HOW IoT DATA ECOSYSTEMS WILL TRANSFORM B2B COMPETITION

By Massimo Russo and Michael Albert

This is the first in a series of articles on how companies can capture the value of the data generated by the Internet of Things.

FORMER CISCO CEO JOHN Chambers got it mostly right when he said that every company today is a technology company. In fact, every company is becoming a technology *and data* company, and the consequences of this distinction are substantial.

The real value of the Internet of Things (IoT) lies in the data it serves up and the insights that result. Much has been written about how IoT is unlocking significant value for companies by enabling smart factories and connected supply chains as well as the ability to monitor products and deliver new services. But IoT isn't just changing how companies operate; it's changing the very nature of their businesses. In asset-heavy industries, the proliferation of IoT data is fundamentally shifting the customer value proposition from goods to services, and this shift is leading companies to adopt new business models that require new capabilities.

The majority of IoT solutions today are built around internal applications such as predictive maintenance, factory optimization, supply chain automation, and improved product design. But to fully capture the value of their IoT data, B2B companies need to think beyond their own walls. By collaborating with new business partners, including industry incumbents and players in other sectors, companies can form new data ecosystems. These ecosystems give their participants access to valuable collective data assets as well as the capabilities and domain expertise necessary to develop the assets into new data-driven products and services.

Data ecosystems will play a critical role in defining the future of competition in many B2B industries. They enable companies to build data businesses, which are valuable not only because they generate high-margin recurring revenue streams but also because they create competitive advantage. New data-driven products and services deliver unique value propositions that extend beyond a company's traditional hardware

products, deepening customer relationships and raising barriers to entry. They also build highly defensible positions, thanks to natural monopolies rooted in economies of scale and scope (similar to monopolies based on proprietary IP or trade secrets). Companies that secure advantaged positions in data ecosystems will generate significant value and competitive advantage across their entire business, including their traditional hardware offerings.

The Power of Ecosystems in a Digital World

Digital ecosystems—networks of companies, consumers, customers, and others that interact to create mutual value—have enabled some of the most profitable and valuable business models that exist today. (See "Getting Physical: The Rise of Hybrid Ecosystems," BCG article, September 2017, and "The Age of Digital Ecosystems: Thriving in a World of Big Data," BCG article, July 2013.) In fact, the five most valuable public companies in the US (at the time of publishing)—Apple, Google, Microsoft, Facebook, and Amazon—are all orchestrators of digital ecosystems. These digital leaders have built platform-based business models that capitalize on the winner-take-all dynamic of ecosystem competition to reach enormous scale and establish dominant positions.

These orchestrators exploit three factors:

- They scale up rapidly, capitalizing on virtually zero marginal production costs, network effects, and low barriers to geographical expansion (in the absence of protectionism).

- They take advantage of the "data flywheel effect"; digital ecosystems enable unprecedented data accumulation and analysis, fueling improvements to products and business processes and stimulating further growth and data access.

- And ecosystems are able to provide seamless and comprehensive digital experiences for customers by organizing

business partners on a single platform to satisfy multiple customer needs. They thereby lock in customers and capture a greater portion of their attention, time, and value.

The internet giants cited previously are all relatively young, primarily consumer-facing digital natives that have risen to prominence on the back of personal computing, the internet, e-commerce, and social media—each of which they helped create or make ubiquitous. Many large industrial companies, by contrast, trace their roots back a hundred years or more. They have comparatively low digital sophistication and deeply entrenched business models built around manufacturing, operating, and servicing heavy equipment. Industrial value chains are typically oligopolies characterized by deep relationships, strong brands, and large installed customer bases with big aftermarkets.

The landscape for digital ecosystem development is completely different in B2B industries, with vertical-specific solutions and hundreds of IoT platforms competing for dominance. The most common applications of digital technologies tend to focus on enhancing existing products and business processes. As a result, digital ecosystems typically grow within the boundaries of existing industry structures. One industry may in fact support multiple platforms and digital ecosystems; we do not expect to see the same degree of digital ecosystem consolidation in B2B that has occurred in B2C.

The value of data in B2B is also more difficult to extract; companies need domain expertise to develop new data-driven solutions as well as the customer relationships required to monetize them. This complexity means that digital ecosystems, such as those built around IoT platforms, are insufficient for capturing the value of data on their own. New, built-for-purpose data ecosystems are required to organize the collective data assets, capabilities, and customer connections of a group of business partners to deliver new products and services—both within and across traditional industry verticals. While digital ecosystems provide the

underlying platforms, data ecosystems enable B2B companies in asset-heavy industries to generate additional revenues and build enduring competitive advantage with their IoT data. (See Exhibit 1.)

The Four Stages of IoT Data Monetization

Many manufacturing and asset-heavy companies are still in the early stages of developing digital capabilities and exploring how to use data from connected machinery and products. Capitalizing on these opportunities will require them to make a transition similar to the one made by technology companies in the 2000s, shifting from business models based predominantly on hardware sales to ones built around software and services. While companies in some industries, such as aircraft engine manufacturing, have been using connected equipment to provide remote monitoring and service solutions, most efforts are still in the proof-of-concept stage, and few companies have developed business or operating models based on IoT data outside of enhancing their existing products and business processes.

To grasp the importance of data ecosystems, management teams at B2B companies first need to understand the four stages of the data monetization journey. (See Exhibit 2.)

While the early stages have been the subject of discussion elsewhere, they bear brief examination here in the context of the progression toward data ecosystem exploration.[1] Even companies at the beginning of this journey should define a longer-term strategy for how they will build proprietary data assets, develop new data-driven offerings, and participate in data ecosystems.

Foundational Digital Capabilities. Companies initiate their digital and analytics journeys by developing the foundational capabilities and digital platforms required to collect, integrate, manage, secure, and analyze data.

This is far from a simple undertaking. Companies need new digital units and governance processes to evaluate which potential use cases have a high return on investment. They must establish operating models to deliver digital solutions, most likely using agile ways of working and cross-functional teams involving IT, manufacturing, engineering, and product development. They will digitize "things"—such as products, manufacturing equipment, and logistics monitors—by embedding sensors, processors, and connectivity. They will collect and store IoT data that they can then integrate with other sources of enterprise data. As the volume and variety of data increase, companies will need processes to ensure good data quality and man-

EXHIBIT 1 | Digital and Data Ecosystems
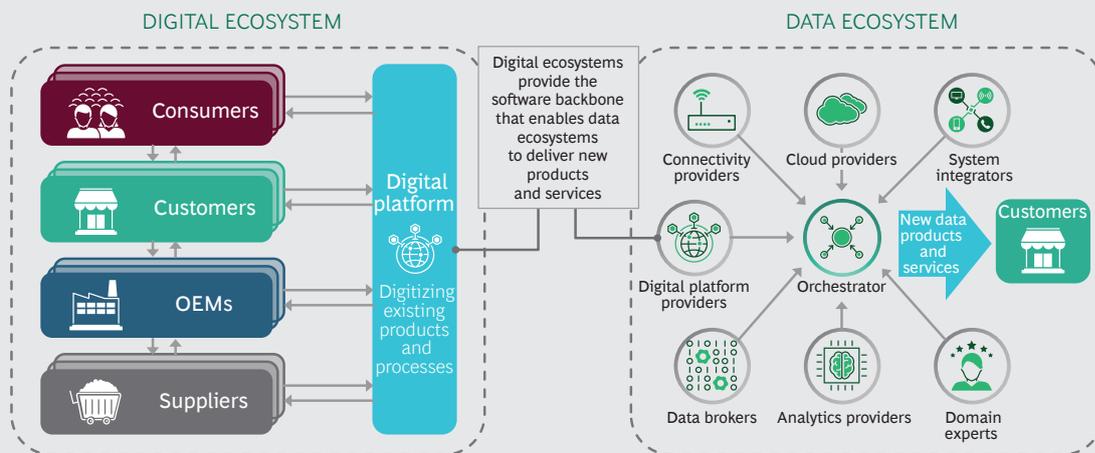
Source: BCG analysis.

EXHIBIT 2 | The Data Monetization Journey

Companies build competitive advantage by:
1. Improving data assets
2. Increasing customer switching costs
3. Raising barriers to entry
4. Heightening influence over partners

Data ecosystem orchestration

Internal data monetization

External data monetization

Foundational digital capabilities

Ongoing digital transformation

VALUE — High / Low

COMPLEXITY — Low / High
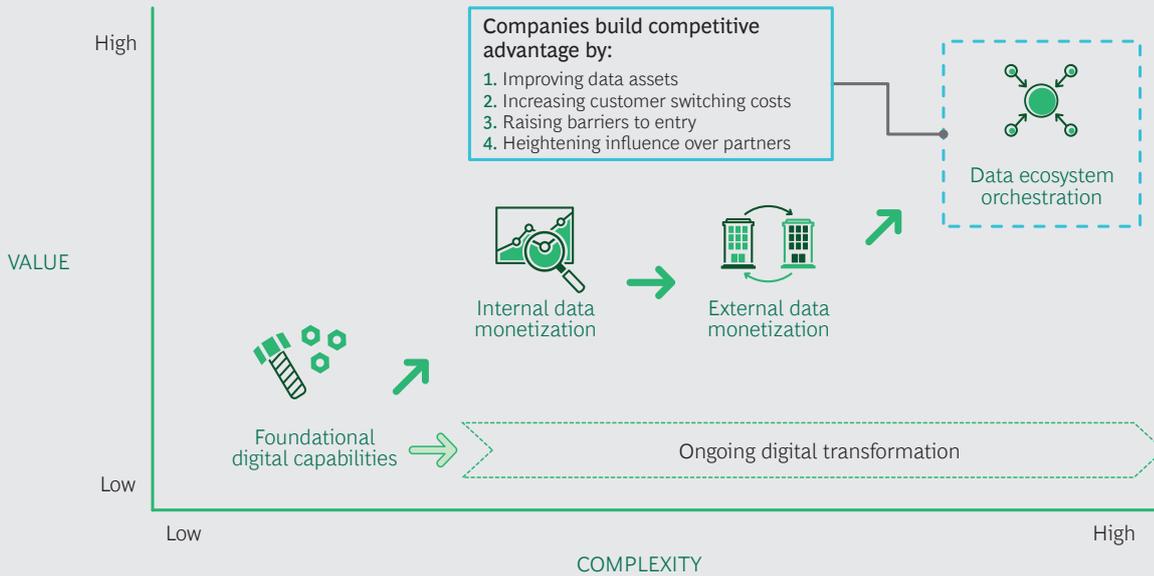
Source: BCG analysis.

agement; to be valuable, data must be accurate, consistent, and complete.

While not an end in themselves, these capabilities are a prerequisite to implementing IoT solutions and capturing value from IoT data—and to participating in data ecosystems. Developing these capabilities requires significant investments that companies can justify only by identifying opportunities to monetize their IoT data assets. This leads to the next two stages of data monetization: applying data-driven insights to internal processes and selling new data-driven products and services externally.

Internal Data Monetization. Internal data monetization is a natural starting point because it can lead to direct cost savings and because implementation is fully within the control of the company. A 2017 Cisco survey of IT and business decision makers in the US, UK, and India found that the most common IoT applications are focused on improving product quality or performance (47%), improving decision-making (46%), and lowering operational costs (45%).

For example, one steelmaker uses equipment sensors to feed a data-driven artificial intelligence algorithm to achieve a uniform thickness of corrosion-protecting zinc on high-grade automotive steel. The AI algorithm provides greater uniformity than is possible under manual control, which reduces the amount of wasted zinc while increasing quality, efficiency, and worker productivity.

Numerous other internal data monetization uses have become common, including improving product designs, setting up predictive maintenance systems, automating supply chains, and implementing other Industry 4.0 smart-factory solutions.

Although internal data monetization can generate significant value, its usefulness as a source of differentiation will diminish over time. Respondents to an MIT Sloan Management Review survey said that they expect the IoT solutions of three years from now to be more common and more easily imitated and to have more substitutes than they do today. To build long-term competitive advantage with IoT data, companies need to shift their focus outward.

External Data Monetization. Building new businesses around external data monetization enables companies to generate incremental recurring revenue streams—often with financials that are more attractive than those of their core businesses. For example,

net margins in data businesses are typically 15% to 25%, compared with the single-digit margins in many asset-heavy industries. Data businesses also command higher price-to-earnings ratios: the typical PE ratio for an information services firm is in the range of 30 to 50, compared with 10 to 20 in asset-heavy industries. New revenues from data can have a big impact on a B2B company's overall financial performance. Consider this: generating 1% of incremental revenue through data could result in an earnings increase of 10% and a valuation increase of more than 25%.

External data monetization extends beyond simply capturing and reselling raw data. In many industries, far greater value can be derived from aggregating and analyzing different forms of data to deliver useful insights—an important step on the road to data ecosystem orchestration. Doing this successfully requires companies to differentiate their offerings, which they can accomplish in a variety of ways:

- **Leveraging Unique Data Capabilities.** Airbus recently launched Skywise, a new aviation data platform that aims to become a platform of reference for all major aviation players looking to improve their operations. Airbus partnered with Palantir Technologies, which provides the platform technology as well as expertise in big data integration and advanced analytics. Skywise integrates multiple historically siloed types of data and data sources (such as work orders, spare parts consumption, component data, aircraft and fleet configuration, on-board sensor data, and flight schedules) into one secure, cloud-based access platform. This integrated data asset enables a variety of new analytics offerings, including services focused on reducing flight disruptions, decreasing maintenance costs, and optimizing flight operations.

- **Accessing Unique Data Assets.** Preferred Networks, a Japanese AI startup founded in 2014, has built a business valued at more than $2 billion by providing machine-learning (espe-

cially deep-learning) technologies to two of Japan's leading manufacturing companies, Toyota and industrial robot maker Fanuc. The startup's valuation is driven by more than just its analytics capabilities; its partnerships give it access to vast amounts of factory equipment data. Preferred Networks uses these unique AI software assets to train its deep-learning algorithms, enabling it to develop differentiated analytics offerings with applicability across a broad range of manufacturing environments. Because machine-learning and artificial intelligence algorithms need to be "trained" on task-specific data, Preferred Networks' data access gives it an advantage that others will have a hard time replicating.

- **Targeting New Markets.** Nokia, a telecommunications equipment company, is providing mobile network operators (MNOs) with a variety of new IoT data services, including sensor installation and management, data processing and storage, data analytics, and a secure blockchain-based payment platform. These services, in turn, enable MNOs to use their existing telecommunications equipment to gather data on air quality, noise, and light; the findings form the basis of data products that they can sell to smart-city authorities, health care providers, insurance companies, and others.

- **Integrating Related Services.** The Chamberlain Group integrates its MyQ technology into each of its LiftMaster connected garage door openers, enabling its customers to remotely operate their garage doors, receive status notifications, and set schedules. While these core services are provided for free, customers also have the option of integrating their garage door opener functionality with partner applications, such as Google Home and Tesla's EVE in-dash touch-screen, for a subscription fee. This integration enhances the customer value proposition, enabling The Chamberlain Group to generate additional revenues from its data-driven services.

Data Ecosystem Orchestration. Companies may be able to provide simple data products and services on their own, but more complex offerings require them to form partnerships to cover all the steps of the data value chain. (See Exhibit 3.) The resulting data ecosystems can include industry incumbents as well as new technology players, including analytics providers, digital platform providers, data brokers, connectivity providers, and system integrators. This type of collaboration is particularly necessary in asset-heavy B2B industries, where both domain expertise and customer connections are critical to monetize IoT data.

All participants in data ecosystems stand to benefit, but the largest share of the spoils accrues to the orchestrator—the player at the center that coordinates the activities of the other participants, aggregates their data and expertise, and delivers a consolidated data product or service to the end customer. Orchestrators control the total value of the ecosystem, steer margins, and determine value distribution among participants; they also benefit from the virtuous cycle in which ecosystem growth further solidifies their position. Data ecosystems enable highly defensible, platform-based businesses that can generate significant incremental value while reinforcing the orchestrator's core business.

In most B2B industries, IoT data ecosystems are nascent or have not yet begun to develop, but some notable examples have emerged. Take Caterpillar, which uses telematics data from its fleet of connected construction equipment, in combination with visual inspection and fluids sampling data, to help customers reduce costs, increase productivity, and improve safety. Caterpillar's suite of digital offerings, known as Cat Connect, includes services such as asset health monitoring and automated grade assist. These services not only add value for customers, they also increase switching costs, as other brands of equipment are not integrated into Caterpillar's product and service ecosystem. As a result, Caterpillar generates additional revenues not only from its data-driven offerings but also from its core business through increased equipment sales and aftermarket services. Caterpillar has orchestrated a broad data ecosystem to make these offerings possible, including partnerships with Uptake (data analytics), Microsoft Azure (cloud services), AT&T (connectivity), Zuora (subscription management), and Trimble (fleet monitoring and visibility). (Caterpillar recently ended its partnership with Uptake after developing data and analytics capabilities in-house.)

Caterpillar is seeking to extend its ecosystem further by making its data offerings

EXHIBIT 3 | The Data Value Chain

Value chain activities	ACQUIRE DATA	→	DEVELOP DATA PRODUCT / SERVICE	→	SELL AND SUPPORT DATA PRODUCT / SERVICE
Required capabilities	• Data access (IoT, enterprise, and external data) • Data management • Data integration		• Advanced analytics (e.g., AI, machine learning) • Industry and domain expertise • Product development		• Product management • Customer acquisition • Pricing and sales • Customer success management
Participants	Data ecosystem orchestrator Platform providers / Cloud providers / Connectivity providers / Domain experts / Data brokers / Analytics providers / System integrators				

Source: BCG analysis.

available on non-Caterpillar equipment. A partnership with Torc Robotics enables customers to retrofit mining trucks built by Komatsu, a leading competitor, with Caterpillar's suite of autonomous solutions. Caterpillar also actively invests in startups such as Airware (enterprise drone analytics) and PEPR (natural gas compressor optimization) to further differentiate its offerings.

Another example is Honeywell, a supplier of automation and control devices and software, which has deep customer relationships across multiple industries, including oil and gas, automotive, aerospace, and building and construction. Honeywell recognized the value of providing new services based on data and analytics to its customers but also realized that it lacked the capabilities required to develop a compelling offering. It created its INspire program to recruit companies with complementary areas of expertise, beginning in oil and gas with partnerships such as Dover (equipment condition monitoring and asset integrity), Flowserve (flow control solutions), and Aereon (air emissions solutions). These partnerships enable Honeywell to offer its customers a set of data and analytics services in such areas as equipment effectiveness, production optimization, and operational performance. Honeywell's position at the center of its ecosystem makes it the nexus for aggregating data, developing data services, and interacting with customers, all of which increase its influence with its partners and support a defensible competitive position.

Determining How to Participate

While IoT solutions can produce significant improvements in a company's processes and products, the value of IoT data is not limited to internal uses. In fact, external data monetization and the formation of data ecosystems will enable many B2B companies to generate incremental revenues and build competitive advantage across their entire business. Companies that have not yet developed strategies for how to participate in data ecosystems should not wait; the opportunities to form essential partnerships and develop differentiated data assets are greatest for first movers.

To determine how to generate value with IoT data and how to participate in data ecosystems, management teams must answer three strategic questions. Each of these questions will be the focus of a future article in our series.

1. **What is a company's current right to win in data ecosystems?** Companies must first assess their ability to secure an advantaged position as an orchestrator or contributor in a data ecosystem. A number of criteria shape the role a company can play, including the differentiation of their data assets, the sophistication of their data business capabilities, and the strength of their customer relationships. Companies need to ensure that they have the right ingredients for success in order to make smart investment decisions.

2. **How can companies drive data ecosystem formation and capture first mover advantage?** Data ecosystems may emerge as part of broader digital ecosystems or they may form independently. Industry structure may allow for the coexistence of multiple ecosystems (the equivalent of Apple and Android) or drive consolidation to a dominant ecosystem because of economies of scale, network effects, and the dynamics of data flywheels. Because the opportunities to secure advantaged positions in data ecosystems are greatest for first movers, management teams need to understand the conditions necessary for data ecosystems to form in their industries as well as the strategies they can employ to address gaps and accelerate ecosystem development.

3. **How can companies build attractive and defensible business models within a data ecosystem?** Management teams should focus on the capabilities and activities within potential data ecosystems that generate the most value and are best aligned with their core competencies. They must also make choices about ecosystem governance, such as whether to make platforms open or closed, and how to distribute value

among participants. To ensure that the selected business models can maintain advantaged positions over time, companies should stress-test their ability to defend against potential competitive and technological threats from traditional competitors as well as new entrants such as technology companies and startups.

NOTE
1. See, for example, "The Dangerous Duplicity of Data," BCG article, February 2018; *Five Lessons from the Frontlines of Industry 4.0,* BCG Focus, November 2017; *Are You Set Up to Achieve Your Big Data Vision?,* BCG Focus, June 2017; "Data-Driven Transformation: Accelerate at Scale Now," BCG article, May 2017; and "Winning in IoT: It's All About the Business Processes," BCG article, January 2017.

C ASH IS KING. So goes the long-standing adage. But a paradigm shift is underway. In the digital economy, data supplants cash in priority and importance. For companies leveraging IoT to establish advantaged positions in data ecosystems, the cash will certainly follow.

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