



The Incumbent's Advantage in the Internet of Things



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The Incumbent's Advantage in the Internet of Things

Massimo Russo and Gary Wang

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AT A GLANCE

B2B companies will build data businesses that generate high-margin recurring-revenue streams and create competitive advantages. Which companies have the advantage that confers the right to win in industrial IoT markets? Which will be able to capitalize?

ASSESSING THE RIGHT TO WIN

Many of the structural factors that determine a potential IoT solution provider's right to win favor incumbents over new entrants.

THE PATHS TO MONETIZING IOT DATA

Companies have a choice of three main revenue models: augmenting traditional product revenues with IoT services; charging for access to a platform, data, or suite of applications; or orchestrating and monetizing a broader IoT ecosystem.

HOW TO DRIVE ADOPTION

Whichever model they choose, companies need clear strategies to drive adoption and generate network effects. We explore four winning approaches.

This is the second in a series of publications on how companies can capture the value of the data generated by the Internet of Things (IoT) and how data ecosystems will play in defining the future of competition in many B2B industries.

DATA ECOSYSTEMS—ORCHESTRATED BY THE likes of Amazon, Google, and Netflix—have demonstrated that they can create enormous value for B2C businesses. For B2B companies, however, developing data ecosystems is more complicated, given that vertical-specific solutions and hundreds of IoT platforms compete for dominance. What’s more, the value of data in B2B is also more difficult to extract; companies need domain expertise to develop new solutions and services as well as the customer relationships required to monetize them. That said, the times are changing fast. The installed base of IoT-connected devices will soar from about 11 billion today to 125 billion in 2030, according to DBS Bank, and the volume—and value—of data created by B2B industries will far eclipse those generated by mobile devices and people surfing the web.

BCG has already published articles about the increasingly prominent role of ecosystems in business and how companies can manage them. There’s no question that B2B companies will build data businesses that generate high-margin recurring-revenue streams and create competitive advantages; some already have. This report explores which companies, thanks to their business mixes and market positions, have the advantage, which can also be called the right to win (but not a guarantee), in industrial IoT markets as machine-generated data is unlocked at scale for the first time, enabling a new logic of competition.

Specifically, in our study of dozens of actual IoT business models and examples, we looked at the following questions:

- Where is there sufficient potential for IoT solutions and services to create value for customers? Under what conditions could rapid adoption of such solutions and services occur?
- What structural factors determine an individual company’s right to win as a provider of IoT solutions, services, or platforms?
- How can companies monetize their IoT investments and data?
- How can IoT platform and ecosystem providers attract customers and ecosystem participants?

The installed base of IoT-connected devices will soar from about 11 billion today to 125 billion in 2030.

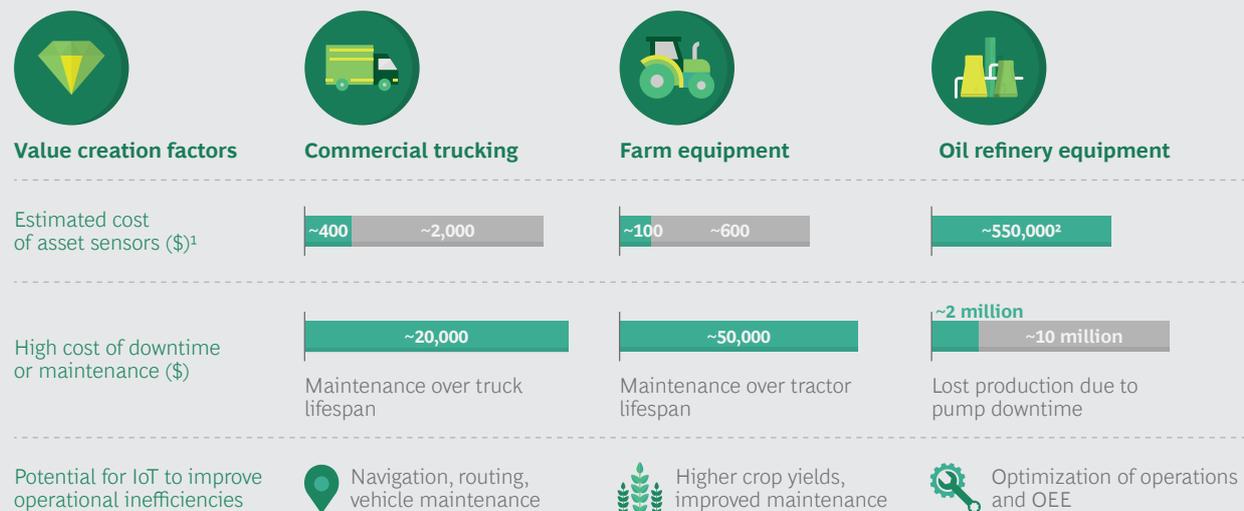
The Speed of Adoption

The speed of adoption of IoT solutions, and the ultimate size of the market for those solutions, will vary by industry. This will present different levels of urgency for incumbents. As Exhibit 1 shows, high-potential markets for high-speed adoption include industries with some combination of the following factors:

- Easy connection of industrial assets—newer generations of connected equipment or existing equipment that can be easily retrofitted with sensors
- A cost of installing sensors and other equipment and connecting to an IoT platform that is much less than the replacement cost of the equipment
- A high cost of downtime or maintenance; a significant cost base must be optimized
- Critical equipment that is part of a complex system that needs to be controlled (such as manufacturers of automobiles, aircraft, industrial robots, or any other highly engineered product)
- Potential improvement of operational inefficiencies (such as input costs and conversion yield) by using an IoT solution

Industries with these characteristics are experiencing an explosion of IoT-enabled offers from startups, technology companies, and incumbents. In fact, a typical customer faces the big challenges of tailoring the various vendors' offerings to its par-

EXHIBIT 1 | Examples of IoT Value Creation Factors Across Select Industries



Source: BCG analysis.

Note: Cost estimates provided are sample data points. OEE = overall equipment effectiveness.

¹The cost estimates are per year and will vary based on type of equipment

²Includes the estimated cost of analytics software specific to downstream pumps

ticular needs and managing the complexity that comes with integrating multiple solutions.

Sophisticated IoT companies try to make those tasks easy. Consider agriculture, for example. Access to, and better use of, all kinds of farm data can benefit farmers enormously: a 30% reduction in input costs and a 10% lift in yield are frequently cited outcomes. Farm equipment can be retrofitted with sensors and precision seeders while field, survey, drone, and satellite data can be aggregated for analysis and insight. But most farmers do not have the necessary capabilities to collect, integrate, and analyze all the data to optimize planting, seed selection, and the application of fertilizers and pesticides.

Enter the incumbent with a compelling IoT offering. Monsanto's Climate FieldView, for example, integrates multiple data sources into a precision agriculture platform. Similarly, the John Deere Operations Center integrates more than a hundred partners into an intuitive platform that helps farmers manage equipment, optimize planting and harvesting practices, and handle the business end of the farm. Monsanto's and John Deere's IoT platforms are successful because they overcome several barriers for customers, including the lack of ability to develop IoT solutions themselves, a limited capacity to integrate existing data, and insufficient expertise in equipment.

A handful of structural factors will determine a potential IoT solution provider's right to win.

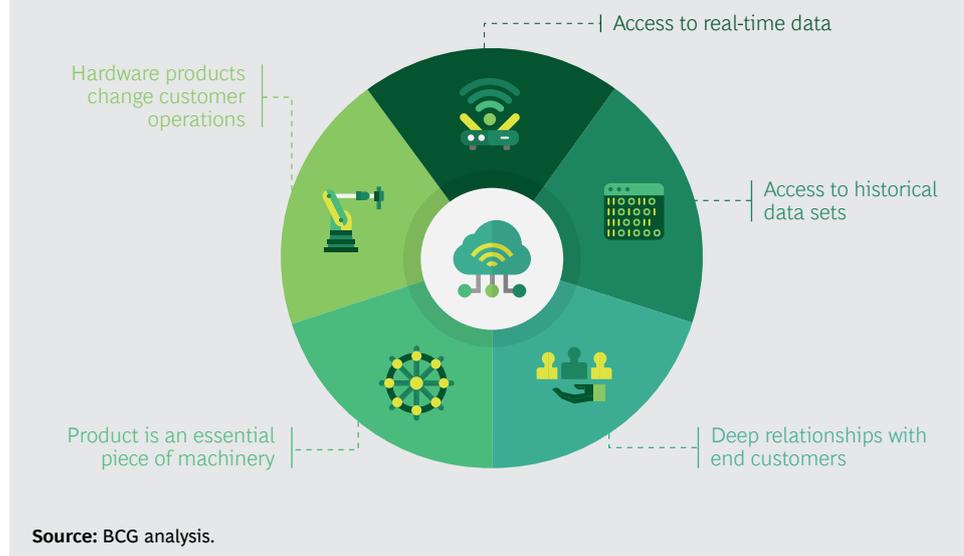
Assessing the Right to Win

New entrants, typically tech companies and digital natives, were the early movers in providing solutions and services using IoT data. In recent years, however, incumbent industrial companies—including Honeywell, Siemens, and Schneider Electric—have entered the game. In some instances, they saw an opportunity to generate incremental recurring-revenue streams, often with financials that are more attractive than those of their core businesses, by offering services derived from data-based insights on top of their traditional product businesses. The medtech sector, for example, provides plenty of opportunity for product-based services rooted in the data that devices generate. In other sectors, such as automotive, companies have ventured into adjacent markets where the combination of their data and product expertise offers new opportunities, such as selling connected-car data to insurance companies or city governments. Services for adjacent markets often involve developing new offerings as a result of partnerships involving analytics providers, digital-platform providers, data brokers, connectivity providers, and systems integrators that cover all the steps of the data value chain.

Whether a potential IoT solution provider is looking at its core market or an adjacency, a handful of structural factors will determine its right to win. (See Exhibit 2.) Many of these actually favor industrial companies with decades of market and product development experience, providing them with a structural advantage over new entrants. These factors do not guarantee success, but they tip the odds significantly toward the incumbent:

- Access to a large set of high-quality equipment-generated data that comes from a substantial share in a particular market and a large installed customer base, as

EXHIBIT 2 | Five Structural Advantages Define the Right to Win in IoT



well as a significant share of products that are either already connected to the internet or could be connected to it.

- Access to a large set of high-quality historical data from existing equipment that enables the training of machine-learning algorithms; the larger and “cleaner” the data set, the greater the potential for useful models that lead to high predictive value with fewer false positives from the algorithms.
- Deep relationships with, and proximity to, the end customer and a strong understanding of the end-customer’s operations; end-to-end visibility of onsite processes and personnel is ideal.
- The provider’s own product operates at the major-equipment, system, or plant level; it is an essential piece of machinery as opposed to a component part and plays a role in a wide range of addressable use cases.
- The ability to “close the loop” and have a direct impact on the customer’s operation, meaning that the provider’s solution goes beyond just monitoring equipment and in fact changes customer operations. For example, technology that actually directs the output of HVAC systems on the basis of temperature, usage, and need is more valuable than sensors that simply monitor temperature and energy usage and display data on a dashboard.

Consider Honeywell and its controls business, for instance. Honeywell UOP (formerly Universal Oil Products) has long provided industrial control systems and equipment to the oil and gas industry. It has a vast installed base of process control equipment, deep domain-specific knowledge, and access to tremendous amounts of well and installation data. In 2015, Honeywell launched its Connected Plant business, which can optimize process outcomes through control systems. Honeywell’s

suite of connected-plant IoT solutions can improve facility uptime by 5%, increase production yield up to 7%, and enhance operator safety.

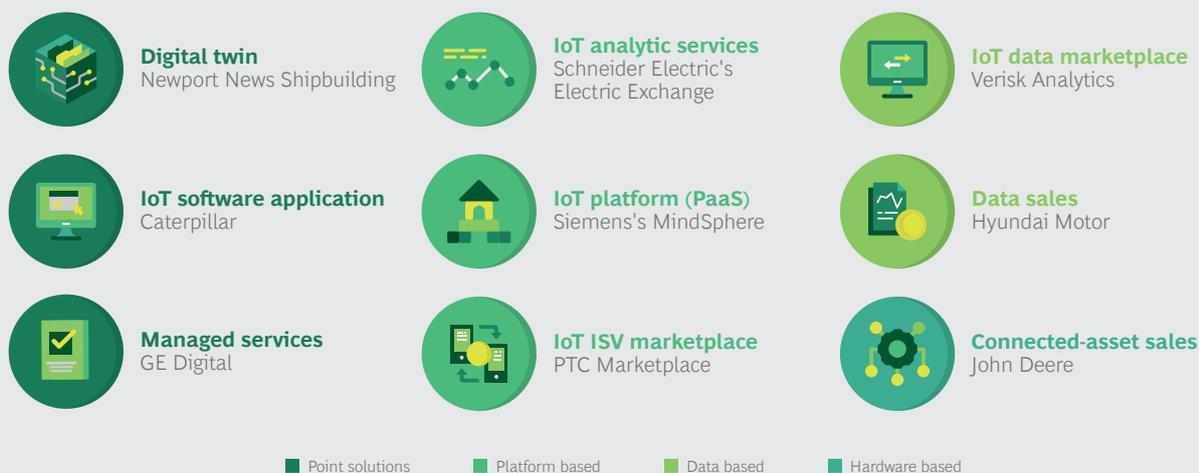
More recently, Honeywell has launched a partner program, INspire, for oil field equipment and service providers. Companies including Dover, Flowserve, Mitsubishi Heavy Industries, and Sparks Dynamics (a specialty analytics company) have joined the Honeywell ecosystem to drive greater value for customers. Honeywell is integrating its own process knowledge with that of its partners—along with a secure IoT platform, data and analytics, and technical field resources—to provide greater value to oil and gas end customers. Honeywell reports that its software revenue is growing at 20% a year. Its software-centric IoT strategy has been rewarded by investors with a strong share price and a generally rising price-to-earnings ratio.

As Honeywell’s experience demonstrates, incumbent industrial companies can have a clear advantage over startups or technology providers—if they can build the internal capabilities necessary to develop IoT data-enabled solutions. Many industrial companies that have been giving away their data, or not connecting equipment to capture data, are now realizing that they have overlooked a powerful source of future competitive advantage.

The Paths to Monetizing IoT

The right to win does not by itself create a winning IoT business, of course. Companies need to identify use cases across their core customer bases and adjacencies, take stock of existing and potential data assets, and select the business models that best fit their value propositions. There are many models to consider, ranging from selling connected hardware to selling raw or enriched IoT data to building IoT point solutions or creating IoT platform-based business models. (See Exhibit 3.) The latter

EXHIBIT 3 | Many Companies Have Already Adopted Various IoT Business Models



Source: BCG analysis.

Note: PaaS = platform as a service; ISV = independent software vendor.

two options merit highlighting because of the requisite investment in developing software capabilities and potential for high-margin software revenue streams.

Companies can offer IoT point solutions (such as digital twins, software applications, and managed services) that address specific use cases, including asset tracking, equipment monitoring, and predictive maintenance. To maximize reach, they will want to make these point solutions available across as many platforms, marketplaces, and ecosystems as possible. Senseye, for example, uses machine learning to predict the remaining useful life of a broad array of industrial equipment and offers an easy-to-deploy predictive maintenance application on both the PTC ThingWorx and GE Predix platforms. By interoperating across equipment classes and IoT platforms, Senseye can reach more customers and improve the performance of its algorithms with the input of a wide variety of data, thereby enhancing the algorithms' value proposition.

Alternatively, companies can pursue a platform-based IoT business model that captures a larger value pool by orchestrating an expanded ecosystem of partners. (See the sidebar "Some IoT Terms and Definitions.") Companies with a strong right to win in IoT often have the best opportunity to become orchestrators of IoT ecosystems that provide more comprehensive and powerful solutions than any single company could deliver on its own. Schneider Electric's EcoStruxure platform and Electric Exchange marketplace are examples of such ecosystems. When the company assessed its IoT opportunities, it identified some 200 potential use cases for its

SOME IOT TERMS AND DEFINITIONS

Plenty of terminology gets thrown around in discussions of IoT and data-centric ecosystems. Here's how we define various terms.

Platform. The technology stack, system interfaces (such as those for application programming), and application development environment combine to allow different parties to contribute or access data and develop apps or other value-added solutions. An IoT platform business model establishes a platform to aggregate device data and a set of business rules (for governance, monetization approaches, data standards, and terms and conditions) that multiple parties can use to build, deliver, and monetize solutions and services, usually through an application

marketplace not unlike the familiar consumer smartphone app stores.

Marketplace. A feature of an IoT platform, the marketplace enables customers to transact business directly with third-party IoT solution providers. It provides subscription and billing management functionality as part of the platform.

Ecosystem. An ecosystem comprises a set of relationships among multiple companies that create and deliver joint solutions to customers where all ecosystem players benefit, typically with one company playing the role of the ecosystem orchestrator while others either enable or contribute solutions.

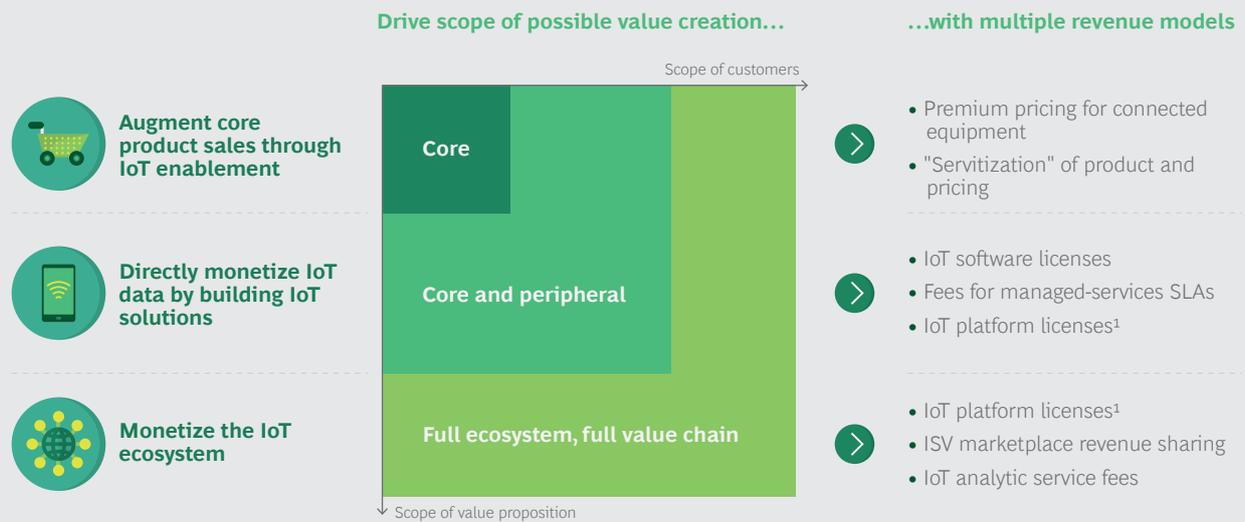
data and expertise and determined that it could pursue 40 on its own; the remainder required partners.

Each of these business models and strategies has its own revenue model. The principal approaches fall into three categories: augmenting traditional product revenues with IoT-enabled product and service bundles, directly monetizing IoT data by building solutions or selling data, and monetizing a broader IoT ecosystem via a platform. (See Exhibit 4.)

Augment core product revenues. The first route to monetization is typically building or retrofitting products with embedded sensors, microprocessors, and secure connectivity with a clear specification to access data and control the product’s function remotely—a hardware-based business model. For example, car companies might develop autonomous vehicles that interoperate with a variety of car-sharing platforms, such as Uber and Lyft. In the future, car companies will likely need to provide autonomous vehicles that can operate on multiple autonomous mobility and ride-sharing platforms because these services will be major customers.

IoT-enabled products can also be bundled with services to capture an aftermarket opportunity in maintenance and spare parts. Companies experimenting with new pricing models can move away from one-time sales of equipment to “servitization” of the product and pricing models—in effect, charging per use. While these models are the most straightforward and often the easiest to execute, they also can be the toughest to sell. Paradoxically perhaps, the closer the IoT service is tied to the traditional product, and the more it is marketed to the same customer base, the harder it can be to convince customers to pay for a separate IoT data service—especially if

EXHIBIT 4 | Companies Can Monetize IoT Data in Three Main Ways



they have been receiving some nonautomated version of the service substantially for free. In addition, sales reps are tempted to bundle the IoT service with the equipment and give it away to help make the larger equipment sale. Strategies to avoid the bundling discount trap can include a separate sale force, embedding the charge in a higher equipment price, or considering a tiered model in which basic services are given away but customers are upsold later once they realize the value.

BCG has found that, with the proper business model in place, value-added services in the medtech industry can deliver both direct and indirect benefits in three ways: realizing higher product prices, pulling through product sales, and creating new service revenue streams. The combination of all three is estimated to result in revenue increases of at least 30% in the relevant areas of the product portfolio for medtech suppliers.

The direct monetization of data, software, and digital twins is potentially more lucrative than traditional equipment market opportunities.

Monetize data directly by building IoT solutions. The direct monetization of data, software, and digital twins is a newer and more elusive path, but it is also potentially more lucrative than the opportunities in a company's traditional equipment market. A number of different models are emerging. One is building and selling industry-specific IoT platforms. The marketplace is already crowded with both native technology companies—such as Microsoft, IBM, and Amazon—and IoT-specific platform providers, including PTC (ThingWorx) and Siemens (MindSphere). With more than 400 IoT platform providers already in operation, some form of shakeout is inevitable.

Another model is building a new service business to help customers implement and monitor IoT solutions. Siemens, for one, has recognized that implementing IoT solutions at scale is challenging for most companies. Siemens has established more than 50 application centers to help customers realize value from its MindSphere platform. Teams of developers help customers build IoT solutions, and a separate IoT services team helps customers redesign their operational processes. Similarly, GE Digital has launched a managed-services business for IoT solutions in which GE provides turnkey asset monitoring and predictive maintenance services.

Developing digital twins is receiving lots of attention. Manufacturers are building full-scale digital models of physical assets, equipment, and processes and are licensing them to customers for use in experimentation, simulation, and optimization. Newport News Shipbuilding is licensing a full digital twin of a ship to the US Navy for ongoing configuration management and service. Similarly, a design and engineering firm in the oil and gas industry is building and licensing digital twins of the oil and gas platforms it engineers and constructs for energy clients.

Companies can also collect and resell IoT data. IoT data marketplaces are emerging that gather, index, aggregate, and normalize device data. One example is Terbine, which indexes data feeds available from a variety of sources, such as public infrastructure sensors, and makes the refined data available on a subscription basis for analytics programs. The goal, according to Terbine's website, is to become the "world's index and curator for machine-generated data." The ability to share, or trade, data of clear provenance in a trusted exchange without the involvement of a data "bank" or "broker" is a natural application of blockchain technology. This is

the mission of IOTA Foundation, which has developed an open-source distributed ledger that uses a blockchain-based IoT data-sharing solution and has strong industry support from Bosch, Volkswagen, Fujitsu, and other companies.

Companies can also analyze data to provide new market insights. Such data services are not new: Thomson Reuters, Dun & Bradstreet, IHS Markit, and other companies make up a \$200 billion industry serving primarily the financial-services and insurance markets. There are plenty of ways for IoT companies to join in. For example, a truck OEM could monitor and anonymize data on shipping patterns from its installed base to create an economic indicator for financial-services companies. Automotive OEMs are partnering with data marketplace providers such as Otonomo to monetize data from connected cars to enable others to develop and market mobility services. Ultimately, the car or truck becomes another data platform, similar to the smartphone. Elevator companies are exploring providing retail foot traffic data to stores and building owners and showing personalized advertisements by integrating with the identity-management systems of buildings.

From an organizational perspective, selling data and analytical insights could require reaching new customer bases that are further from the core. For example, car companies monetizing data with insurance providers will need new business development and sales capabilities geared for commercial customers rather than consumers. Many find that incubating the IoT business into a new entity with a clear focus on commercializing new market opportunities is the best way to take advantage of the inevitable lessons learned from launching an IoT business. Strictly considering either the return on investment or the internal rate of return could preemptively starve the new IoT business.

Orchestrate and monetize an IoT ecosystem. The third, most advanced opportunity—and the one with the largest addressable market—is to monetize an IoT ecosystem from the orchestrator position. Companies will likely need an existing platform and a set of standards to facilitate the collaboration of ecosystem participants. The platform can be provided in partnership with others, such as a technology company, but the specific business rules and standards need to be established by the industry players and apply to all ecosystem participants.

As with direct monetization, we are already seeing multiple other monetization models take shape. One is to offer so-called freemium access to a platform and charge for premium first- and third-party solutions, as exemplified by Airbus's Skywise platform. Airlines pay for such services as the monitoring of a pilot's behavior during flight, predictive maintenance, spare-parts inventory optimization, and analytics that improve fuel efficiency—an especially compelling service given that fuel represents 60% of an airline's operating cost.

Revenue sharing is another model. Honeywell has entered into revenue-sharing agreements with third-party providers selling services through the Honeywell Connected Plant business's INspire program.

Schneider Electric charges access fees, after a free trial period, for application programming interfaces (APIs) on its Schneider Electric Exchange through micropay-

The opportunity with the largest addressable market is to monetize an IoT ecosystem from the orchestrator position.

ments tied to specific data feeds for connected equipment. Everybody benefits: Schneider Electric can offer a much broader set of services for customers than it would be able to do on its own, and software and service providers gain access to a global customer base. Third parties selling solutions on Schneider Electric Exchange charge user license fees or one-time fees, or apply other pricing models.

Orchestrators offering an IoT platform with analytic services can reap substantial revenue opportunities, provided that they can drive platform adoption and create a network effect.

How to Drive Adoption

Each monetization option requires a distinct strategy for driving adoption. If a company is building a point solution, then the strategy should be to operate and capture data across multiple platforms and ecosystems. Interoperability and market reach are paramount. If, on the other hand, the goal is to drive value through platform adoption and network effects (either directly or via ecosystem orchestration), then companies have three potential strategies.

Each monetization option requires a distinct strategy for driving adoption.

Launch a killer app to drive platform adoption. Sometimes, a killer app can have such a strong value proposition that it creates a customer base ready for platform adoption. In commercial trucking, for instance, KeepTruckin built an easy-to-adopt killer app in the form of an electronic logging software and hardware solution that tracks location and other data from trucks. By catering to the dynamics of the industry (lots of individually owned and small-fleet trucking companies, for example), the company gained broad adoption and expanded its offering to include intelligent cameras for driver safety, among other solutions. It has also created a set of open APIs to enable application development, which evolved into a third-party fleet management app marketplace that broadened the company's value proposition to trucker customers. Insurance companies, for example, can connect and offer insurance products that are based on driver behavior. Parking providers can create booking applications to allow drivers to reserve space for when they reach the limit of the number of consecutive hours they are permitted to drive.

More recently, the company announced an intent to launch its Smart Load Board, a freight marketplace that uses the truck data that it has collected to help shippers match loads with trucking fleets on the basis of drivers' route preferences, current location, hours of service, and other data. Trucking fleets can accept or bid on loads electronically. With its two marketplaces—one for fleet management apps, the other for freight supply—KeepTruckin can provide much greater value for fleet managers than it would have been able to do on its own. As of April 2019, the company had built a valuation of \$1.5 billion.

Companies considering this route must first assess whether they can create a killer app that is sufficiently differentiated to compel adoption. This may not always be possible in some industries.

Orchestrate an IoT ecosystem with a broad solution portfolio. Incumbents with a strong right to win can pursue a solution-first adoption strategy by offering a set of

their own and partner solutions on an industry-specific IoT platform (such as a white-label platform from a tech provider). Schneider Electric and Honeywell are both trying to drive adoption by aggregating their own and third-party solutions to increase value propositions for customers while opening up the data available through APIs for independent software vendors to deliver new solutions. In this approach, the company provides industry-vertical specific data and customer access to third-party solution providers via an app marketplace, thereby creating a network effect.

Lead with a freemium platform offer. Companies can also incentivize platform adoption by aggregating customer data and providing cross-industry benchmarking information for free. Airbus's Skywise offers airlines free access to the platform's collection of anonymized operational data in return for contributing their own data, thus enhancing Skywise's algorithms and the validity of its operational benchmarks. This adoption strategy works when aggregating customer data itself is a precondition for building IoT solutions.

Design the platform to accelerate time to value. Platform providers should design their platforms to help customers overcome potential deficits in digital skills, particularly data science and application development. One company, C3 IoT, which operates the C3.ai platform, offers a low-code or no-code application development environment to enable end users, such as plant process engineers, to employ machine-learning algorithms to build IoT applications. Siemens is targeting such customers with its Mendix acquisition for MindSphere. Given the general shortage of talent in data science, these platform providers seek to ensure that companies with varying digital-skill profiles can realize the benefits of IoT.

Consider the strategy for adoption. Any investment in building IoT businesses will require a clear adoption strategy to reap a return. Therefore, the critical question that management teams need to first ask themselves is, Do we have a killer app that will drive adoption? If the answer is no, then they must ask:

- Can we use our and partner's IoT solution(s) to build a marketplace of solutions that will collectively drive enough value for customers to adopt our platform? If so, what kind of partners do we need to recruit in order to form an ecosystem supporting our IoT strategy?
- Can we offer a compelling, cross-industry data aggregation offer for free that lowers adoption barriers and delivers industry insights? Do we have a roadmap to upsell customers to higher value solutions?
- If we offer a platform, can we ensure that customers will build their solutions on top of it?

THE INTERNET OF THINGS is still in its infancy, but the competitive dynamics for monetizing IoT data are taking shape. Within a given industry, companies with a strong right to win can potentially reap significant returns with a winning solution, platform, and ecosystem strategy. Network and data flywheel effects can take

Companies with a strong right to win can potentially reap significant returns.

hold if a given player can drive enough adoption of its platform and ecosystem. There are already plenty of players from both the industrial and tech sides of the fence. As individual IoT solutions garner industry followers and platforms, and as ecosystems build defensible positions, the options for those looking to establish a foothold will narrow. The right to win is not a guarantee.

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