescient maintenance capabilities. By implementing Internet of Things technologies into service equipment, manufacturers can enable remote operation and servicing, enhance production flexibility and customization capabilities, while democratizing secure access to essential information throughout the entire supply chain.

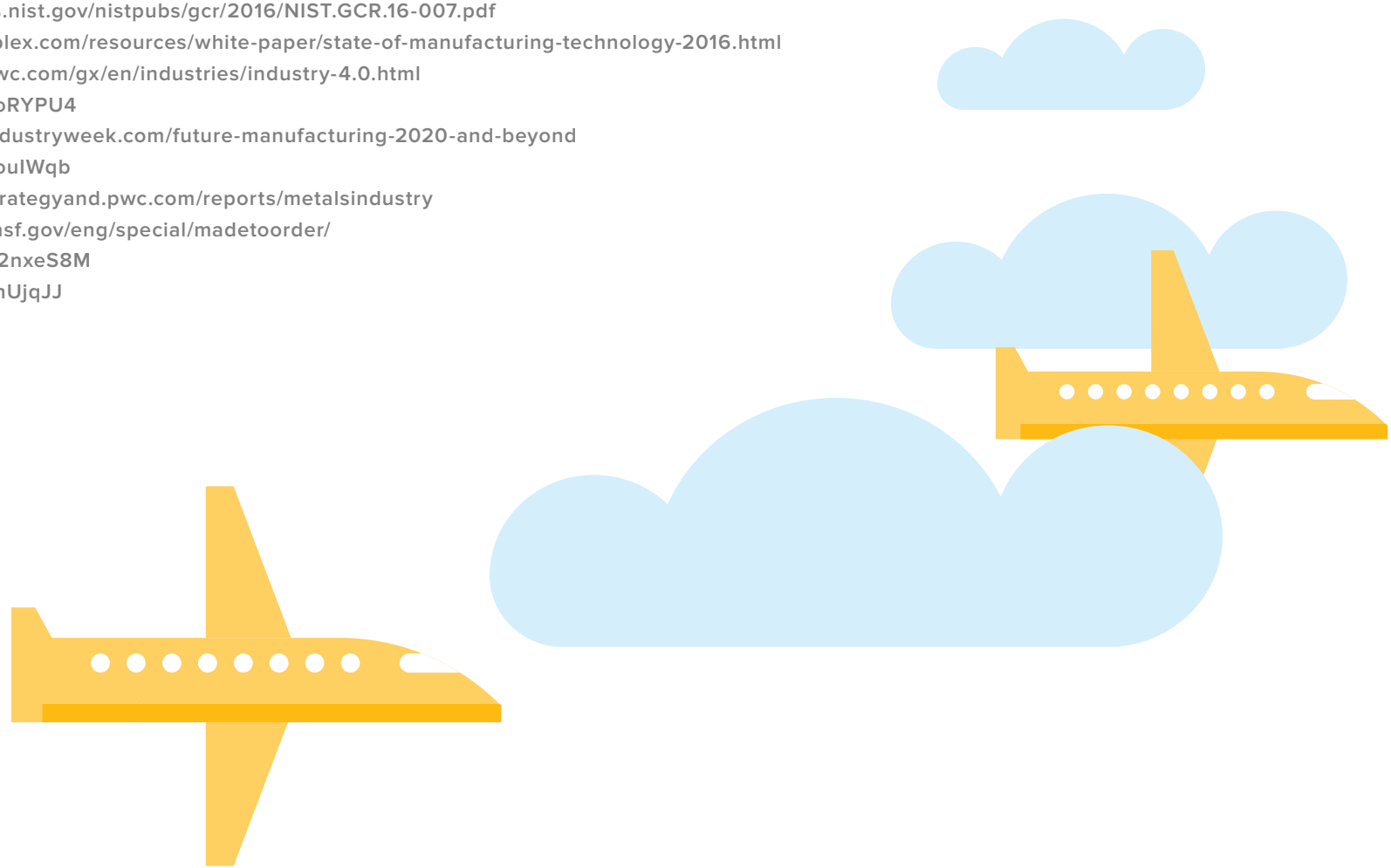
**BIG DATA ANALYTICS** empower manufacturers to extract actionable insights from troves of information. Whether optimizing production output and efficiencies through real-time monitoring of operations, influencing the product development pipeline or anticipating future outcomes based on the study of historical tendencies and current behaviors in the marketplace, these tools ensure companies are better positioned to take advantage of coming shifts and opportunities for long-term success.

**MACHINE LEARNING** is not only accelerating the path towards ultra-efficiency, but is paving the road towards a new generation of manufacturing as a service, extending the life of a product beyond a one-time purchase. By fitting end products with sensors and connected capabilities, manufacturers can remotely monitor the effectiveness of finished products and derive usage patterns and insights to inform performance refinements, maintenance schedules and future product creations.

**REAL-TIME COMMUNICATION PLATFORMS** enable remote teams and cross industry partners to share ideas or work together on projects in secure, virtual environments. By accelerating the speed of collaboration, research and development teams can reduce development cycles and lower product development costs, while ensuring multiple iterations throughout the process result in a high-quality end product. The technologies can also be leveraged to simulate and test future production infrastructure when looking to scale or implement new operational capabilities.

# Endnotes


1 http://nvlpubs.nist.gov/nistpubs/gcr/2016/NIST.GCR.16-007.pdf
2 https://www.accenture.com/us-en/insight-supply-chain-management-cloud
3 http://www.idc.com/prodserv/insights/#manufacturing-digital_supply_chain
4 http://nvlpubs.nist.gov/nistpubs/gcr/2016/NIST.GCR.16-007.pdf
5 https://www.plex.com/resources/white-paper/state-of-manufacturing-technology-2016.html
6 http://www.pwc.com/gx/en/industries/industry-4.0.html
7 http://bit.ly/2oRYPU4
8 http://www.industryweek.com/future-manufacturing-2020-and-beyond
9 http://bit.ly/2oulWqb
10 http://www.strategyand.pwc.com/reports/metalsindustry
11 https://www.nsf.gov/eng/special/madetoorder/
12 http://pwc.to/2nxeS8M
13 http://bit.ly/2nUjqJJ

# About PSFK

PSFK is the world's leading provider of innovation insights. Since 2004, we have offered the tools, content and advice to inspire creative professionals to make better products, services and experiences.

Our daily business intelligence portal and newsletters help members find and track new ideas that they can use in their work. Our reports provide insights into trends driving creative business and our audiences access thought leadership from pioneers at our events. PSFK Labs, our consulting service, provides corporations with trends-led strategy, concepting, content and delivery.


**Piers Fawkes**
President & Founder
piers.fawkes@psfk.com
+1 646.520.4672

**Scott Lachut**
President of Research & Strategy
scott.lachut@psfk.com
+1 646.520.4672

**Project Lead**
Conner Dial

**Design**
Sasha Zwiebel

**Illustrations**
Romualdo Faura

**PSFK**
42 Bond Street, 6th Floor,
New York, NY 10012 USA
psfk.com | @psfk





Version 1 | Published 2017

Download this report at: psfk.com/report/future-of-manufacturing


# About Microsoft

Microsoft (Nasdaq "MSFT" @microsoft) is the leading platform and productivity company for today's mobile-first, cloud-first world. Microsoft is committed to empowering manufacturers with digital transformation solutions and secure cloud connectivity within rapidly changing business and technology environments. As manufacturers seek to enrich their market offerings through services-based business models, Microsoft offers a rich ecosystem of partners essential in creating innovative products, positioning customers at the forefront of business structures and powering frictionless operations.


**Colin Masson**
Director of Manufacturing Industry Solutions, Microsoft Cloud & Enterprise

**Bill Moffett**
Global Industry Senior Product Marketing Manager, Microsoft

**Sanjay Ravi**
WW Managing Director of Discrete Manufacturing Industry, Microsoft

Microsoft with psfk