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How disruptive technologies are opening up innovative opportunities in services

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Technology and advanced analytics are revolutionizing services — and creating new sources of value for industrial companies that know how to use them. Here's a roadmap that works.

In search of sustainable ways to grow, industrial companies are turning to their vast installed base as a source of recurring revenues and profits. Revenues from servicing, especially aftermarket services and parts, are generally more stable than those from equipment sales and have shorter lead cycles, so they offer a way to counter the cyclical nature of capital investments. In some subsectors, such as flow control, services tend to generate higher margins than equipment sales. What's more, pursuing new servicing opportunities can transform a company's relationship with its customers by giving it deeper insight into how its products are used.

The proliferation of connected devices and sensors, coupled with a thousand-fold increase in computing power over the past decade, is opening up new ways to deliver services and interact with customers (Exhibit 1). For instance, the IoT (broadly defined as a combination of sensors, analytics, and connectivity) allows industrial companies to monitor equipment health remotely and develop new commercial offerings, such as outcome-based contracts in industries with high downtime costs. Industrial companies have started building technology-enabled capabilities to take advantage of these opportunities. United Technologies, for

EXHIBIT 1

Disruptive trends are reshaping servicing.

| Key trends | Description | Impact |
|---|--|--|
| <ul style="list-style-type: none"> • By 2025, 50% of workers will be freelance • By 2035, 40% of productivity improvements will be driven by AI • By 2021, the augmented-reality market will reach \$108 billion | Digital offerings led by IoT, AA, <ul style="list-style-type: none"> • Use devices that accurately report reason for failure to reduce diagnostic time • Use augmented and virtual technology to help technicians complete complex repairs more quickly | 10–25% reduction in mean time to repair |
| | Workforce as a service <ul style="list-style-type: none"> • Workforce is available whenever and wherever needed to help reduce spend on full-time employee | 5–20% reduction in labor cost |
| | Dynamic dispatching <ul style="list-style-type: none"> • Use dynamic dispatching to reduce idle time and improve field technicians’ productivity | 10–20% improvement in productivity |
| | Reactive to proactive service <ul style="list-style-type: none"> • Next-generation digital, analytics, and IoT tools support shift from reactive to proactive service | 30–40% reduction in mean time to repair |
| | Proactive fulfillment of customer needs <ul style="list-style-type: none"> • Anticipate service needs before incident and reduce unplanned downtime | 10–20 pp improvement in customer satisfaction |

instance, acquired analytics firm Predikto in 2018 to enhance its predictive-maintenance offerings and scale its digital and analytics capabilities.

Many other companies are starting to apply advanced analytics (AA) and digital tools to derive instantaneous insights into field operations and use them to optimize deployment in real time through techniques such as dynamic field dispatching and remote servicing. These technologies are allowing industrial companies to deliver a step change in impact through improved technician productivity, reduced mean time to repair, and higher customer satisfaction.

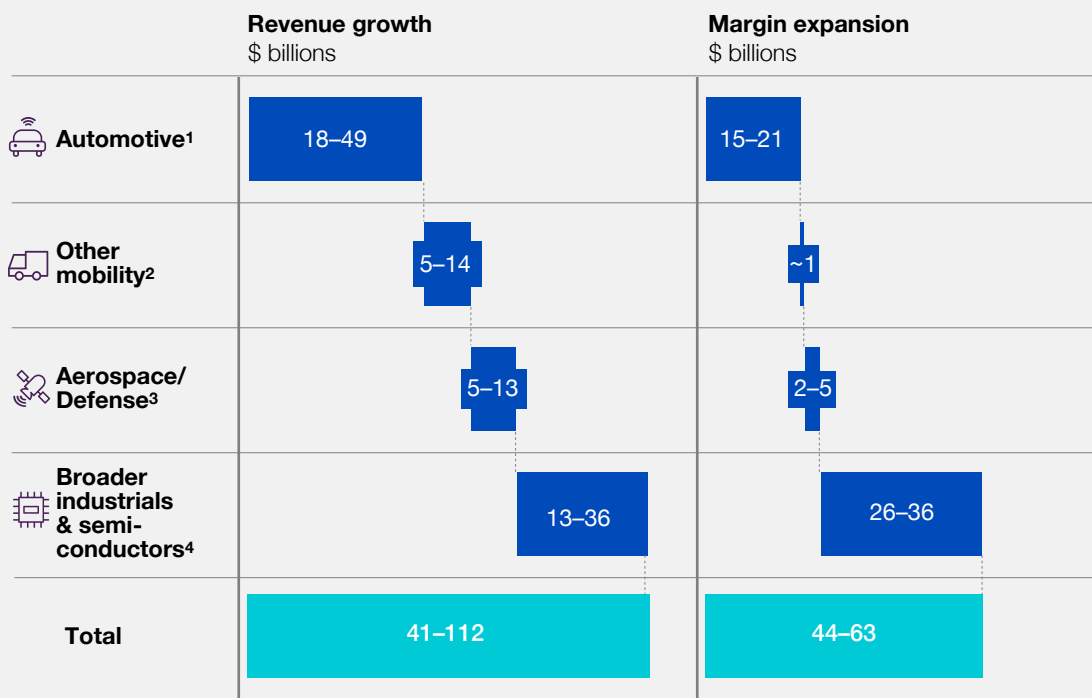
Below, we outline the enormous opportunities that tech-enabled servicing opens up, consider the value potential it unlocks, describe what a successful approach looks like, and review the steps leaders can take to begin their servicing transformation.

Where the value lies

Our analysis has identified a pool of approximately \$40 billion to \$110 billion in revenue growth and \$40 billion to \$60 billion in margin expansion that could be captured through tech enablement in industrial services globally (Exhibit 2). This value comes from four main sources: a 1 to 3 percent revenue uplift from cross-selling, upselling, and new business models; a 3 to 10 percent increase in service revenue from smarter pricing of aftermarket parts and services; and a 20 to 30 percent reduction in field-service personnel costs from optimizing demand and labor management.

A few leading companies are already achieving considerable success from efforts like these. One OEM reduced troubleshooting steps for its technicians by 50 percent and increased first-time fixes by 15 percent, enabling it to cut costs and increase market share. And an industrial-technology

EXHIBIT 2 The value from tech enablement in servicing varies by industry segment.



¹ Whole value chain including tier-one suppliers, automotive OEMs, and dealers
² Commercial vehicles and off-highway equipment (e.g., for construction and agricultural use) including tier-one suppliers, equipment manufacturers, and dealers and distributors
³ Includes tier-one suppliers and equipment manufacturers
⁴ Includes industrials, food processing and handling, motion and controls, industrial automation, and electrical, power, and test equipment across the value chain: component suppliers, equipment manufacturers, distributors, VARs, engineering and services providers, and product companies

provider that turned its field force into a lead-generation engine saw five to ten percentage points of incremental revenue growth.








The scale of servicing opportunities is best assessed by lifetime value, defined as the total revenue an OEM can receive from servicing its installed base. When McKinsey analyzed aftermarket lifetime value in more than 40 Fortune 500 companies ranging from wind-turbine providers to truck manufacturers, we found striking variations from one subsector to another (Exhibit 3).¹ In some industries the lifetime value of the aftermarket was almost equal to the price of the initial product,

while in others aftermarket revenue was virtually nonexistent.

An innovative approach to servicing

With a successful tech-enabled service strategy, a company can not only gain a deeper understanding of how customers use its products but also increase the number of customer touchpoints, giving it more opportunities to explore and respond to customer needs. Our experience of working with dozens of industrial companies on technology transformations shows that new value can be created from all parts of the servicing process: managing customer demand, optimizing field labor,

EXHIBIT 3 Service revenues vary widely by sector.

| Equipment | Aftermarket lifetime value | = Product lifetime | x Lifetime penetration ² | x Average annual service |
|---|----------------------------|--------------------|-------------------------------------|--------------------------|
|  Gas turbines | 75% | 20–50 years | 29–77% | 4–6% |
|  Helicopters | 53% | 18 years | 32% | 4% |
|  Data storage¹ | 43% | 4–5 years | 70–80% | 10–15% |
|  Electric drives | 35% | 20 years | 21–27% | 7% |
|  Wind turbines | 34% | 25 years | 78% | 1–3% |
|  Heavy-duty trucks | 30% | 10 years | 21–42% | 107–367 |
|  Passenger cars | 16% | 13 years | 42% | 4–10% |

¹ Mainly reflects spare parts

² Lifetime penetration is a function of attach rate, and typically shows wide variation between industries

SOURCE: Aditya Ambadipudi, Alexander Brotschi, Markus Forsgren, Florent Kervazo, Hugues Lavandier, and James Xing, “Industrial aftermarket services: Growing the core,” McKinsey.com, July 2017

managing parts, and delivering superior customer experience (Exhibit 4).

Managing customer demand

















Traditionally, the difficulty of predicting and managing customer demand has led to high equipment downtime and poor service. Two drivers of this unpredictability are the limited use of scheduled servicing and the low penetration of condition-based monitoring, in which equipment is monitored while in operation. Industries vary in their approach to scheduled servicing, but out-of-warranty assets typically suffer lower adoption and more unplanned repairs. A few industries—such

as aviation, renewable energy, and mining—have started to adopt IoT-enabled condition monitoring to prevent asset breakdowns, but few OEMs as yet have the infrastructure and technology to offer their customers monitoring services.

Leading companies are using four methods to manage customer demand more actively:

- **Remote monitoring.** By taking advantage of IoT and real-time connectivity, companies can continuously monitor the health of individual assets and entire facilities to predict potential problems and manage demand. For instance,

The value in servicing comes from four main sources.

| Sources of value | Examples of digital levers and enablers | | | |
|--|--|--|--|--|
| Managing customer demand |  Remote monitoring and notifications |  Predictive maintenance |  Flexible asset-specific planned repairs |  Upstreaming and remote resolution |
| Optimizing field labor |  Flexible workforce management |  Dynamic dispatch optimization |  Next-generation diagnostics |  Performance management 2.0 |
| Managing parts |  Predictive demand forecasting |  Virtual parts depot and real-time inventory |  Network and logistics management |  Dynamic parts pricing |
| Delivering superior customer experience |  Lead generation and management |  Churn and retention management |  Digital self-serve applications |  Digitized order-to-cash process |

makers of heating, ventilation, and air conditioning systems can connect remotely to building-management systems to evaluate the performance of their equipment. By connecting data from meters, sensors, and control panels and adding an AI-driven intelligence layer on top of existing building-management systems, they can continuously monitor and model energy usage and provide recommendations for appropriate energy-saving measures. The IoT specialist Enlighted has taken this approach a step further by using its lighting sensors to identify occupied and unoccupied spaces and offering innovative space-utilization services.

- **Upstreaming and remote resolution.** After identifying issues through remote monitoring, companies can use digital and analytic tools to automate delivery and support services, dispatching field technicians promptly to jobs when they are needed and reducing service-delivery costs and inefficiencies. One company saw demand for simple repairs fall by 17 percent after using technologies such as automated incident-resolution systems to provide remote support for some 23 percent of service calls.
- **Predictive maintenance.** A few companies are taking asset productivity to new levels by

applying advanced analytics to an array of structured, unstructured, machine-based, and nonmachine-based data to predict when and how equipment may fail. They use insights from this process to optimize the time their technical help desk spends resolving issues and to deploy field technicians more efficiently. One oil-and-gas equipment manufacturer reduced downtime from its gas compressor by 70 percent through such an approach.

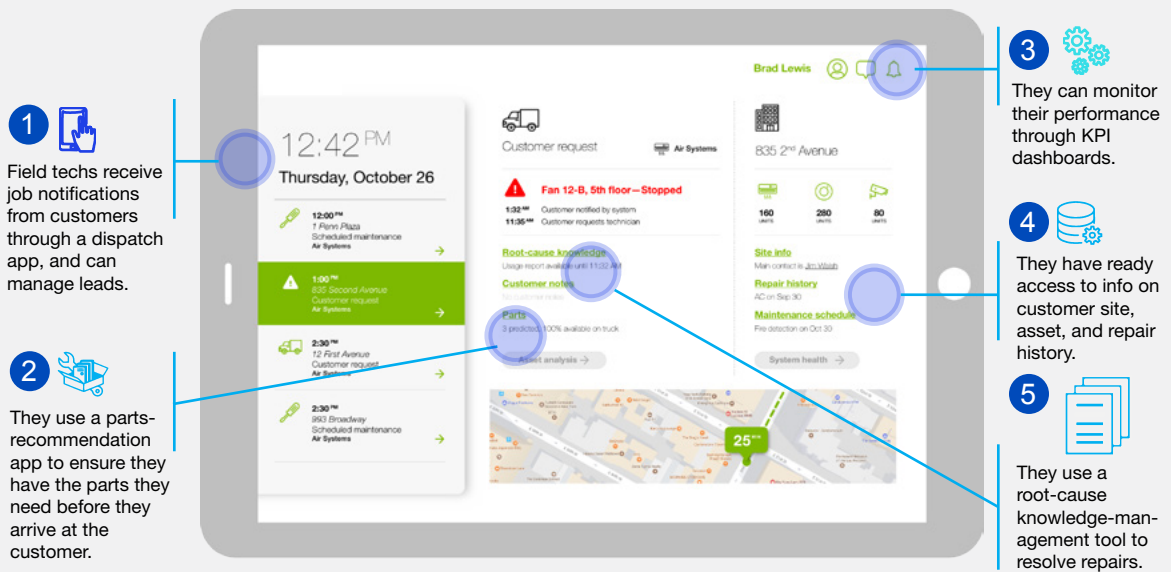
- **Planned maintenance.** Industrial companies are also using technology to combine repairs that would previously have been performed separately on different schedules. When an asset is down, they use analytics to diagnose other potential problems, allowing the technicians in attendance to perform unscheduled repairs and thereby reduce unplanned demand. Companies

are also taking advantage of data and analytics to move from milestone-based maintenance to condition-based maintenance with tailored planned-maintenance schedules.

Optimizing field labor

Although field labor represents the largest share of cost in most service organizations, it is often undermanaged. Companies have little or no visibility into employees' work or schedules, resulting in wasted time, poor service, and lost revenue. In one industrial OEM, we found that more than 40 percent of a typical technician's working day was wasted, with two to three hours of idle time, up to an hour of unnecessary driving time, and one to two hours of avoidable visits. Few companies codify knowledge effectively, and a customer's service experience often depends more on the technician than the company.

EXHIBIT 5 A one-stop solution helps field techs manage service requests.



Four practices can help companies to optimize field productivity:

- **Flexible workforce management.** To ensure sufficient capacity and enable effective demand forecasting and schedule planning, companies are using digital tools that connect demand and supply in real time. By using digital scheduling tools to seamlessly manage an efficient mix of internal workers and subcontractors, companies can be responsive to customer needs without incurring large fixed costs. One industrial-services company estimates incident rates and service volumes with the help of real-time external data feeds such as weather patterns, then uses this expected demand to schedule appropriate workforce capacity. Another industrial company that introduced flexible scheduling was able to reduce overhead by \$35,000 per technician and cut overall technician costs by 50 percent.
- **Dynamic dispatch optimization.** In our experience, field-management systems rarely provide accurate visibility, and job-booking allocations seldom reflect task times. It's not unusual to see more than a third of each day lost through late starts, early finishes, and other unproductive time. By using sensor data and fleet telematics to track technicians' schedules in real time, companies can add 20 to 30 percent to the working day. One leading telecom provider introduced an automated job scheduler that allocates technicians all their jobs for the day and adjusts their schedules dynamically to maximize productive use of time.
- **Next-generation diagnostics.** To perform a robust diagnostic, technicians need the right tools. Ideally, a diagnostic kit would cover model year, repair history, customer questionnaire, suggestions for diagnosis, detailed problem-solving manuals, and lists of parts needed. A mobile one-stop solution like that illustrated in

Exhibit 5 can help field techs schedule service requests, check that they have the right parts, and understand the root causes of a breakdown. Some automotive OEMs have begun to diagnose issues remotely using telematics signals sent from vehicles. A central team uses the signals to give technicians a preliminary diagnosis, saving them time and reducing wait time for spare parts.

- **Performance management 2.0.** Robust performance management helps companies pinpoint where service labor needs improvement. By combining optimized scheduling with technology-driven process improvements, they can improve wrench time (the time a technician spends actually performing necessary tasks). One industrial company introduced real-time dashboards with granular data and was able to boost field productivity in its regions by 7 to 20 percent.

Managing parts

A badly managed spare-parts operation can not only hurt revenue but also damage customer satisfaction and loyalty. When a part required for a repair or service isn't available, repair time increases, the customer's experience is poor, and future revenue from that customer may be jeopardized. Getting a part shipped to the repair point causes delay; meanwhile, technicians get reassigned to other tasks and the job goes to the back of the queue, often taking days to complete. When a part isn't essential to a repair or service, not having it in stock could mean the company loses revenue—and upselling and cross-selling opportunities as well—if the customer doesn't return to buy it later.

Companies optimizing parts management tend to focus on four areas:

- **Predictive demand forecasting.** Most demand-management systems still rely on historical sales patterns, but the introduction of technologies

such as radio-frequency identification (RFID) alongside big data and advanced analytics allows companies to move to predictive forecasting instead. By anticipating when an event is likely to happen and predicting what parts will be required when it does, companies can increase first-time fix rates and improve customer satisfaction.

- **Virtual parts depot and real-time inventory.**

In a distributed field organization, the sheer size of the installed base and range of potential repair locations makes inventory management challenging. One solution is to convert every technician's truck into a virtual repair location by combining predictive forecasting with a real-time inventory-management system that uses RFID or similar technologies to track the parts carried by each technician. Companies seeking real-time visibility of inventory and data across their network will need to invest in digital tools to keep track of inventory and advanced analytics to support flexible allocation. In one

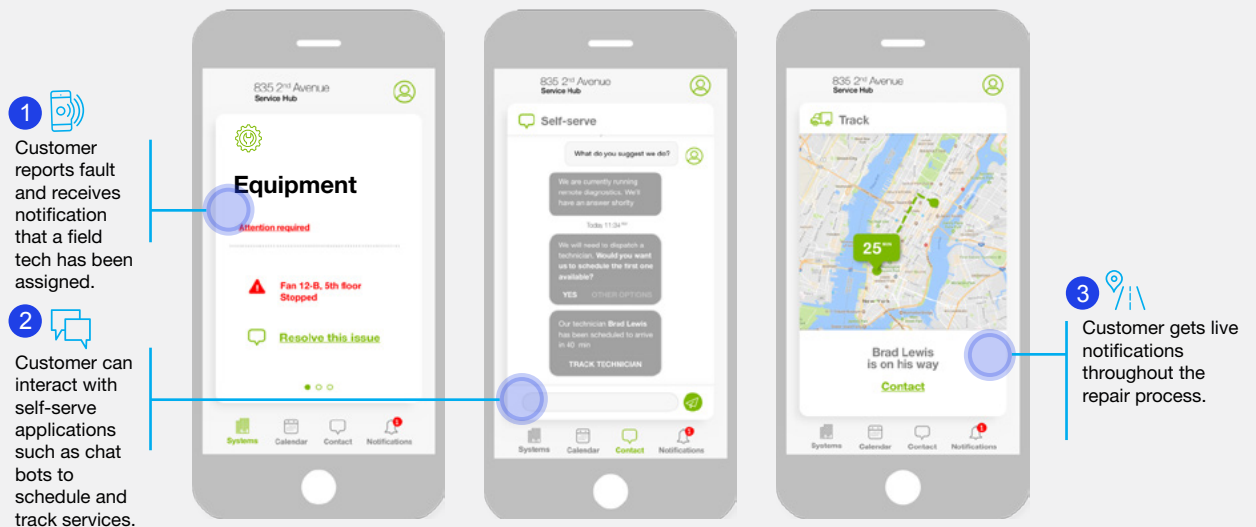
industrials distributor, we found that using analytics to manage stock at the level of SKUs and repair points increased stock-on-shelf by more than 50 percent.

- **Network and logistics management.**

Supporting a distributed field organization requires a well-managed fleet, something companies often struggle to achieve. To unlock value, they need to harvest and integrate large sets of granular fleet data—GPS tracking, routing histories, and the like—that often go untouched because of resource constraints or the proliferation of data warehouses. In one industrial OEM, we found that the use of digital and analytics can typically reduce fleet costs by 7 to 12 percent and spare fleet by 10 percent, while improving availability by 5 to 10 percent.

- **Dynamic parts pricing.** Another area where tech enablement helps companies create value from parts management is pricing. Once a robust technology infrastructure is in place, companies

EXHIBIT 6 A self-serve app gives customers transparency throughout the repair process.



can apply advanced analytics to probe supply and demand at the level of individual parts and introduce dynamic pricing. This involves replacing standard prices with prices tailored to individual customers, locations, and parts or kits based on variables such as price elasticity, competition, product uniqueness, and customer bargaining power. After introducing dynamic pricing, some OEMs have been able to capture pricing improvements approaching 10 percent.

Delivering superior customer experience

Great customer experience comes from delighting the customer at every stage in the service process, not just at one or two touchpoints.

Companies that excel at customer experience use tech-enabled capabilities in three areas in particular.

- **Digital self-service applications.** One of the biggest pain points for industrial customers is an opaque servicing process that leaves them with unanswered questions: What is the problem with their equipment? What caused it, and how can it be prevented in future? What is the breakdown of the service cost? Which stage has servicing reached? When will it be finished? Through a combination of sensors, GPS technology, app-enabled field technicians, and digital check-in and checkout tools, industrial companies can now keep customers informed of progress and any changes to plan through automatic updates. Exhibit 6 illustrates a reimagined customer experience in which digital and mobile tools provide visibility at every step in the service process.
- **Churn and retention management.** As in any industry, it costs much more to acquire a new customer than to retain an old one. By analyzing data across multiple customer touchpoints, industrial companies can predict which customers are at risk of churn and which

offers are most likely to help retain them. One industrial company aggregated data from contract, sales, product, and customer records into a data lake, mined it using advanced techniques, and then applied predictive analytics to estimate churn and evaluate the effectiveness of personalized customer offers. This enabled it to introduce a differentiated sales strategy that increased the attach rate for service contracts by 90 percent.

- **Digitized order-to-cash processes.** Accurate and timely billing is critical in servicing, yet few companies do it well. Customers frequently complain about inaccurate billing and unresponsive customer service. Companies can address these challenges by adopting technologies such as robotic process automation to manage tasks across the order-to-cash process.

Getting started

Growing service revenues through technology enablement requires different approaches in different circumstances, but all industrial companies would do well to take a few basic steps:

- **Don't solve complex data problems; find simpler ways to get the data you need.** For companies with disparate systems and a distributed workforce, building a comprehensive, reliable data source is no mean feat. Service data is often unstructured, and integrating data from multiple sources is difficult. Some companies compromise by using partial or observational data. But advanced data-extraction technologies and data lakes now allow companies to build a rich granular database in a matter of weeks, while cheap data storage enables them to store data in any format or volume indefinitely. Thus equipped, they can rapidly analyze granular data at low cost and in a scalable manner.

- **Define technology-enabled service offerings.** Develop a deeper understanding of your end customers' economics at subsegment level across your business units, brands, and revenue and profit pools. Segment service needs and identify where technology could be a key differentiator. Design a service strategy that uses data generated—now or in the future—by the installed base for your equipment. To craft a new value proposition, create technology-enabled offerings for both your customers (such as remote monitoring) and your field technicians (such as digital diagnostic tools).
- **Enhance your digital, analytics, and technology capabilities.** Taking into account your customers' needs and your technicians' pain points, work out which capabilities you require, which you have already, which you need to develop, and how differentiated you are from competitors. Form an integrated view of the capabilities you need, and build them in phases. Look at the broader technology ecosystem, evaluate data and analytics solution providers, and partner with them where necessary.
- **Integrate your commercial strategy across field tech, inside sales, and direct sales channels.** Tailor your sales approach to drive aftermarket sales. Provide incentives for sales teams to drive services as well as OEM projects. Equip sales support staff with analytics tools to help them mine your installed base for leads and drive contract renewals. Reward field technicians for parts revenues and sales leads, and enhance their digital tools so they can easily pass leads on to commercial teams.
- **Balance cost with customer experience using digital tools.** Field technicians usually represent the lion's share of costs and offer the greatest scope for improvement. Develop initiatives such as real-time tracking tools to drive dynamic dispatching, optimize time-and-task and first-time-fix rates, and reduce performance variability through granular analytics. Enhance customer experience by offering more self-help capabilities.
- **Follow a phased approach with a clear roadmap that ties technology to your service strategy.** Adopt a two-speed approach to technology: quickly deploy capabilities that support the customer experience while you work methodically to integrate back-end functions. Rapidly pilot new tools and analytics, and refine your technology roadmap as you go. Schedule the rollout of initiatives, the high-level investment plan, and quick wins. Determine what performance-management mechanisms you need to sustain impact.



The next wave of service transformation is here, and it is being driven by technology. Industrial companies that can fundamentally reimagine service technology as a core component will be well positioned to achieve above-market growth and superior cost position. ■

¹ See also Aditya Ambadipudi, Alexander Brotschi, Markus Forsgren, et al., "Industrial aftermarket services: Growing the core," McKinsey.com, July 2017.

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