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The new world of digital operations

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Executive summary

The shift to the industrial Internet is rapidly gathering steam, yet most of the focus has been on making connected products and services for customers. Much less attention has been paid to how and to what degree the industrial Internet will transform companies' internal operations, as it certainly will.

The changes wrought by the digitization of industrial operations can best be broken down into four key areas: manufacturing, capital asset management, the supply chain, and product innovation and development. Suppliers are already busy developing digital solutions to cover many "use cases" for each of these key areas — the jobs to be done and the resulting value creation opportunities — even as the number of use cases themselves is multiplying quickly.

If companies are to take full advantage of the great promise of the industrial Internet, they must develop an overall strategy for how to go about it, and then gain a full understanding of the ecosystem of solutions emerging around each of the four areas. That will allow them to build the business cases needed to determine the value of each use case they hope to implement, and then to develop the capabilities required and the road map that will get them to their goal.

Companies setting out on this journey must remember that there is no perfect technology solution. Success will require that companies focus not on the technologies themselves, but rather on the operational problem, or problems, they are trying to solve. Most important, they need to start now.

The operational imperative

Variously called Industry 4.0, the industrial Internet, or simply digitization, the emergence of machine-to-machine interactions, human-to-machine interactions, robust data and analytics capabilities, and cheaper, more ubiquitous sensors is pushing the Internet of Things (IoT) into the core operations of more and more companies. The convergence of the IoT and analytics is generating a new world of big data. And big data, in turn, is enabling new capabilities such as tailored customer offerings, predictive solutions, and the like.

Together, these technologies are rapidly transforming how companies interact with customers, develop and manufacture new products, and conduct operations in every part of their businesses. The end-to-end experience is changing rapidly.

The effect of these technologies will be profound, with long-term implications for companies, along with their executives, employees, business partners, and customers. The results of our recent survey on how companies are progressing toward full digitization, "Industry 4.0: Opportunities and challenges of the industrial Internet," indicate that the benefits, in terms of connected new products, tighter ties with customers, and more efficient operations, will be equally significant. But so will the risks, as companies struggle to learn how to take advantage of it all — and how to pay for it — especially given the market's current hype and confusion regarding this transformation.

A key aspect of the coming transformations is how they will affect core operations, especially at companies that produce physical products, engage in physical supply chains, and depend on asset-based production schemes. Digital operations are already beginning to transform how these companies develop, make, and distribute their products and services to their customers, whether as sellers, buyers, or users of these new technologies — or all three at once.

Four tightly interwoven and interrelated business operations are especially ripe for transformation enabled by digital and IoT capabilities: next-generation manufacturing, optimized capital

assets, smart supply chain and service, and connected product development. How, and how quickly, companies devise and implement their strategy for moving forward along the path to digital operations will significantly affect just how competitive they are in the next few years.

This report offers guidance on the critical questions raised by operations executives in our Global Operations Survey: How can companies monetize the value of digital operations? What does the current ecosystem of digital operations technology look like? And how should companies develop a road map that ensures rapid progress without the risk of implementing costly solutions that soon become obsolete?

An evolving ecosystem

Although customer-focused digital strategies continue to capture much of the attention surrounding the industrial Internet, many companies have been applying the same principles to help them improve core operations. For example, by connecting factories and suppliers to the Internet, a pump manufacturer might generate much greater visibility into its operational performance while optimizing its factory equipment, materials use, flow, and labor costs. The result is greatly improved manufacturing performance in terms of speed, cost, quality, and safety, as well as lower supply chain risks and better service to customers.

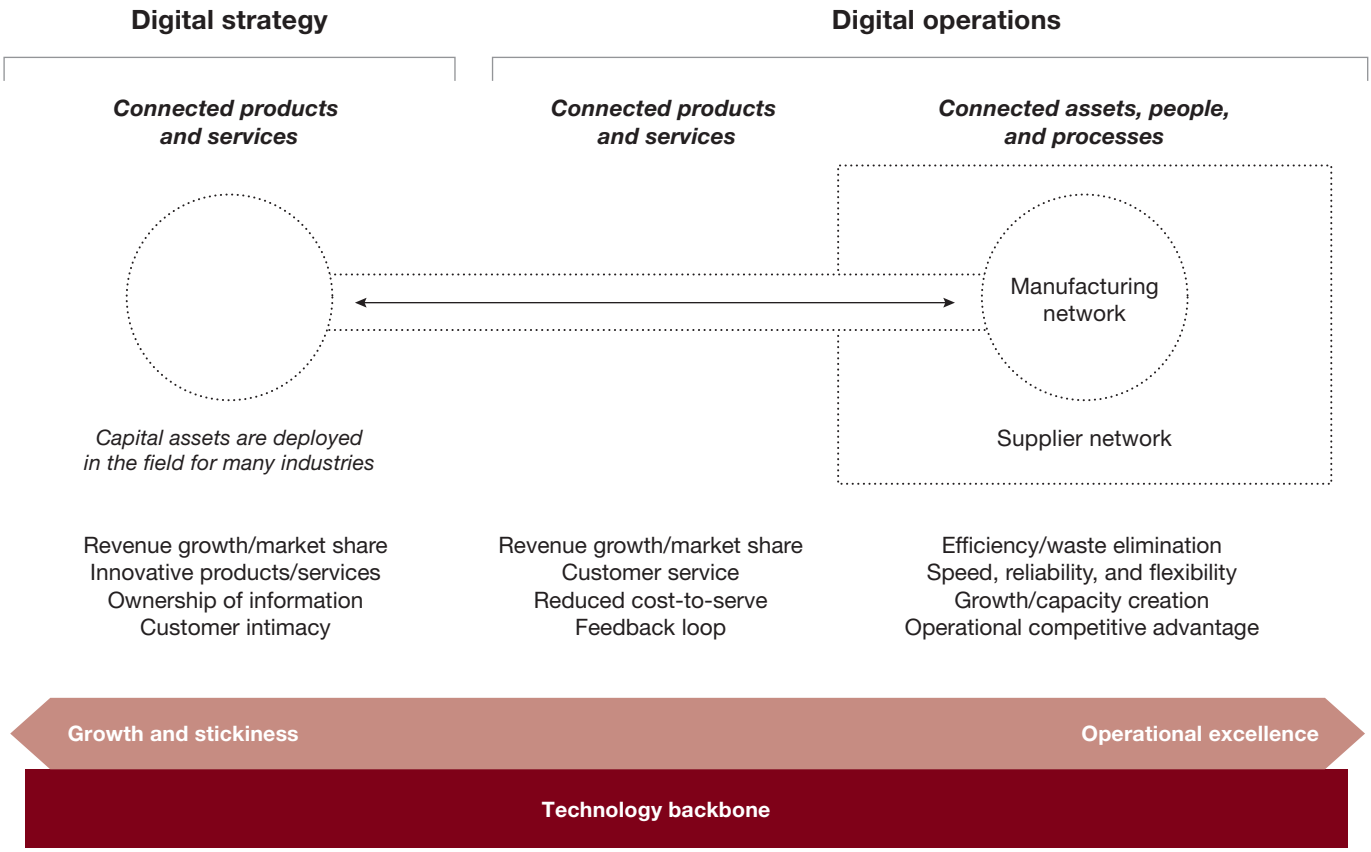
In short, the initial effort to devise new digital strategies focused on creating value for customers is now being met with an equally exciting move into every aspect of digital operations, from product development to sourcing and supplying materials and components, to manufacturing and capital asset optimization, to distribution to customers. All of it is underpinned by the ongoing development of the technology backbone — the sensors, communications equipment, and data integration platforms that make it all possible (*see Exhibit 1, next page*).

The goal of digital operations is to enable the real-time, data-driven decision-making and control capabilities promised in the philosophies of lean manufacturing and Six Sigma operational excellence. Every company across the diverse products and services spectrum now has an unprecedented opportunity to control operations and extract more usable data throughout its supply chain, manufacturing, and distribution ecosystem.

The technologies that are coming into play as part of Industry 4.0 are opening up a range of new business opportunities for a wide variety of players, and forward-thinking companies are looking at ways to capitalize on — if not outright define — how these opportunities will shape the competitive landscape around them. More and more digital solutions are coming onto the market, and costs are declining. Yet the landscape is still fragmented and confusing, and progress remains uneven and highly variable depending on the business process affected — manufacturing, logistics, and the like. And different companies are

Exhibit 1

Digital strategy and digital operations in the industrial Internet landscape



Source: Strategy& analysis

offering solutions for different processes, further complicating efforts to fully integrate them.

Nor is this landscape expected to evolve in a homogeneous, synchronized way. In our view, the industrial Internet of things will develop as seven major "use case" categories (*see Exhibit 2, next page*). The first two involve companies' customer-facing strategies, and the last one bears on the technology infrastructure every company will need. It is the middle four that span the range of companies' core internal operations. A complete understanding of how these four work, and how they fit together, is essential to the full development of a digital operations program.

Given the complexity and relative immaturity of the digital operations landscape, most companies are looking for guidance on how to identify and implement the right solutions for their long-term operational strategies and how to quantify the value creation potential and overall economic impact of these solutions. In doing so, they should begin by answering questions in four key areas:

1. What problems are we trying to solve? How much value can we gain by digitizing our core operations to solve those problems?

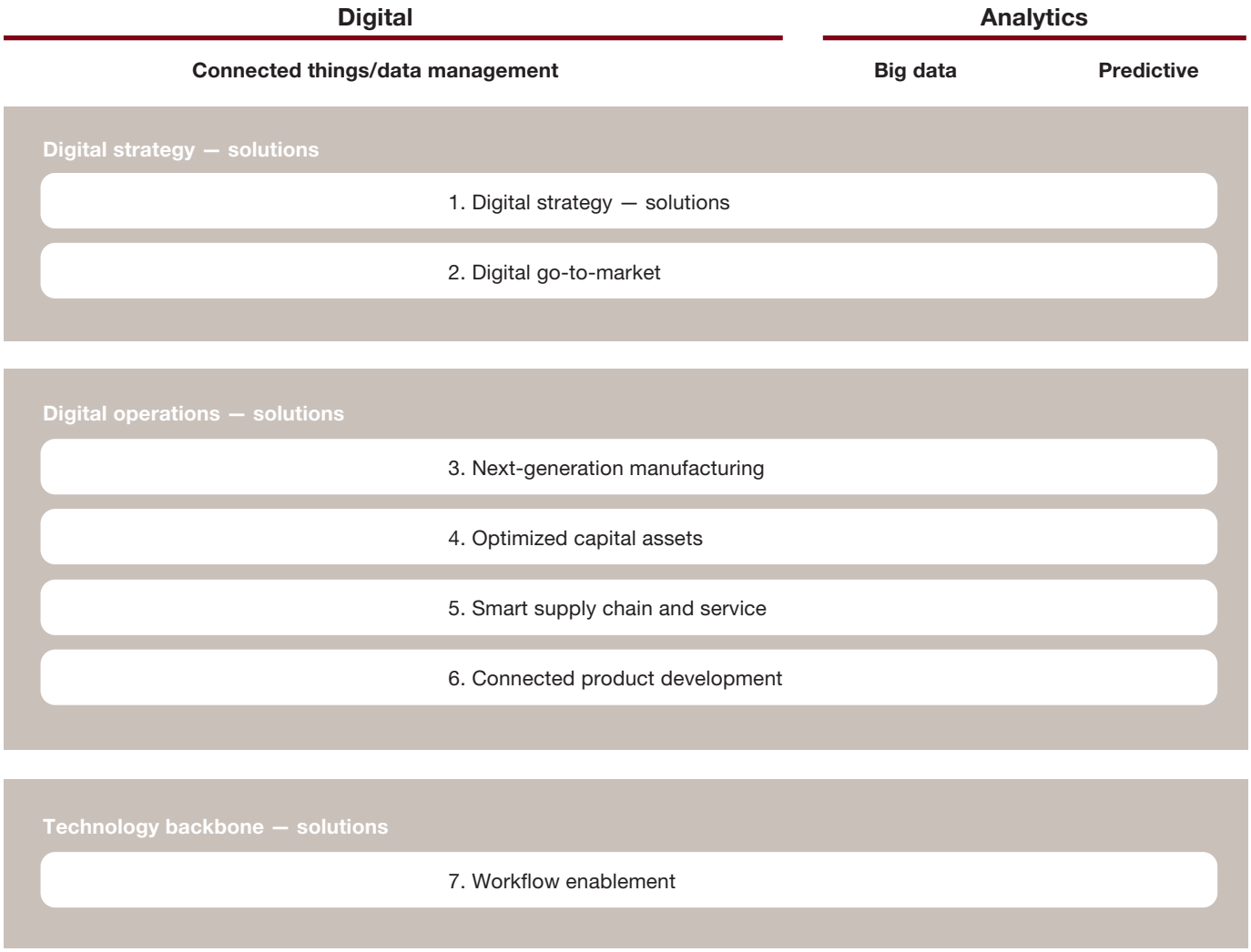
2. How do we monetize this value? What use cases should we focus on?

3. How do we put together the solutions our company needs? Which platforms are mature enough to stand up to our demands, and where are there still gaps in what's available? Should we make rather than buy?

4. How quickly can and should we deploy these solutions? What is the time-phased road map to drive maximum business value?

In short, before proceeding, companies must understand clearly where the value lies, given their individual situations and progress, and then move forward through a careful consideration of the four use case categories already emerging in this rapidly changing landscape.

Exhibit 2
Seven elements of Industry 4.0



Source: Strategy& analysis

Next-generation manufacturing

Of the four areas of digital operations, next-generation manufacturing (also called digital manufacturing) has probably gained the most momentum in the past year or so. Although machine-oriented solutions targeting machine data, automation, downtime reduction, and capacity have gained the most attention in the market so far, other aspects of digital manufacturing — notably, solutions targeting labor, materials, and production flow — are rapidly coming to the fore. Thus, digital manufacturing, in the most general sense, involves the creation of the entire "connected factory" (*see Exhibit 3, next page*).

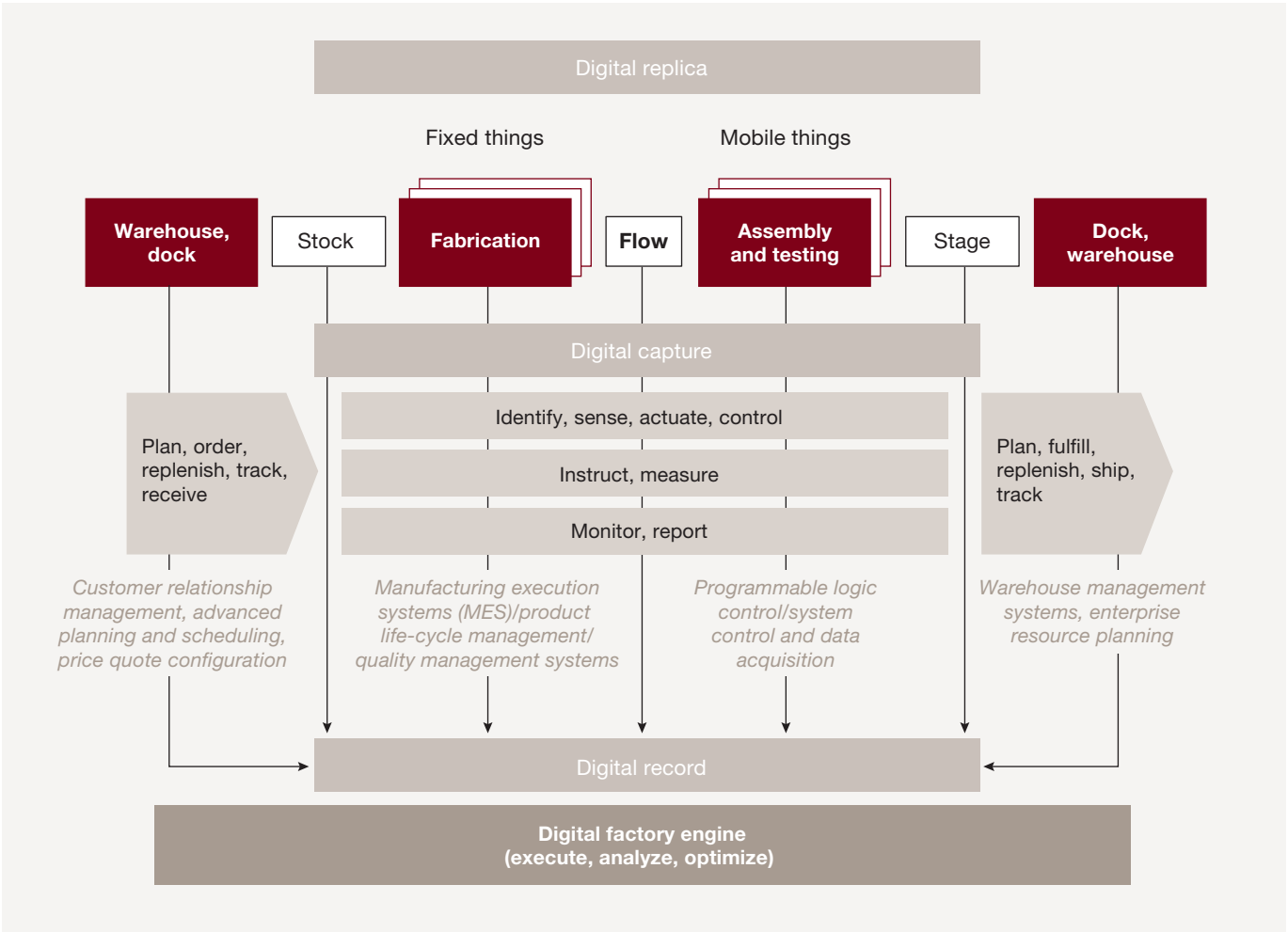
The overall value proposition created by this combination of elements will vary depending on industry, current manufacturing maturity, and technology infrastructure maturity, yet the potential long-term benefits can generate major increases in capacity, reductions in labor and overhead cost, and Six Sigma–level quality improvements. The challenge in achieving such results, of course, lies in developing a robust business case that ties these value creation opportunities tightly to the underlying enablers and drivers.

Though the digital manufacturing landscape is likely to evolve dramatically in the next 24 to 36 months, it is already beginning to converge and concentrate around four specific areas — machine, materials, flow, and labor. Each area includes a number of use cases, and the market is already resolving into about 40 unique cases (*see Exhibit 4, page 13*).

In the machine market, for instance, a number of players are entering from the industrial automation and device side, addressing machine performance, remote services, equipment maintenance, and the like. These players, including Rockwell Automation, Siemens, and ABB, to name a few, are also moving across the IoT stack, providing solutions that extend from data extraction to data processing and platforms to industrial apps and user interfaces. Providers in the other three areas — materials, flow, and labor — are offering track-and-trace and real-time location services to track inventory and people on the shop floor using RFID, broadband, GPS, and other technologies (*see Exhibit 5, page 14*).

Exhibit 3

A framework for the connected factory



Source: Strategy& analysis

Exhibit 4

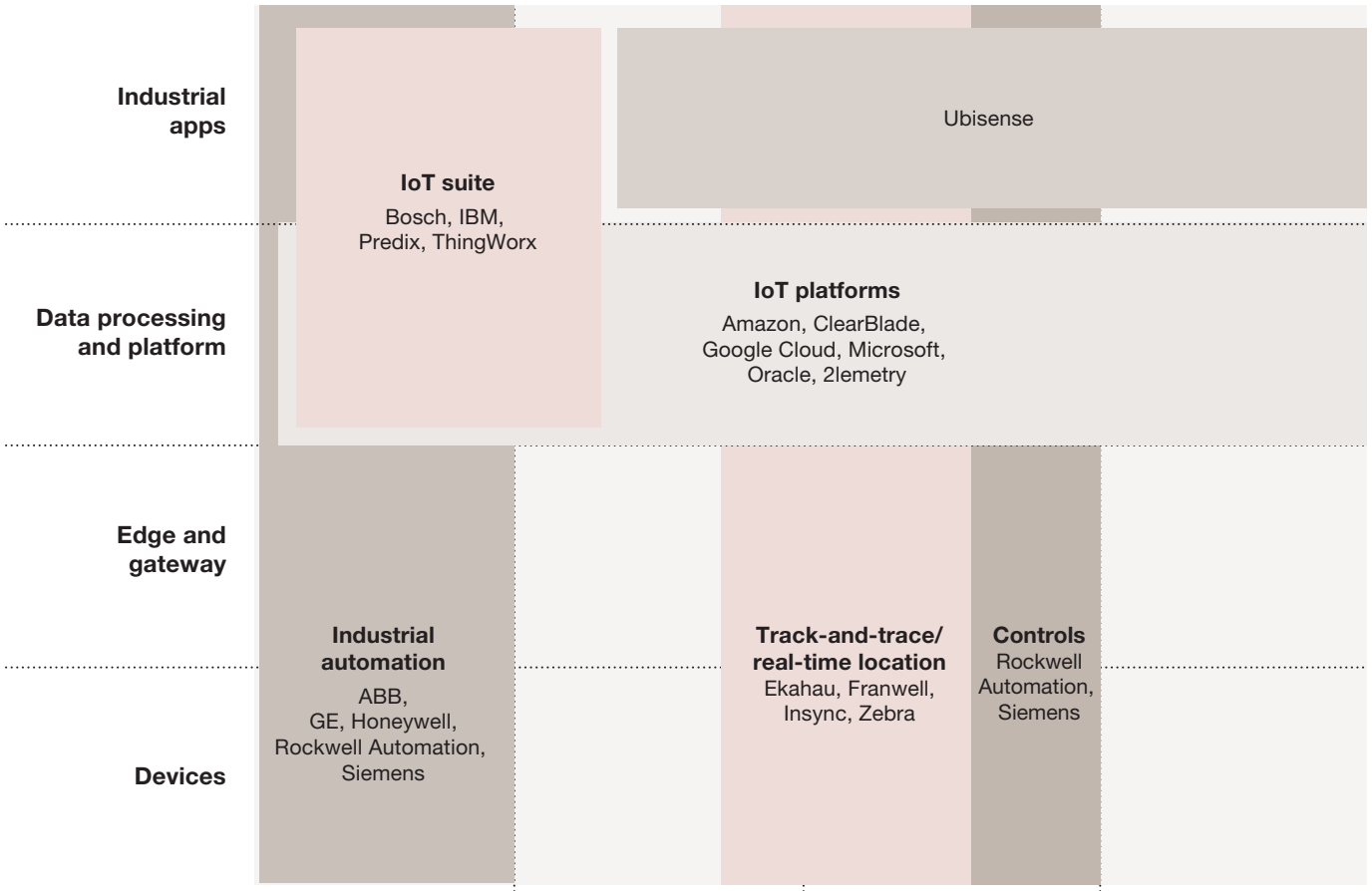
Digital manufacturing use case examples

Machine	Materials	Flow	Labor
Asset management	Inventory replenishment	Production flow monitoring	Augmented reality solutions
Machine performance monitoring	Real-time supply chain monitoring	Capacity monitoring	Safety and compliance management
Predictive maintenance	Warehouse activity optimization	Real-time supply chain monitoring	Warehouse activity optimization
Remote services	Supplier quality management	Lead time management	Lead time management
Energy optimization	Shelf-life monitoring	Tools and equipment tracking	Tools and equipment tracking
Open protocol integration	Virtual spare parts warehouse	Search capability	
Product customization	Product improvement	Shipping activity optimization	
Equipment intelligence	Warranty management	Real-time alerts	
	Consignment management	Service-level management	
	Quality analytics	Customer data analytics	
	Historical performance analysis	Integrated operations	
		Production line simulation	

Source: Strategy& analysis

Exhibit 5

Digital manufacturing players in the IoT stack



Machine	Materials	Flow	Labor
Machine performance monitoring	Inventory replenishment	Production flow monitoring	Augmented reality
Asset management	Quality analytics	Capacity monitoring	Man–machine interaction
Predictive maintenance	Supplier quality management	Flow and schedule optimization	Safety and compliance management
	Shelf-life monitoring		
	Tool and equipment tracking		

Note: This is not meant to be an exhaustive list of companies in the ecosystem.

Source: Strategy& analysis

Increasing capacity through digitization

A Tier One automotive supplier was struggling to meet customer demand, due to a bottleneck in its machining centers caused by slow equipment cycle times, unplanned downtime, reactive maintenance, and variable availability of materials. The problems were forcing the company to run 24/7 shifts and airfreight parts to meet customer commitments.

In response, the company implemented a new machine-, materials-, and flow-oriented digital manufacturing system. The system extracted information including real-time machine data, inventory, and throughput data from the plant in order to analyze production patterns and identify the right sequencing and flow. The analytics capabilities fed real-time production scheduling tools that helped smooth production cycles and reduce waste. The elimination of production constraints led to a 20 percent increase in throughput and incremental revenue potential of US$14 million per day.

The future of manufacturing. Regardless of which portion of the IoT stack companies are working to enter, the most compelling digital manufacturing solutions involve robust operational intelligence engines, or IoT platforms, and they are likely to carry the day as the market matures and stabilizes. Indeed, this has driven a number of nontraditional entrants, including technology companies like Microsoft and Google, to enter the market with powerful data and analytics platforms while partnering with more traditional industrial automation companies to provide the devices for data extraction. Sellers of digital manufacturing solutions are beginning to understand the importance of end-to-end solutions with particularly strong capabilities in the data platform layer.

In short, the many digital manufacturing solutions emerging in the market are expected to offer compelling answers to address the more significant priorities as highlighted in PwC's Global Operations Survey — connectivity, an understanding of customer and market segmentation in the factory itself, and a desire for flexibility and complexity reduction in addition to automation, integration, and standardization.

Unfortunately, there's no silver bullet, which is preventing the marketplace from emerging faster. Typically risk-averse, most manufacturers require a robust value proposition before allocating the resources necessary to bring about such a drastic transformation. Quantifying that value proposition must begin with the business strategy, which in turn must be based on a clear understanding of the problems you are trying to solve and the manufacturing-driven operational advantage you are looking to exploit.

Optimized capital assets

The second area that is being transformed through digitization is capital assets, which includes both fixed assets and fleets. Spending on these two kinds of assets is huge: The top 50 fleet management companies spend more than US$75 billion annually in maintaining these fleets, and a similar amount of money is spent on fixed assets. Indeed, asset management makes up as much as 40 percent of overall costs at many companies.

Yet the majority of companies with large asset bases continue to struggle with basic performance issues: high maintenance costs, low reliability, reactive fixes, low utilization, and safety incidents. Though some industries, such as aviation and freight, have made considerable efforts to update their fleet management programs, many others, including power and utilities and oil-field services, continue to employ suboptimal practices. Our research shows that companies can erode between 6 and 18 percent of their shareholder value through poorly deployed capital assets (*see Exhibit 6, next page*).

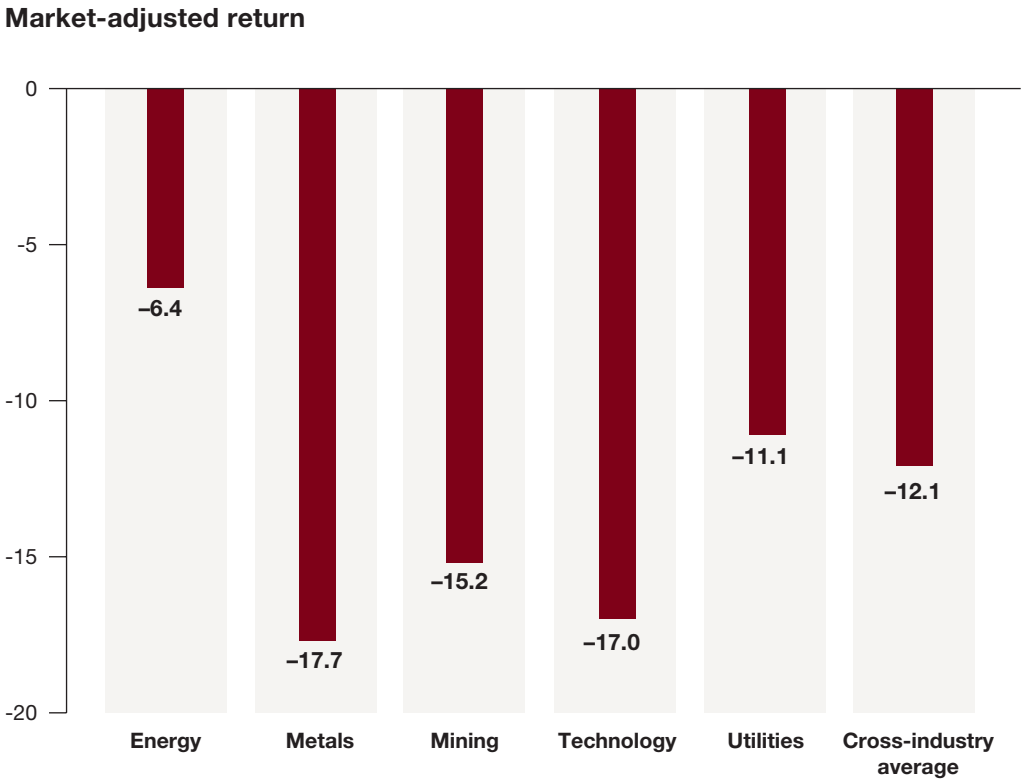
Moreover, asset management is getting more complex as many companies move to a services business model and deploy and manage assets on customers' premises. The combination of customer convenience and cloud support is requiring new models for service.

The benefits of optimizing capital assets are significant. Based on our analysis, companies can lower maintenance costs by as much as 20 to 40 percent, increase asset utilization by up to 20 percent, and reduce capital expense by 5 to 10 percent, while improving environmental health and safety. The stakes, in short, are high.

Companies looking to optimize their capital assets should first analyze their current efforts as being made up of three core elements — capital strategy, project delivery, and asset management — and view all three as working hand in hand, along with support from other company functions and capabilities.

Exhibit 6

Asset-related value erosion and cost implications



Source: Strategy& analysis

Digitization is now the most effective tool for ensuring that these three core elements of asset optimization are aligned and working together. The best of the digital solutions can integrate these elements to drive transformative operational improvement. The benefits typically arrive in three steps: developing asset intelligence, optimizing asset performance, and achieving better results across functions (*see Exhibit 7, next page*).

Buyers should look for solution providers that can demonstrate detailed understanding of the kinds of sensors that should be placed on the client's assets, the proper software and how it should be integrated with the client's existing software, and finally the nature of the business decisions that their solution can help make through the use of data and analytics. Solutions that don't offer all three of these components will likely perform poorly.

Digitizing an oil-field services fleet

A large oil-field services company was spending more than $1 billion in annual maintenance on its fleet of large industrial pumps. Most of the maintenance work was highly reactive due to labor-intensive data collection methods and communication processes between asset management, operations, and maintenance personnel. The result was a general lack of understanding about why equipment failed and about the life span of components. Maintenance routines were either ad hoc or calendar-driven, rather than predictive based on how the equipment was used.

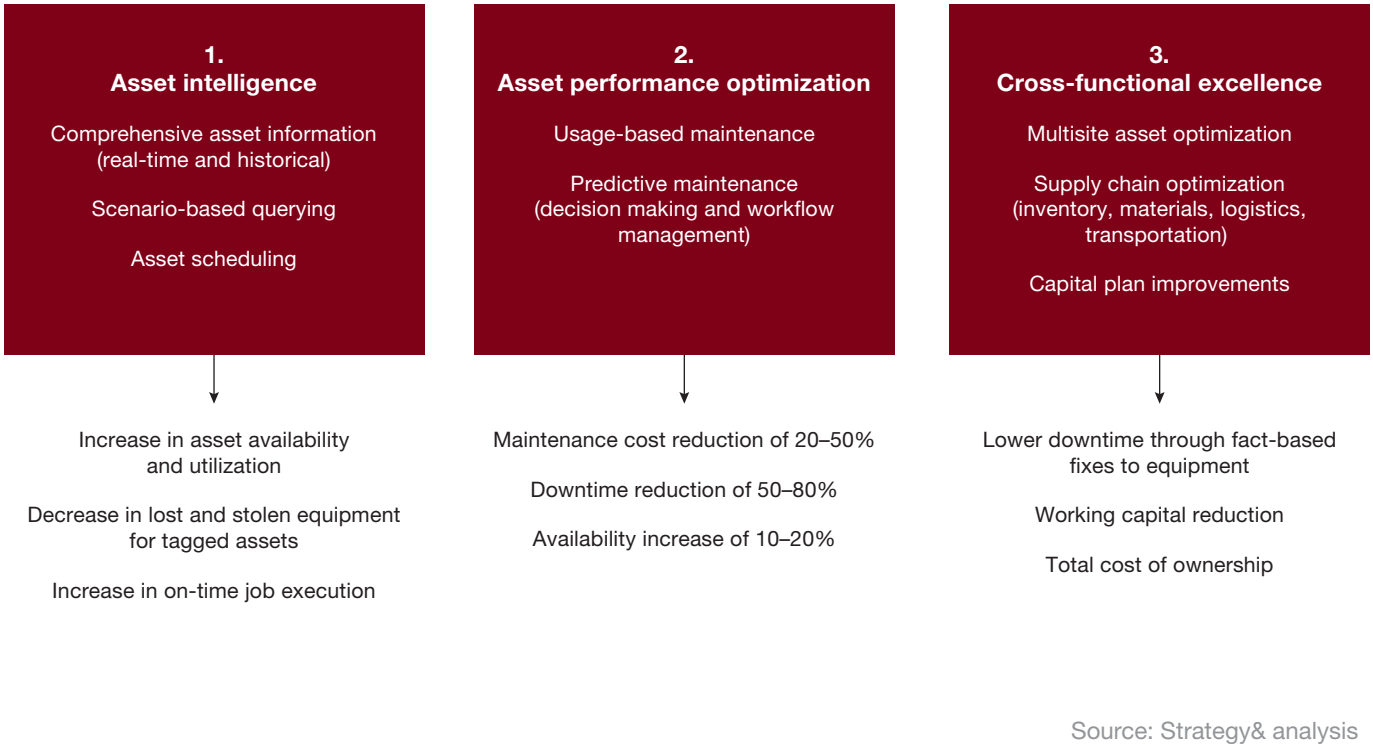
As a result, the cost of maintenance as a percentage of replacement asset value was exceeding 20 percent, compared with an industry range of 3 to 8 percent. Analysis showed that a digital solution could generate annual savings of more than $100 million, as well as improved reliability and customer satisfaction.

The company began the transformation effort by installing sensors on all of its equipment to provide real-time information on location, usage, and degradation of materials. The combined information from components, crews, and fleets was then analyzed in real time to determine the maintenance requirements on a continuous basis. The real-time visibility provided to several functional groups — including sales, operations, maintenance, supply chain, and engineering — enabled the organization to make smarter decisions about scheduling jobs, loading the maintenance shops, and managing customer expectations.

The value generated by the solution spanned the entire operating model, from cost reduction and higher utilization on the operational side to better customer service and revenue generation on the customer-facing side.

Exhibit 7

Three steps to better asset performance through digitization



Source: Strategy& analysis

Smart supply chain and service

Most products arrive in the hands of customers through traditional processes. Sales and operations build forecasts, make procurement plans, and order the necessary materials to produce the products, and manufacturing builds the products at the planned production rates. Distribution plans are established to account for some variation in demand, and customers are promised specific delivery dates. If all goes well, the gap between demand and supply at every point in the system will be small. But that rarely happens.

Over the course of the next few years, this will improve, as smart supply chains and services — or, more broadly speaking, digital value chain solutions — continue to build on digitized manufacturing and asset management to include external activities and end-to-end optimization capabilities.

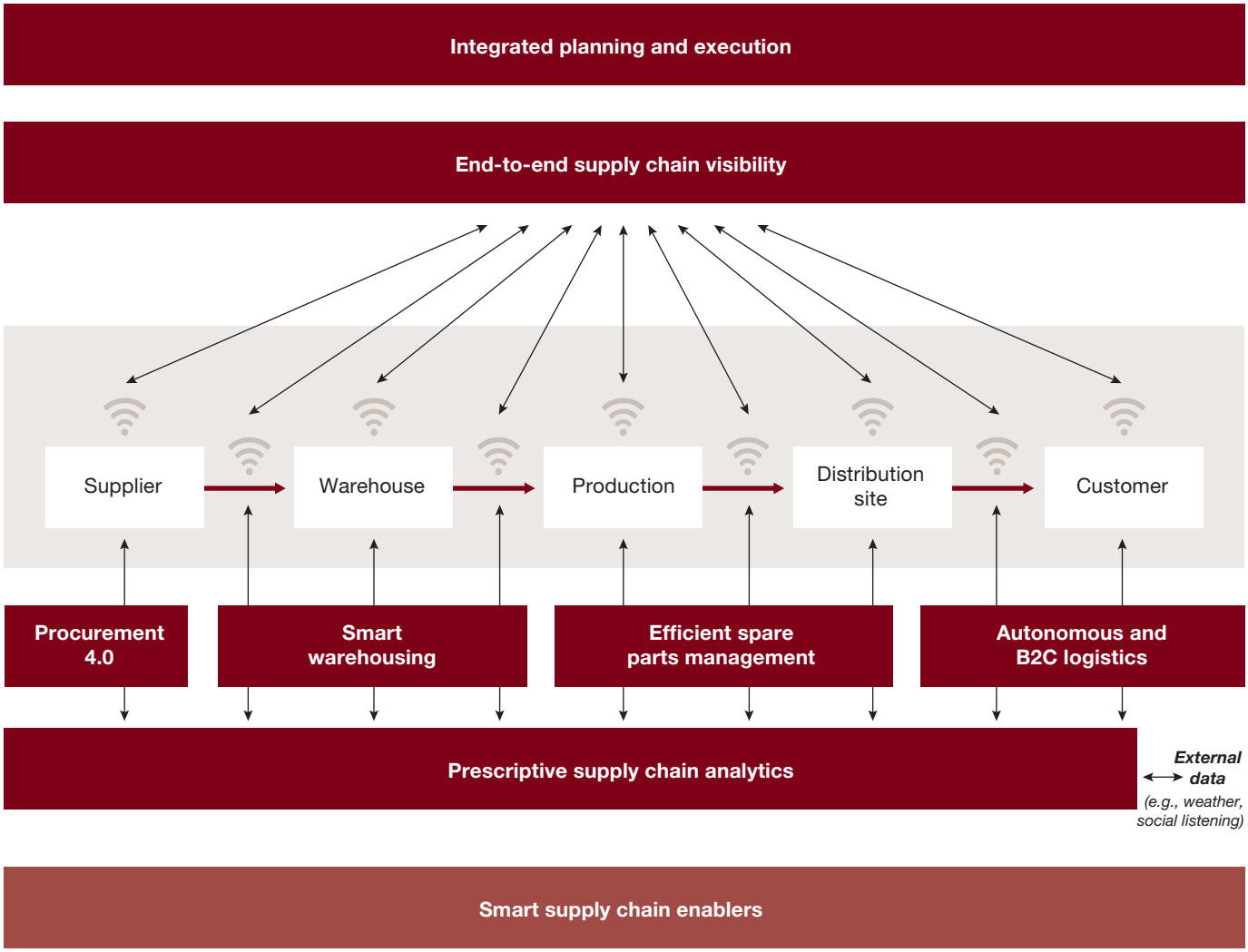
The smart supply chain consists of six key building blocks: horizontally integrated planning and execution, logistics visibility, procurement, smart warehousing, spare parts management, and prescriptive analytics (*see Exhibit 8, next page*). Companies that can put together all these pieces into a coherent and fully transparent system will gain a huge advantage by creating tangible value in the areas of customer service, flexibility, efficiency, and reduced costs.

But companies that want to make the smart supply chain ecosystem a reality can't simply gather the required technologies. They must also build the necessary capabilities, find the people with the right skills, and manage the shift to a culture that's willing to carry out the effort. In other words, they must transform their entire organization. That's a big task, but the rewards are high. Digital supply chain leaders expect sizable economic benefits for both the top and bottom lines.

The smart supply chain consists of about 50 unique processes across every element of the SCOR[1] framework — plan, source, make, deliver, return, and enable (*see Exhibit 9, page 22*). Companies must decide which processes and enabling technologies are most appropriate and deliver the most value, depending on their existing supply chain maturity and levels of collaboration with their supply chain partners.

Exhibit 8

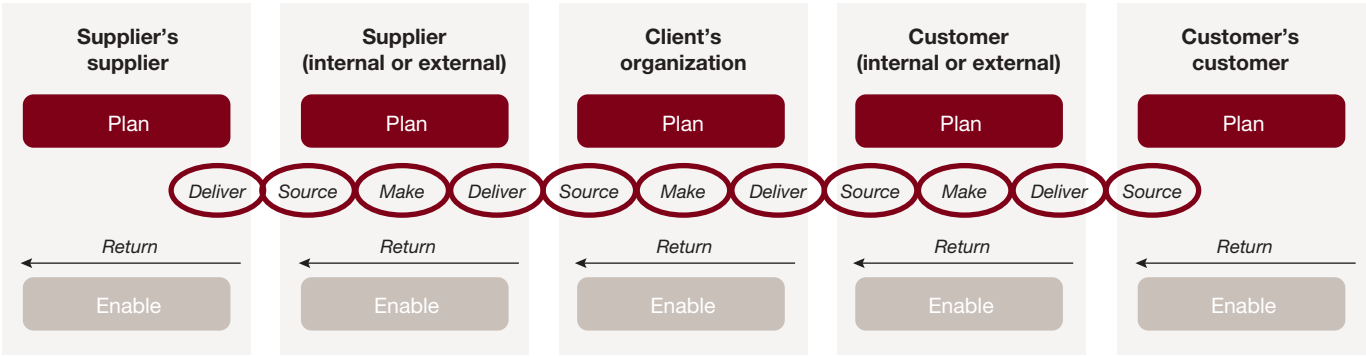
End-to-end smart supply chain capabilities



Source: Strategy& analysis

Exhibit 9

Digital supply chain use cases along the SCOR framework



Plan

- Supply chain visibility system
- Real-time supply chain monitoring
- Compliance management
- Transportation optimization
- Self-service warranty claim submittal
- Supply chain optimization
- Enterprise-level spend analysis
- (Near) real-time scheduling
- Demand management
- Inventory replenishment
- Control center
- Multi-echelon inventory optimization
- Consignment inventory and efficient spare parts management
- Inventory incentives and promotions for customers
- Supply network planning

Source

- Supply chain visibility system
- Supplier quality management
- Receiving goods inspection

Make

- Asset management
- Utility and energy optimization
- Equipment downtime monitoring
- Production flow monitoring
- Tools and equipment tracking
- …

Deliver

- Transportation optimization
- Cloud-based fleet management

Return

- Self-service warranty claim submittal
- Prevention of overshipments
- Return policy conformance integration
- Web-based return materials authorization

Enable

- Mobile access to information
- Quality analytics
- Bar-coding/RFID
- Supply chain risk management
- Global supply chain risk register
- Inbound and outbound materials track and trace
- Supply chain risk monitoring and assessment
- Autonomous logistics systems and vehicles
- Smart warehousing
- Connected pallets and products
- Augmented reality solutions
- Operator enablement/search capability
- Optimization of transportation management
- Warranty management

Note: ® SCOR is a registered trademark of APICS.

Source: Strategy& analysis

At present, the competitive landscape of solution providers is aligned with the different categories of processes. Many solutions currently focus on the "plan" stage — no surprise given that planning is one of the biggest challenges in the supply chain and spans all other categories. Integration platforms that are now emerging offer core planning capabilities to support day-to-day operations, including "what-if" scenario planning.

Also coming onto the market are collaborative cloud-based platforms that allow players across the supply chain network to connect and exchange information on demand to help coordinate the source, deliver, and return functions. In addition, track-and-trace solutions are fast becoming a primary source for critical supply chain data, and such technologies as active and passive RFID, as well as GSM and satellite tracking, are becoming increasingly sophisticated. Although these technologies are not new, the ability to integrate and analyze the data they generate has increased dramatically in the past few years.

Indeed, data integration is the primary driver behind the smart supply chain, enabling the capture and analysis of both structured and unstructured data from internal and external sources to provide critical insights and information throughout the supply chain. So-called control towers can then consolidate all the various data streams to deliver "a single source of truth." Furthermore, companies like Jabil are developing supply chain control tower services that will harness the large amount of parts supply and pricing data to help customers make smarter supply chain decisions at lower costs. Put together, the full ecosystem offers end-to-end connectivity across the entire supply chain (*see Exhibit 10, next page*).

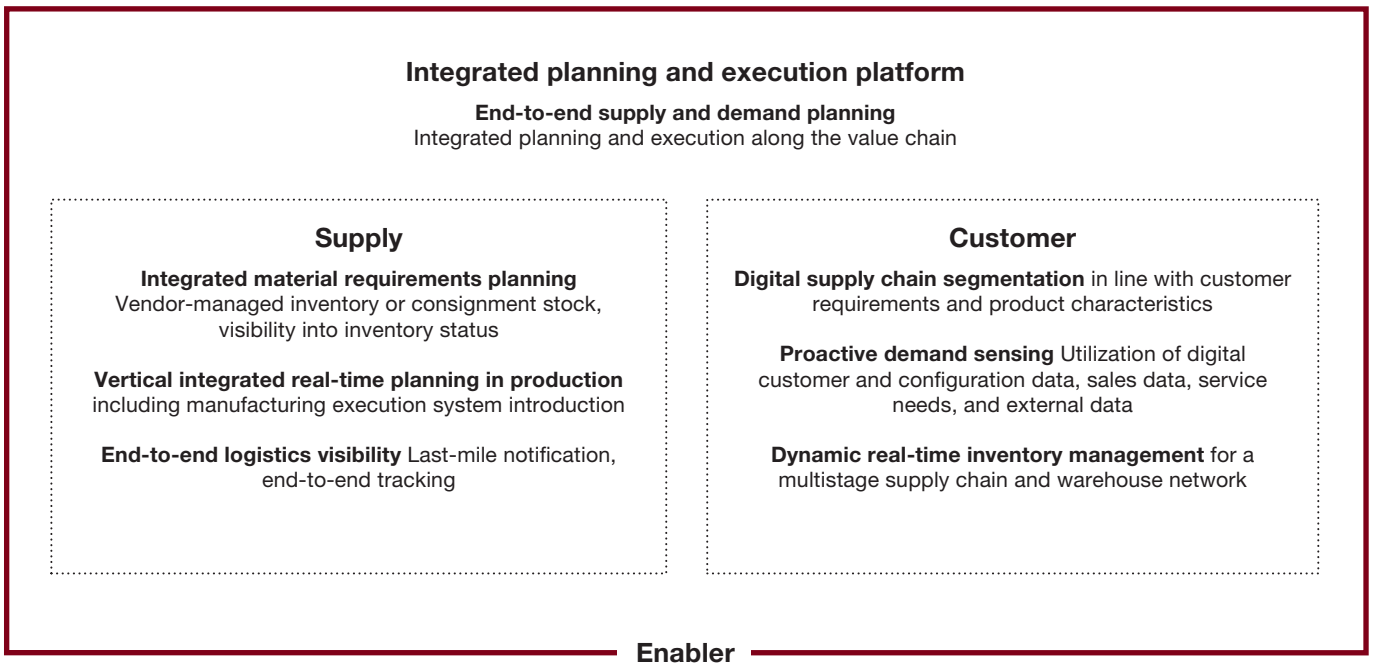
Even more provocative technologies such as autonomous vehicles, augmented reality, and additive manufacturing are also beginning to shape the supply chain of the future, offering additional value creation opportunities, especially by increasing the efficiency of warehousing and logistics operations.

The goal of the digital supply chain, of course, is to better support the primary business goal of every company — to get the right product into the customer's hands as quickly as possible in a responsive and reliable way, while increasing efficiency and product quality. This, however, will be no easy task. The investments and effort necessary to bring the digital supply chain to life are considerable, especially if the objective is to achieve true end-to-end integration and visibility across the supply chain. To find the right starting point, companies should review their current supply chain maturity, identify areas for improvement, and develop solutions for the use cases that will target those critical areas.

Provocative technologies such as autonomous vehicles, augmented reality, and additive manufacturing are beginning to shape the supply chain of the future.

Exhibit 10

The integrated planning and execution platform links all players in the supply chain



Source: Strategy& analysis

The transformation to a smart supply chain

Like many companies, a global consumer products company was seeking to enhance its competitive advantage by improving efficiency, flexibility, and capacity utilization across its supply chain, with the goal of reducing costs, increasing working capital, and decreasing product lead times. The multiyear journey, however, would require a global transformation spanning multiple business units, functional areas, and geographic locations. The value potential was enormous — more than $1 billion — due to the company's global scale and first-mover advantage in specific product segments. Its powerful position in the industry meant that developing truly smart supply chain capabilities had the potential to generate a competitive advantage so great that it could severely disrupt the industry.

The company began the effort by creating a multiphase transformation plan that included ideation, scoping, and the development of specific use cases, followed by a more detailed plan to deploy the use cases, governed and enabled by a program management office in charge of building the appropriate capabilities. The next phase in the journey consisted of pilot programs in select geographies and business units designed to implement and test specific use cases, such as real-time materials tracking, control towers, and smart warehousing. The pilot programs served as the proof of concept to set the stage for an ongoing global rollout that is expected to deliver major improvements in key operational metrics over the next five years.

Connected product development

Connected product development, the fourth key area of digital operations, has two primary goals: to incorporate feedback information on how customers actually use products into the development process, and to aid in the process of moving new products from design to production. As such, it is unique in the sense that it is just as closely connected with the digital go-to-market aspect of digital strategy as it is with digital manufacturing.

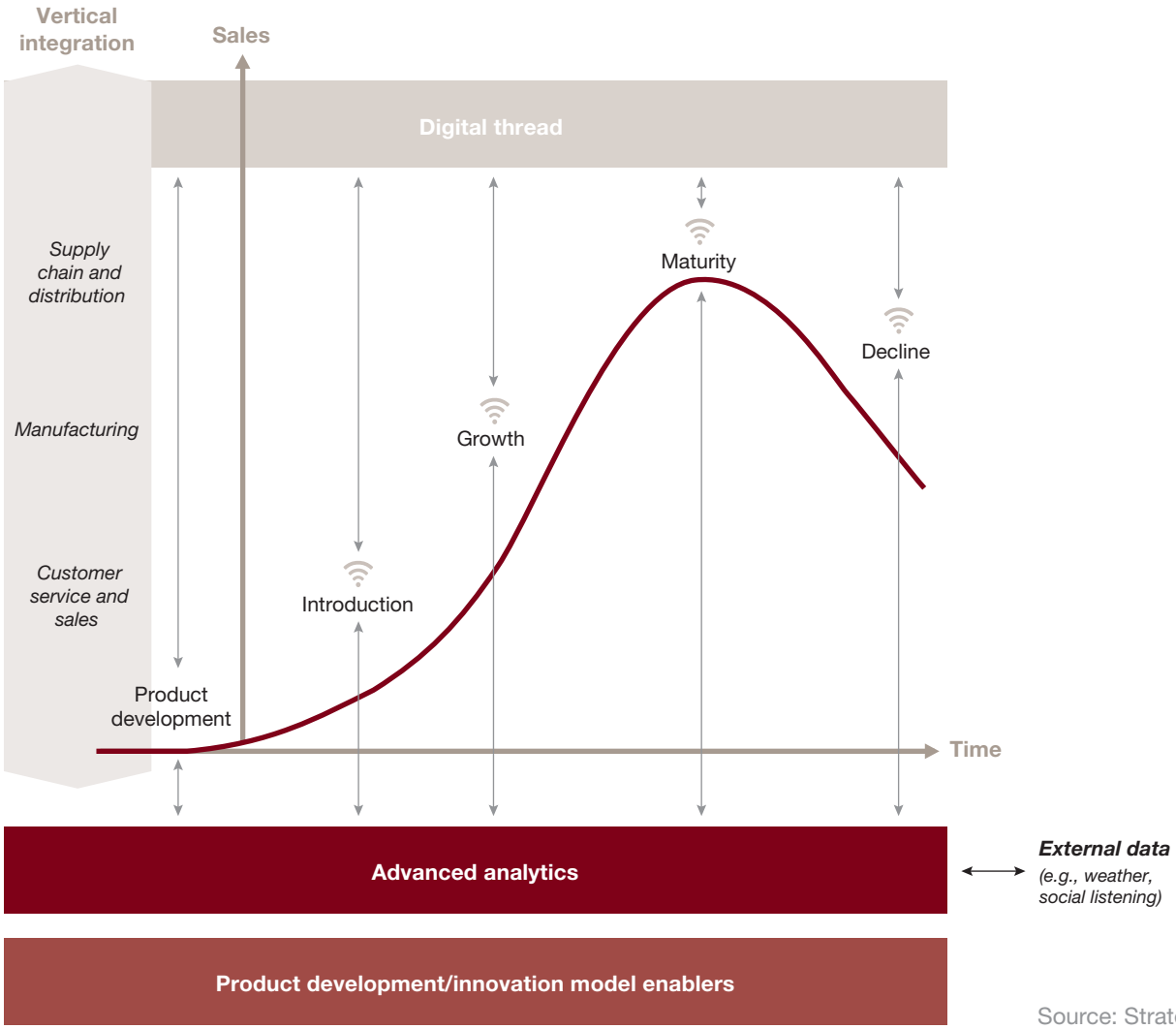
The product development function has long used digital tools and models such as CAD simulations, but new processes and technologies now allow for a deeper level of insights into product performance in the field and existing customer requirements. Big data lets companies assess product performance against a number of variables such as environmental factors and specific usage patterns — much of them captured in real time — that were not available for analysis just a few years ago. R&D teams can use this information for product updates, and a variety of other new tools let both internal and external partners collaborate more effectively throughout the product development process.

As products move from ideation and development to retirement, this wealth of data across the life cycle can now create a product's "digital thread," the aggregated, product-specific data stream that combines information from a variety of systems and sources. One exciting new source of data is the "digital record" of a product, which is continuously updated as the product itself passes through its life cycle. Such information helps the manufacturer understand how the product behaves in different production environments and provides traceability from inception to retirement (*see Exhibit 11, next page*).

The second goal of connected product development is to promote collaboration among functional teams and partners by having them work together on cloud-based platforms. These allow data to be transmitted more efficiently from research and engineering to manufacturing and suppliers, allowing for all involved to test whether designed products and components can be easily manufactured. The resulting reductions in time-to-market, improvements in the customer

Exhibit 11

Connected product development across the product life cycle



Source: Strategy& analysis

experience, and increased efficiency and productivity have the potential to generate considerable value.

Already, about 15 use cases are emerging in the areas of product design, product management, and customer experience (*see Exhibit 12, next page*). Others are being developed rapidly. Companies like John Deere and Tesla are already able to update their products' performance criteria over the air, allowing them to reduce manufacturing complexity by shifting customization of product characteristics from the hardware to

the software level. Product development and innovation can continue even after the product leaves the factory, enabling completely new innovation and business models.

Exhibit 12
Connected product development use cases

Design	Product management	Customer experience
Design collaboration/co-creation	Wireless updates/enhancements	Product customization
Concurrent engineering	Defect/quality monitoring	Over-the-air updates/enhancements
Enhanced regulatory compliance	Customer usage monitoring	Defect/quality monitoring
Rapid prototyping	Customer behavior/ preferences analytics	
Crowdsourcing	Real-time product monitoring	
Product simulation/testing	Real-time digital twin tracking	
Digital twin for simulations	Digital life-cycle management	
Digitally enabled machine learning		

Source: Strategy& analysis

A digital record for aircraft engines

As part of the initial phase of digitizing its operations, an aircraft engine manufacturer sought to reduce engine downtime and increase the overall life span of its engines through connected product development and product life-cycle management. The company designed new sensors into the product and created a digital record data model of each engine to capture and store real-time information about its performance and operating environment. The data was then combined with the engine's manufacturing data and information about the aircraft as part of the digital thread.

The company developed analytical tools on top of this data to assess performance down to the level of individual components, to prolong the life of its engine and aid in the development of its next-generation engines. The company is now able to compare this analysis with predefined design criteria to determine the engines' optimal operating conditions and allow for predictive maintenance, thus opening up opportunities to capture more value across the entire product cycle.

The way forward

The path to fully digitized operations will not be easy. IoT and big data are only enablers, not solutions. Executives who react to the hype will find themselves with a sea of data but poor information and little business value. The key challenges will always be defining clear solutions with strong value propositions, developing the right set of capabilities, and finding the right talent. That will require putting together a strategic plan, including a well-defined road map for implementing the technical, organizational, and business process changes. Four steps are crucial.

1. Validate the monetization plan. The digital operations journey starts with addressing questions about value, cost, and risk. Companies will be able to answer these questions only after determining their business strategy and analyzing their current operational maturity. Begin with planned use cases and respective value models, and then adapt them and validate their value propositions through detailed business cases that fit the needs of your company and current market offerings. Business cases should be based on thorough modeling and benchmarking exercises, and should include realistic operational and financial targets.

2. Understand the ecosystem. Companies must be able to define the solution or solutions they are looking for and understand the market landscape to determine the right solutions provider (or providers). These solutions will be significantly different from the traditional platform-centric models for ERP, CRM, and the like, and instead require an entire ecosystem of platforms, solutions, communications, and security. Moreover, the current technology landscape varies significantly for each use case. Take the time to understand the ecosystem specific to the use cases you decide to implement.

Partnerships and alliances will most likely be part of the process of determining and implementing the right solution. Evaluate potential partners or allies in light of the long-term competitive landscape to ensure that you are buying into a platform or solution that will give you the highest level of intelligence, competitive advantage, and security, and that will be around to provide value-added services in the long run.

3. Identify the right talent to refresh the operating model and capabilities. The people side represents a commonly overlooked element in any digital operations transformation, yet business leaders consider this a significant challenge in implementing any digital strategy. Ask yourself who will own the new digital road map and who will use new information to make operational decisions. As with any transformation effort, owners, champions, and subject matter experts must be identified and empowered to execute the implementation. At the same time, operations leaders must be champions of the solution and understand their new decision-making capabilities.

Who should those operations leaders be? What is the proper profile for a next-generation vice president of operations who fully understands the emerging digital revolution? The answer likely falls at the intersection of operations and technology, and companies have to staff roles with this in mind. The challenge is that the right profile probably does not currently exist in the organization today. Tomorrow's digital operations leaders must be groomed in light of core operations, technology, and engineering skill sets.

4. Build the road map. Finally, the "Where do we start?" question is often where paralysis sets in. Leading companies tackle this by defining their strategy around what we call a capabilities system. This is made up of four or five distinctive capabilities — the combination of processes, tools, knowledge, skills, and organization that set your company apart from its rivals and allow you to carry out your chosen way to play. It might be one or more of the use case categories discussed above — digital manufacturing, perhaps, or supply chain management. Establishing clear links between the strategy and the capabilities system will drive that understanding down through the decision-making process of the overall transformation effort.

Conclusion

The field of digital operations is entering a new, significantly more mature phase. Enablers and engagers are offering an ever-growing range of solutions for digitizing every element of operations, and the market is growing fast.

However, focusing solely on the solutions on offer, and their technological implications, will only lead to confusion and paralysis. Instead, think in terms of problem statements and value creation opportunities, and the corresponding use case categories that will enable the proper solution. Then work back to evaluate the current market landscape for each of those categories.

Finally, don't wait for the perfect solution for each use case category, or the right answers to the many questions surrounding digital operations. There is no silver bullet for your company. It will be a journey. Begin now by developing your strategy, the distinctive capabilities, and the people and processes that can give you a right to win in the digital future. And remember that the first movers will command a great advantage.

Endnote

[1] The Supply Chain Operations Reference (SCOR) model is a standardized framework maintained by the APICS Supply Chain Council and used across a range of industries.

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