The State of Industrial Internet of Things 2019: Spotlight on Operational Effectiveness

Authors
Joe Biron, CTO, Internet of Things
Shawn Kelly, VP, Corporate Strategy
David Immerman, Business Analyst
Jon Lang, Lead Principal Business Analyst
The State of the Industrial Internet of Things is an ongoing series of market research and analysis conducted by PTC. These reports explore the robust and increasingly complex opportunities presented by the Industrial Internet of Things (IIoT) market. Tapping into PTC’s 30 years of technology expertise, 30,000 global customers, and 1,000 technology and service partners, the State of the Industrial Internet of Things series delivers actionable trends and insights across the entire IIoT ecosystem.

Executive Summary:

Based on findings from recent quarters, there are a noteworthy number of enterprises pursuing initiatives to build and enable IoT solutions to achieve operational effectiveness. This report will primarily focus on obtaining operational effectiveness through industrial IoT, supporting use cases and technologies apparent across different forms of manufacturing and operations environments.

This edition of our State of Industrial Internet of Things series explores the development and adoption trends for innovative companies implementing industrial IoT solutions across functions and operational settings. Our research shows primary drivers include streamlining operational efficiencies and increased productivity across environments and roles in their internal value chain. Our key findings include:

- Enterprises with people as a focal point of their digital transformation strategies are benefitting from implementing IIoT touchpoints across the organizational hierarchy. With value being received by multiple beneficiaries, projects quickly grow to large-scale, multi-site deployments.
- IoT is becoming commonplace in heavy-industrial environments with applications expanding in abundance across discrete manufacturing in industrial factories, automotive plants, electronics and high-tech facilities, and process manufacturing in oil refineries, food and beverage supply chains, and pharmaceuticals, among others.
- The solution environment, deployed use cases, and usage of different technologies throughout the IIoT stack continue to be varied. Therefore, seamless integrations, diverse technology portfolios, and domain expertise are increasingly required for adopters to achieve success.
- Industrial enterprises that are faced with global pressures are leveraging more holistic, pre-built IIoT solutions including greater technological breadth and partner ecosystems in order to move quickly; 89% of respondents expect to transition use cases to production within a year of purchase. This increasing adoption of pre-built IIoT solutions is in many cases expediting deployment timelines to a few months and even some enterprises are recognizing time-to-value in a matter of weeks.

Methodology

The insights contained in this iteration of the State of Industrial Internet of Things report series have been developed through primary and secondary market research conducted by PTC. The primary research includes exclusive data representative of one of the largest sets of IIoT users in the market: ThingWorx customers. PTC has been engaging with its customers since 2015 to reveal their current and planned use of IIoT to drive digital transformation across their operations and products. The sample for this data set includes enterprises across multiple verticals and geographies with a focus on industrial settings. PTC supplements this proprietary data with market projections and case studies from dozens of analyst firms, consultancies, and thought leaders. The State of the Industrial Internet of Things distills this body of knowledge and provides a comprehensive view of the current state of the market.

In this update, we offer a data-driven perspective informed by our recent research and a view into a subset of enterprises capitalizing on the opportunity presented by the IIoT—those deploying the technology within manufacturing and operations environments to drive operational effectiveness.
Demographics

The Industrial Internet of Things is undoubtedly playing a crucial role in organizations across different verticals undergoing significant digital transformation. Business value is being achieved by enterprise adopters seeking and obtaining outcomes including strategic differentiation in products or services, increasing operational effectiveness, and improving productivity. However, becoming increasingly pivotal for industrial companies facing global forces, is leveraging IIoT to become more efficient and productive within the manufacturing and operations functions. These challenges include the looming skills gap of ten million manufacturing jobs yet to be filled, increasing risks and cost pressures with attractiveness of manufacturers to investors at its lowest point since 2016, and the ensuing threat of digital disruption, which forecasts half of S&P 500 firms will be replaced over the next ten years. In the factory, the manufacturing function greatly benefits from IIoT. This applies not only to manufacturing personnel who are operating equipment and machinery in their own facilities, but to those who manufacture the equipment and machinery to be used in an end user’s factory. Roles in non-factory environments like warehouse supervisors or hospital managers are also leveraging the IIoT to further streamline operations functions. IIoT use cases driving transformational outcomes are becoming prevalent across industrial factories, automotive plants, oil refineries, utility grids, and others, dispersed across geographies including Americas (35% of respondents), EMEA (30%) and APAC (30%).

IIoT Solution Environments

Connecting IIoT solutions can occur in an array of different industrial settings. Included within each setting are various connected endpoints and sensors retrofitted to brownfield assets or pre-integrated with newer industrial equipment. Such assets include MRI machines, power transformers, transit systems, materials handling, and other systems. Organizations are leveraging IIoT to unlock pivotal insights into these traditionally black-boxed environments across increasingly connected factories and non-factory industrial settings.

The factory continues to become a frequent IIoT solution setting where the primary use of an IIoT platform is predominately in manufacturing settings, although IoT-enabled products living in end user’s factories is a growing use case supporting emerging initiatives such as digital twins. IIoT is driving operational effectiveness through these native factory implementations as well as customer’s end factories.

Aside from macroeconomic and global forces facing manufacturers, this traction in factories starts with seamless connectivity into legacy equipment, machinery, PLCs, sensors, and other on-the-floor systems via tapping into industrial protocols and device drivers. Once this secure connectivity is made, an IIoT platform is required to manage, contextualize, and analyze the now internet-connected device(s) to unveil crucial insights and drive use cases, which we'll map out further in the report.

Value continues to be driven into other increasingly connected environments outside of the factory, where there are massive opportunities for improving operational effectiveness and productivity. Hospitals are mending together siloed systems including devices, machines, staff, and even patients to streamline operations through IIoT connectivity, platforms, and analytics solutions.

Oil & gas and utilities respondents are monitoring and predicting their high-value remote asset health data to maintain uptime and drive prudent service KPIs such as reducing unnecessary inspection visits or improving first-time-fix-rates; 38% of PTC customers’ connected things are remote. Connected environments will continue to grow in intelligence and include other high-value settings such as airports, cities, buildings, mines, or shipyards.

Key Industrial IoT Use Cases

Given the increasing adoption of IIoT by manufacturers it is not surprising that the leading use case is operational intelligence for manufacturing. With successful implementation of this use case in-tune with trusted IIoT partners, manufacturers are gaining end-to-end visibility of their industrial operations and monitoring key efficiency metrics. These include monitoring of machines (asset downtime, changeover times), the factory (overall equipment effectiveness, product
IIoT touchpoints are increasingly available internally with role-based solutions on shop floor HMIs and upwards through multiple worksite views of several plants across a supply chain.

A major beneficiary continues to be at this higher-level operational view for manufacturing executives monitoring and analyzing metrics, such as production planning across multiple facilities, as well as plant managers responsible for KPIs within a specific factory's walls. The theme of this broader contextual view is mirrored in operations (outside of factories) use cases with supervisors.

Throughput), and enabling other valuable business insights such as quality monitoring for compliance or improving these outcomes for customers by providing IoT-enabled products.

Much of the value is coming through IIoT analytics measuring the interaction between multiple assets, as well as tying them to other business systems. The increase of predictive maintenance use cases for manufacturing, operations, and services illustrates the on-going shift of these systems from being reactive toward increasingly preventative. Analyzing a machine’s baseline health then applying machine learning algorithms tuned with set operational thresholds can alert the proper personnel of an abnormality before the asset breaks down and causes ripples throughout the value chain. Unplanned downtime has plagued manufacturers for generations; Aberdeen Research estimates the average cost per hour of downtime is upwards of $260,000. The analytics-driven predictive insight of a factory’s operational status could also reach further downstream through updating delivery status to a logistics provider.

**Industrial IoT Use Case Beneficiaries**

IIoT adoption has been noticeable across markets with IDC estimating **worldwide IoT spending was $645.9 billion in 2018** and forecasted to reach $1.05 trillion in 2022. Equally important is IIoT’s impact as it benefits different functions in organizations;

**Figure 1: Top Industrial IoT Use Cases driving Operational Effectiveness**

- **Operational Intelligence**: 28% (Manufacturing), 3% (Operations), 31% (Service)
- **Asset Monitoring & Maintenance**: 19% (Manufacturing), 4% (Operations), 3% (Service)
- **Predictive Maintenance**: 12% (Manufacturing), 3% (Operations), 3% (Service)
- **Remote Monitoring**: 8% (Manufacturing), 8% (Operations), 4% (Service)
- **Remote Service**: 4% (Manufacturing), 4% (Operations), 3% (Service)

**Lavifood**: is a global provider of produce and agricultural products further streamlining its operations via IIoT. The Vietnamese company is gaining a fresh look of its (factory) plants through connectivity down to machines on the floor and real-time analytics enabling operational intelligence of the environment. Leveraging an IIoT platform increases Lavifood’s product yield and improves quality, pivotal for the company in the increasingly competitive food and beverage industry.
processed, sourced, analyzed, and stored. When organizations are looking to adopt IIoT, they must assess the entire technological stack a provider is offering (including its supporting partnership ecosystem) and how it aligns to their business needs and current technology. Data sourcing at the device or ‘edge-layer’ is a crucial component of IIoT, especially in high-value factory environments such as discrete manufacturing.

For example, in an automotive manufacturing plant there are thousands of machines performing mission-critical tasks or processes that require minimal latency to maximize uptime and operational efficiencies. In this instance, keeping the data sourcing close to the point of origin, whether on the device, gateway, or nearby server is vital. Also increasingly important are edge analytics, where through machine learning algorithms and other software applications, only pivotal data is transmitted off the edge, device, or gateway, which can optimize bandwidth and energy usage, imperative in power-constrained remote assets.

Integrations into organization’s existing systems such as on-site data management applications is interlinking its technologies and workers through IIoT. The fixed wing and rotorcraft systems provider is gaining operational efficiencies through integrating its currently deployed product-centric software (CAD, PLM) and manufacturing systems (MES, MOM, FMS) with its floor systems and devices (torque wrenches, pressers, etc.) to create a more encompassing manufacturing information system (MIS). This deployment is made possible through industrial connectivity to these devices and an IIoT platform contextualizing these system and software applications through a robust and interactable view. Merging these data feeds also increased IIoT touchpoints as workers could easily access work instructions and operational data as well as streamline employee training and certification tracking use cases where Woodward is also evaluating augmented reality’s role.
and back-end ERP and CRM systems, can further contextualize these data feeds.

However, as is the case in most IIoT deployments, leveraging certain technologies for data sourcing is situational. As IIoT deployments branch out of a single facility and IIoT is embedded into multiple dispersed facilities, the cloud’s scalable infrastructure will become pivotal.

The cloud can further optimize compute resources and drive powerful future use cases. A manufacturer storing terabytes of historic operational trend data in the cloud and running machine learning algorithms to detect patterns can provide fundamental insights into supply and demand forecasting or assembly line optimization. Massive amounts of data trained with deep learning algorithms in the cloud can generate a trained and inferenced deep learning model. This model can then be applied through an edge instance on the factory floor to recognize patterns and potentially reduce an on-site system’s false negatives and positives.

There are countless opportunities to optimize the IIoT stack across manufacturing deployments, but the common thread is that solutions that have the ability to integrate with the entire purview of operations technology as they become self-reliant on one another, will ultimately thrive in this market.

The pharmaceutical automation company Parata Systems leverages a variety of IIoT-enabling technologies to improve operational effectiveness for its customers. With machine-learning and IIoT analytics, Parata identifies potential issues of its products out-in-the-field in context to end users’ live operations and even predicts their performance. The company ties-in pivotal enterprise system data via an API into Salesforce, which further predicts the need for on-site servicing (90% reduction in on-site software updating) and quickly pinpoints errors (average service calls reduced from 28 minutes to seven).

Transition to Production

We continue to observe the trend of IIoT adopters quickly moving from ad-hoc trial test cases to full-scale production, with proof-of-value being realized more rapidly. Our latest data illustrates this accelerated pace with 89% of respondents in 2018 planning to move to production in the next year, up from 83% in 2017.

This rapid pace of transition can be attributed to more encompassing IIoT solutions with a breadth of enabling technologies already pre-integrated.
Trusted partners and systems integrators are undoubtedly still crucial to this pace but IIoT solutions that already include the necessary components can quickly be deployed, drive use cases, and accelerate time-to-value with correlating ROI, which is typically the ultimate goal of IIoT. In context to IIoT platforms, 451 Research cites this trend as providers striving toward the ‘80/20 rule’, where adopters receive 80% of the platform as pre-packaged and coded and only 20% requires custom integration to get up-and-running. In the fast-paced world of manufacturing where global pressures continue to mount, we see adopters of IIoT platforms with pre-integrated solutions that can be quickly scaled rather than disparate pieces of technologies that are burdensome to build with and costly to merge into existing processes, will negate potential adoption concerns on time-to-value.

**Bigger Picture**

Myriad global forces are causing organizations to become more ‘digital’ at a rapid pace to avoid disruption, become more efficient, and capitalize on new opportunities. This digital transformation means different things to different industries. In manufacturing it comes back to operational efficiencies and becoming more flexible and agile; a KPMG study cites two-thirds of CEOs claim ‘agility is the new currency of business, if we’re too slow, we will be bankrupt.’ To gain the upper-edge on these looming forces, executing on an IIoT strategy is becoming invaluable in industrial enterprises. These adopters will benefit from extensive IIoT solutions quickly solving their business needs of today and capable of scaling to meet future requirements of tomorrow. The competencies of IIoT providers will become more apparent as these projects grow and these shifting requirements need solutions from providers with the right mix of technology, domain knowledge, and a partnership ecosystem to fill the gaps. Successful IIoT deployments in manufacturing and operations functions will continue to span across organizational hierarchies enabling synchronized operations with IIoT touchpoints ranging from the CXO to front-line worker.

For more information, contact an expert to learn about the ThingWorx Industrial Internet of Things Platform.