
# There Are New Markets for Industrial IoT Data

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The availability of industrial IoT (IIoT) data is creating new ways for industrial organizations to collaborate and to innovate. In effect, data functions as a new kind of lubricant for industrial processes. However, that is not its only use.

Everyday activities show that Internet data has a non-trivial economic value and has gained currency as a tradeable asset. Industrial organizations should anticipate that the same will be true of IIoT data.

To capitalize on IIoT data opportunities, industrials need to develop strategies for different market segments – by types of data and customer. Their chances of a successful implementation will depend on four internal capabilities:

1. managing data as an asset class,
2. identifying value-propositions with data-engineers and -scientists,
3. installing scalable, technology capabilities for data sourcing and supply,
4. and, innovating in business development, intellectual property and regulatory fields related to IIoT data.

## How the IIoT is Modernizing Industrial Practices

With a 200-year history dating back to the Industrial Revolution, industrial firms have evolved processes for making, selling and supporting industrial hardware at scale. They rely on tried and tested supply chain models, conformance standards and commercial frameworks for sales and warranty support activities.

However, the value of this experience base is about to experience a new revolution. Thanks to low-cost connectivity and data science technologies, the very nature of industrial hardware and operations is changing. It is now straightforward to monitor remote and nomadic assets. These may be fixed container tanks. They may also be self-propelled, construction machines, located remotely, outside the traditional boundaries of factories and industrial plants.

The ability to gather more and better quality industrial data is exposing new sources of value as organizations find ways to apply that data to make better decisions. For example, industrial firms can optimize asset usage intensity via more frequent observations. They can use software to geo-lock the operating envelope for expensive machinery to prevent misuse or theft, potentially lowering their insurance premiums. There are even ways to associate equipment data to with individual users thanks to the ready access of personally identifiable data.

These developments raise several important questions. Might it be possible for machine data to become as valuable, if not more, than the underlying hardware itself? What are the implications for industrial era, hardware-centric business practices? And, what kinds of new markets will emerge as industrial IoT data matures into a new class of tradeable assets?

## THE IMPACT OF GLOBAL INDUSTRIAL POLICIES AND ACCESSIBLE TECHNOLOGY

While they use different labels, industry policy in leading nations is fueling the demand side of the IIoT phenomenon. In 2013, a German government project [1] adopted the term "Industrie 4.0", in reference to the fourth industrial revolution, linking machines, data and services. China launched its "Made in China 2025" initiative[2] to upgrade Chinese industry comprehensively. And, South Korea launched its national IoT Master Plan [3] to foster global-scale IoT- business capabilities. The impact of these industrial powerhouses and export-led nations will raise product-management and innovation thresholds globally.

Two supply-side developments make this possible. One is the availability of data from connected devices. Affordable and ubiquitous connectivity makes it easy to record large quantities of data from remotely located industrial-plant and sensors on a regular basis. In the public sector, government agencies and large cities are embracing the Open Data[4] movement to report on their performance and to supply data that drives economic development, business innovation and better citizen services[5].

The second development is access to visualization and data analysis tools, such as artificial intelligence and machine learning. These enable a variety of applications. Examples include efficient asset management as well as condition monitoring and predictive analytics applications, all of which account for tangible operational and cost-saving benefits.

### Data-availability is Creating New Ways to Collaborate and Innovate

In addition to the impact on internal operations, IIoT data is changing the operating envelope for industrial firms. Consider the intersection of supply chain management, IIoT and the emerging field of distributed ledger technology (also known as Blockchain). The ability to register and track components in an engineering assembly lets an organization validate the quality of its products. Firms can also enhance their brand integrity by providing consumers with

[1] *Securing the future of German manufacturing industry: Industrie40 Implementation Recommendations http://www.acatech.de/fileadmin/user_upload/Baumstruktur_nach_Website/Acatech/root/de/Material_fuer_Sonderseiten/Industrie_4.0/Final_report__Industrie_4.0_accessible.pdf*

[2] 中国制造 2025 - *"Made in China 2025 https://www.csis.org/analysis/made-china-2025*

[3] *Master Plan for Building the Internet of Things, http://www.iotkorea.or.kr/2013_kor/uploadFiles/board/KOREA-%20IoT(Internet%20of%20Things)%20Master%20Plan%20-%202014.pdf*

[4] *The Open Data Institute https://theodi.org/*

[5] *London Data Store, https://data.london.gov.uk/*

visibility into the provenance of everything from agricultural foods to diamond necklaces. And, full visibility into supply-chain transactions will unleash new industry dynamics as competitors analyze ledger histories for market-intelligence insights[6].

There is considerable promise from exposing proprietary, operational data if organizations can find ways to control access and capitalize on potential opportunities. The business choice to share data is not straightforward and will pose significant dilemmas for many firms in the coming years.

Nevertheless, there are examples of its benefits. In 2000, Goldcorp, Inc., a Canadian gold producer, gave worldwide access to all geological data for its mining properties for a prize of $575,000. More than 1,000 prospectors studied that data to identify promising sites. Eighty percent of these sites yielded significant gold reserves, exceeding $6 billion in value[7].

If we fast-forward about 20 years, the current challenge is arguably about handling time-series data for the purposes of pattern recognition and predictive applications. Much of this expertise exists outside of large industrial firms so these organizations will need to find ways to collaborate via acquisitions, joint-ventures or data sharing initiatives.

**Data-sharing Business Dilemmas**

Jeff Travers is the Head of IoT for Ericsson, the global telecommunications equipment supplier. He describes the data dilemma for a mining company. It is frustrated because the company supplying its trucks, as connected vehicles, is failing to share a rich stream of data it is gleaning about their usage.

Should it be obliged to share that data?

"That's the question," Travers responds. He points out that "both sides need to understand the business has changed – if you don't go into this with open eyes, then you get this skewed situation where the truck maker has deep insight and the mining company doesn't."

*Enterprise IoT Insights interview, https://enterpriseiotinsights.com/20180413/channels/news/business-has-changed-for-both-sides-ericsson-tag40*

John Deere, the agricultural and construction equipment manufacturer, offers a slightly different example of innovation. Its application of IIoT technologies illustrates the opportunity for manufacturers to add services to their portfolio of offerings with IIoT data. One element of John Deere's precision agriculture strategy involves connectivity in

[6] Blockchain and the Mobile Industry – http://www.more-with-mobile.com/2018/03/blockchain-and-mobile-industry.html

[7] *Open Innovation: Goldcorp Challenge - https://www.ideaconnection.com/open-innovation-success/Open-Innovation-Goldcorp-Challenge-00031.html*

its farm equipment. The data from these machines helps to improve machine performance and farming outcomes[8]. To achieve this, John Deere formed a dedicated business unit - Intelligent Solutions Group.

The combination of remote connectivity, precision data and software allows John Deere dealers and farmers to coordinate machines and optimize sowing and harvesting jobs, for example. John Deere's multi-sided business model includes data collection and on-line access tools so that farmers can make better informed agronomic decisions.

Data ownership and exploitation rights are a consequence of this evolution in the agri-business model. In a sign of how the treatment of IIoT data is evolving, John Deere recently announced that it had achieved the Ag Data Transparent (ADT) Certification[9] which protects farmers from having their data being used against them or inappropriately shared.

### Economic Evidence for Data Becoming a Tradeable Asset

The consumer sector, which has a relatively long history for trading personal data, offers a few lessons for IIoT data opportunities. Some of this information exists in the public domain thanks to the Federal Trade Commission[10].

The motivation for trading consumer data in order to aggregate across multiple sources becomes apparent from a 2013 regulatory filing[11] by the data broker, Acxiom. In order to develop a single view of a customer, for targeted marketing purposes, there is a significant economic benefit to combining data from multiple sources. Acxiom claimed that multi-variate targeting performed 4-10 times better than traditional approaches.

One would expect Uber, a company whose business model relies on intensive use of

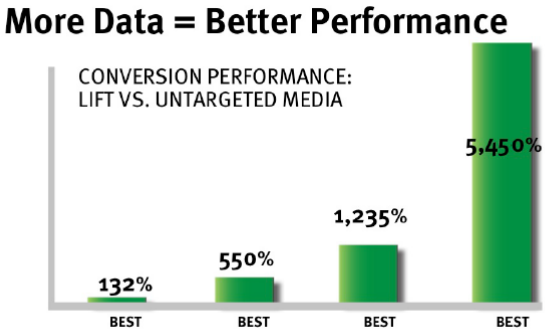



*Figure 1 Multi-variate Data Delivers Better Marketing Performance*

[8] *John Deere Committed to Those Linked to the Land, Investor Presentation, Deere & Company Aug/Sep 2016 (accessed via https://investor.deere.com/home/)*

[9] *John Deere achieves Ag Data Certification (2018) - https://agfundernews.com/john-deere-obtains-ag-data-transparent-certification.html*

[10] *Questionable practices under FTC scrutiny - https://www.ftc.gov/news-events/press-releases/2013/12/ftc-testifies-data-brokers-senate-committee-commerce-science*

[11] *Acxiom Investor Day Product Briefing, Scott Howe, CEO, 6 Mar 2013*

data, to be cautious in sharing any data about its business operations. Under pressure to reclaim its license to operate in London, the company made a concession to share [12] journey data aggregated from millions of journeys in London and help transportation planners in their work. This shows how Uber used its proprietary data as a tradeable asset for regulatory negotiation reasons.

Returning to the case of John Deere, its Open Data Platform allows farmers to share data with each other (or not) as well as with 3rd party app developers and data-analysis service providers. The platform sources data from John Deere and competitor machinery, external databases (e.g. finance, weather) and crowd-sourced data from farms around the world.

In the healthcare arena, the testing firm 23andMe has pioneered a simple and low-cost service for individuals to profile their ancestry and health based on a DNA sample. While the firm does not sell, lease or rent personal data, it does share aggregate information with third parties for business development, research, marketing emails and service-improvement purposes. The ability to study trends and patterns through different slices of the human population is equally applicable to the industrial world. Consider the value of studying hydraulic pump or HVAC compressor failures for similarly powered machines from different manufacturers.

## MARKET SEGMENTS FOR IIOT DATA

The market for IIoT data is nascent. Transactions are typically narrow in scope and based on one-off delivery approaches. These lack the flexibility to scale. The emergence of large and liquid markets for IIoT data will depend on different data types, new customer segments and the commercial strategies enacted by data-rich organizations.

### Data Types

Early experiments with open data and responses to Freedom-of-Information requests take the form of snapshots of historical information. In the IIoT arena, an analogy might be a catalogue of deployed assets such as machines and tools in a manufacturing plant. It could also include roadside equipment, geo-mapping data and car-parking meters in a smart city. These are static views for a particular moment in time.

A second category covers time-series data. An example might be a historical record of equipment maintenance interventions and break-downs. There is no periodicity to this kind of data, except in the case of routine maintenance.

Remote connectivity allows for data sampling at regular periodicity. This makes it possible to apply signal processing techniques to continuous-time data. An example might involve analyzing temperature gradient or vibration

[12] *Uber offers to share journey data with London city planners* https://www.theguardian.com/technology/2018/mar/15/uber-offers-to-share-journey-data-with-london-city-planners

measurements to gauge the health of a machine.

For data trading purposes, there are ways to package these different data types.

- Raw data – this may be encoded, implying some translation effort for a third-party user, or in an open-standard format.

- Value-added data – examples include clean data (removal of duplications, interpolation where there are data gaps, translation into an open-standard format), sub-sampling to reduce data volumes (a trade-off that reduces dynamic richness) and other approaches to aggregation (as applicable to Edge computing applications).

- Contextualized data – this involves packaging data with semantic descriptors for ease of interpretation by IIoT applications. For example, a temperature sensor might transmit a raw-data value of 37. By packaging this with semantic data to indicate the unit of measurement, precision and range it becomes more valuable to an IIoT application. That is because two separate and potentially unrelated entities, sensor and application, can recognize one another and exchange data with less customization effort. Semantic descriptors also facilitate interoperability and allow industrial firms to multi-source instrumentation components.

A necessary complement to these data packages is a certification framework. This sets standards for how data owners supply data. It also assures users about the quality, service support and availability of data streams. The Open Data Institute offers a pioneering example through its proposed scheme.

**ODI Data Certification Framework**

**BRONZE:** data is openly licensed, available with no restrictions, accessible and legally reusable.

**SILVER:** satisfies the Bronze requirements, the data is documented in a machine readable format, reliable and offers ongoing support from the publisher via a dedicated communication channel.

**GOLD:** satisfies the Silver requirements, is published in an open standard machine readable format, has guaranteed regular updates, offers greater support, documentation, and includes a machine readable rights statement.

**PLATINUM:** satisfies the Gold requirements, has machine readable provenance documentation, uses unique identifiers in the data, the publisher has a communications team offering support. This is an exceptional example of an information infrastructure

*Source: Open Data Institute, https://certificates.theodi.org/en/about/badgelevels*

**Customer Segments**

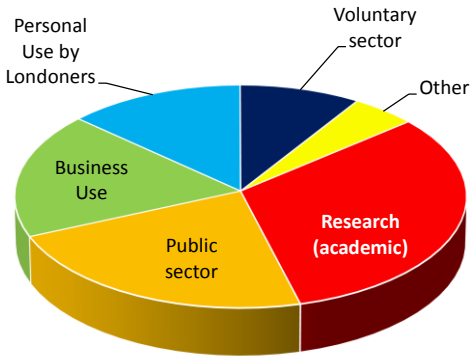
There are several customer segments for IIoT data just within an industrial organization. Operations departments use IIoT data to monitor and control production schedules. The Procurement department might use IIoT data for supply chain management. And, the finance department might use IIoT data for expenditure planning or insurance coverage.

In the future, data owners need to look outside their organizations to service new classes of user and capture additional sources of value from their data assets. The immediate candidates are supply chain partners. Upstream, supplier partners should value equipment data to gain insights into operating performance for new product development purposes. Downstream partners in distribution channels should value IIoT data to improve their operations.

There will also be new classes of data user, ranging from data management firms (e.g. to clean and to package data) to application developers and service providers (e.g. outsourced field support).

Statistics from the London Data Store, a Greater London Authority initiative to publish city data, identifies six categories of external-users. Their applications span in issues such as business and economy, demographics, environment, health, housing, planning and transportation.

Over time, devices will become more sophisticated. They will supply performance data on a continuous basis and become a part of everyday life. That is when manufacturers should prepare for data requests from regulatory bodies (e.g. for accident investigations) and public-scrutiny agencies (e.g. for consumer protection).




*Source: London Data Store, Greater London Authority*

*Figure 2 London Data Store Users*

Industrial firms also need to anticipate consumer privacy issues. This will arise when data from their devices and products is linked to their owners. Examples include connected cars, home appliances and consumer-healthcare devices.

**Commercial Strategies**

The third factor that will define the prospects for data trading is the commercial strategies of data owners. In the case of public-sector agencies (e.g. city administrators, public transport, health and welfare agencies) that are public-sector interests and economic benefits to publishing data. The commercial challenge in these cases is about how to provide data on sustainable terms i.e. there has to be a monetization path that lets cities at least recover their costs.

In the private sector, industrial organizations might pursue walled-garden approaches where they limit availability and access to

IIoT data amongst trusted, business partners. This concept underpins present-day interest in distributed ledger technologies.

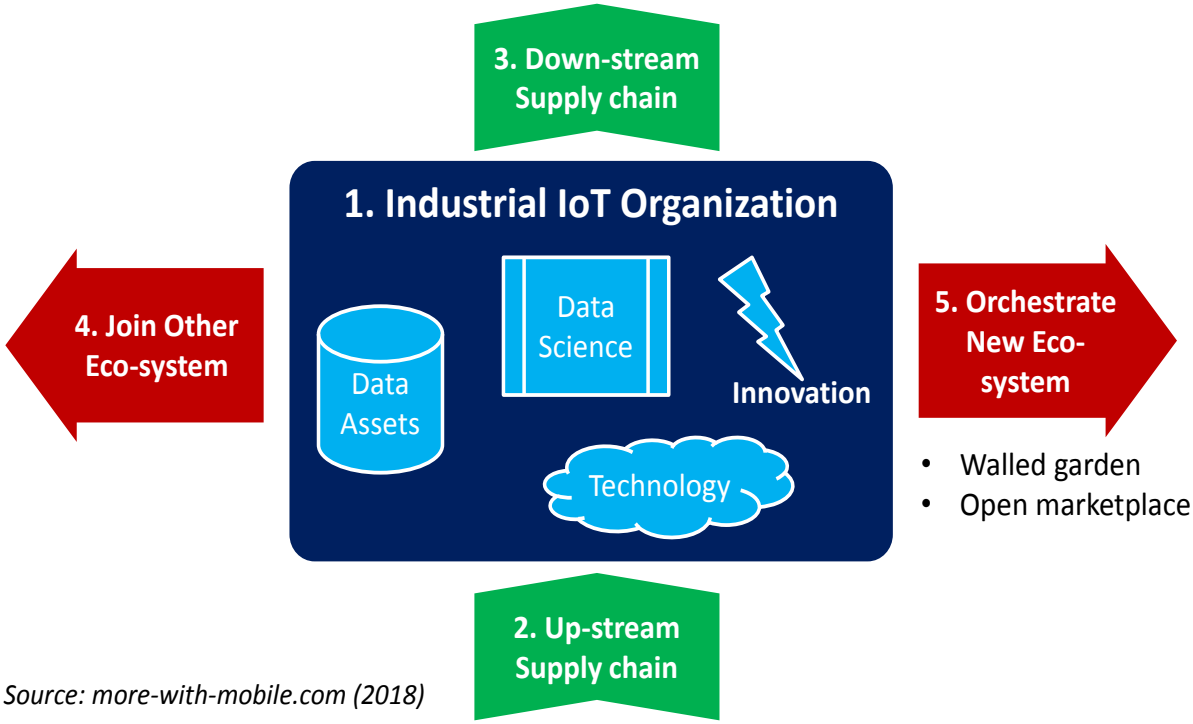
There will be greater scope for innovation and new opportunities from an open approach that encourages third-party specialists, along the lines that Gold Corporation experienced. A cautious first step might be for data owners to release data selectively and prove the viability of an ecosystem that brings together analytics, app-developer and service provider partners.

In fragmented markets, an industry alliance might be the right approach. It could act as a neutral body to aggregate data for non-operational issues. As an example, consider how manufacturers might develop a failure-mode database for high-availability machines (i.e. analysis of low incidence of failure events for the purposes of developing predictive algorithms). This could involve users of machines from different suppliers pooling time-history data for different events (e.g. overheating, bearing wear, shaft misalignment etc.) to create a learning base for machine learning and pattern recognition algorithms.

## How Can Industry Respond?

Industrial organizations are on the threshold of new, IIoT opportunities. This holds true as long as they initiate strategies around data to complement their more traditional product and service offerings.

Assuming that an organization's executive leadership accepts the need for an IIoT data strategy, there are five avenues they can pursue. We can map these in the context of an industrial organization and business-partner interfaces.




*Source: more-with-mobile.com (2018)*

*Figure 3 Framework to Prioritize and Target IIoT Data Opportunities*

**#1 Develop IIoT Data Capabilities within the Organization**

The first step for each organization is to set up and maintain a catalog of IIoT data assets. To this, the organization needs to add three capabilities. One is a data science team that has the expertise to analyze and use the data to make business and operational decisions. This is a cross-organizational competence and one that fits with the IIoT Competence Center recommendation in the IIC's Business Strategy & Innovation Framework[13].

A second capability relates to the technologies needed to acquire, store and distribute IIoT data in a secure and reliable manner. An innovation capability is the third item. It encompasses a functions relating to business development, intellectual property [14] and regulatory alignment approaches to commercializing IIoT data sustainably.

**#2 Formalize Up-stream Supply Chain Opportunities**

Industrial firms that procure components from suppliers may have few, if any, rights to production and supply-chain data beyond their specification and quality-control metrics.

In the case of industrial services, plant managers might outsource facilities management functions. They are likely to obtain periodic performance reports but probably not on an *ad hoc* basis. Any change in reporting functions (e.g. frequency, granularity etc.) might incur additional, change-of-scope costs from up-stream suppliers.

There is a need to formalize such arrangements as an organization shifts to a model where it requires more frequent and on-demand data gathering.

**#3 Explore Down-stream Supply Chain Opportunities**

There is a similar need to explore and formalize down-stream supply chain opportunities as to how their products are used. Depending on their size, organizations may find that they have less leverage with down-stream business partners and greater pressure to conform to down-stream data management practices and encoding standards.

**#4 Join Other IIoT Data Eco-system**

Some firms may find themselves operating in industries where there is value in joining an external, IIoT data eco-system. A good example of this is health applications, be they human or machine related. The value stems from aggregating particular classes of data to provide latitudinal population insights.

[13] *Industrial Internet Consortium: Business Strategy & Innovation Framework,* https://www.iiconsortium.org/BSIF.htm

[14] *Data as IP and Data License Agreements, Practical Law Practice Note 4-532-4243, Fried Frank LLP (2017)*

**#5 Orchestrate New IIoT Data Eco-system**

A more ambitious prospect is to create and orchestrate a new IIoT data eco-system. Open data portals, as in the case of London Datastore, and data exchanges [15] are examples of pioneering efforts to explore new market opportunities.

The challenge with open initiatives is one of scope. In addition to the issue of sourcing and sharing IIoT data, the eco-system orchestrator also has to address issues of data certification and licensing as well as policing the operations of participants to prevent rogue behavior.

An alternative approach is to pursue walled garden strategies. This allows a coordinator to manage data-exposure and proprietary algorithm risks by limiting access to a verified group of business partners.

## WHAT CONCLUSIONS CAN WE DRAW ABOUT IIOT DATA?

Data has value, perhaps much more than manufacturers and operators of industrial plants currently realize. Lessons from the consumer market show multiplier effect of using more data, especially when combining several different viewpoints.

The challenge for industrial organizations is to find ways of extracting and capitalizing on IIoT data. Internal teams of data scientists will unearth some of the opportunities. Many more might be possible through open, but controlled, data sharing strategies involving supply-chain partners and new, third-parties. This will depend on IIoT data owners taking bold steps to treat data as an industrial asset, similar to volume-produced machines and factory tools.

By adding the data-equivalent of hardware features to machines, industrial organizations will discover new business models to capture value from their data. Many of these features will be familiar from the hardware world – leasing and ownership rights, certification marques, service level agreements, and, warranties etc. – although their implementation will have to deal with assets that exist as software.

New business models will force industrial organizations into new directions, opening up the possibility of multi-sided business models and individual assets being of value to several customer segments. Industrial firms will have to develop packaging, distribution and trading relationships in peer-to-peer environments and horizontally integrated value-chains as distinct from today's vertically-aligned structures.

These developments will cause certain amount of industry disruption. Organizations that supply data-intensive, industrial products and services look well positioned to capitalize. Examples include sensor manufacturers, instrumentation and data-logging specialists, remote-connectivity providers and alliances that pool data for cross-population analyses. For others, the challenge is to avoid being left

[15] *ATIS: Data Sharing Framework for Smart Cities - http://www.atis.org/smart-cities-data-sharing/*

behind and becoming separate from IIoT-enabled value chains.

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