ABERDEEN GROUP

IOT AND ANALYTICS: BETTER MANUFACTURING DECISIONS IN THE ERA OF INDUSTRY 4.0

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Increasingly, Best-in-Class firms are combining IoT and advanced prescriptive analytics to make better decisions regarding assets, products, processes, and operations. The resulting insights and recommendations reduce asset downtime, increase product quality, and represent the foundational beginnings of the virtual factory.

A massive amount of data is generated from manufacturing assets and equipment. And while data is plentiful, operational, predictive and prescriptive recommendations are in short supply. To increase efficiency, Best-in-Class manufacturers are combining IoT and advanced analytics to improve their overall manufacturing decisions in asset maintenance and quality of products, processes, and operations. These technologies are providing manufacturers with the predictive and prescriptive insights to optimize their production and maximize resources.

Operational Efficiency Pressures in the Era of Industry 4.0

We live in a new manufacturing era that has been called the fourth Industrial Revolution. This period is characterized by the digitalization of manufacturing (a.k.a., Industry 4.0, smart manufacturing, industrial IoT) to include **cyber-physical systems**: IoT sensors, big data, predictive analytics, cognitive computing, robotics, and 3D printing. Manufacturer commitment to this digital transformation is strong. In fact, Aberdeen data shows that 27% of manufacturers plan to achieve a digital transformation.

Against the backdrop of Industry 4.0, top-performing firms are driven by their need for operational efficiency. This phenomenon is perfectly illustrated by the simultaneous need for cost reduction

in production and the need to drive revenue growth. To top it off, mass-produced, individually-configured products must be delivered in an environment rife with last minute order changes where time-to-market is at a premium.

Definition: Best-in-Class

The Aberdeen maturity class framework places companies in one of three categories based on their self-reported performance across key metrics:

· Best-in-Class: Top 20% of respondents based on performance

· Industry Average: Middle 50% of respondents

· Laggard: Bottom 30% of respondents

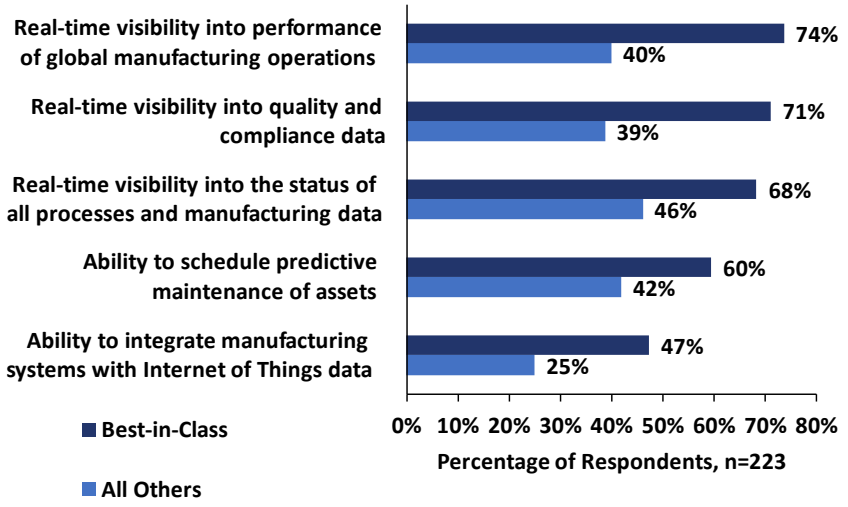
Sometimes we refer to a fourth category, All Others, which combines Industry Average and Laggard organizations.

Based on their performance, service leaders might fall into any of the above groups. The Best-in-Class findings represent the performance results all service leaders should strive to achieve.

IoT in Manufacturing: A Foundation for Visibility & Virtual Factory

To increase efficiency in the era of Industry 4.0, Best-in-Class firms are rapidly implementing IoT capabilities twice as fast as All Others (Figure 1).

Figure 1: Best-in-Class Capabilities for IoT-Connected Operations



Source: Aberdeen Group, July 2017

These IoT systems collect manufacturing data in a transparent, comprehensive, and interactive way to provide real-time visibility into assets / equipment, process quality, and plant resources. IoT also fosters visualization. Best-in-Class firms are 74% more likely to view asset status via real-time / event-driven operational dashboards with role-based data accessibility, navigation, aggregation, or drill down, to identify problems.

On the Virtual Factory

Manufacturing execution systems (MES) on the factory floor have resulted in a wealth of data collected on the production and form of physical products. Data collection is now digital, and gathered from a variety of physical, non-destruction sensing technologies. In light of these advances, the digital twin is now moving from merely aiding in understanding the physical product, to being a critical component of an enterprise-wide closed-loop product lifecycle—that is, the "virtual factory."

These events portend the rise of the virtual factory (see sidebar). The virtual factory concept changes digital factory simulation from predicting how the product *is to be* manufactured, to a real-time simulation that shows how the product is *actually* being manufactured. Possible use cases abound; you could:

- ➔ Manage machines, processes, and people with speed and agility (like a SimCity video game!)
- ➔ Monitor factory assets in real time by analyzing historical operational data to predict failure and fix it before it occurs
- ➔ Use video to monitor quality in real time
- ➔ Quickly simulate and compare the results of retooling an entire product line "on the fly"

In short, the virtual factory will provide a real-time, role-appropriate, operational view of the entire factory floor (plant, processes, equipment, etc.) for anyone, at any time, from anywhere. The virtual factory becomes the new cockpit for piloting, controlling, and improving the factory.

IoT and Analytics: Foundation for Better Decisions

IoT allows equipment to "talk," providing a real-time status update for critical assets. But as more factories and equipment are embedding IoT technology, the volume of streaming data will grow beyond the limits of traditional asset analytics. To process, analyze, and optimize this data, manufacturers are increasingly employing advanced prescriptive analytics. This combination of IoT with advanced analytics results in better manufacturing decisions in two areas: asset maintenance, and quality of products, processes, and operations.

In addition to advanced analytics, manufacturers are also beginning to employ cognitive computing technology with the goal of solving problems by enhancing human expertise. Cognitive

Definition: Cognitive Computing

Cognitive computing, broadly speaking, describes technology platforms that are based on the scientific disciplines of artificial intelligence and signal processing. These platforms encompass machine learning, reasoning, natural language processing, speech and vision, human–computer interaction, as well as dialog and narrative generation, among other technologies.

computing systems are well-suited to provide higher-level advice because they are probabilistic. Cognitive systems are also inferential, testing hypotheses and moving from premises to conclusions. Finally, cognitive technology can also make sense of large amounts of IoT information, make suggestions on how an asset or process may fail, and even make decisions on the most effective means to remedy the problem.

Intelligent Assets Through Prescriptive Analytics

The new frontier in asset maintenance is prescriptive. Prescriptive analytics and prescriptive maintenance have a solutions focus, integrating data and knowledge from multiple sources, including IoT, to identify the best course of action. While prescriptive analytics can be used to drive broader business objectives, prescriptive maintenance uses targeted analytics to produce actionable asset management recommendations.

Targeted analytics are integral to the concept of prescriptive maintenance. These solutions are "fit-for-purpose" in the specific industry or environment in which they are deployed. For instance, a discrete manufacturing processing analytics solution would understand the nuances, roles, data aggregation conventions, and key operations of that industry.

Users should look for asset management solutions that contain pre-built predictive and prescriptive industry models. Rather than reinventing the wheel, a better bet is to seek out industry-ready prescriptive solutions that only need minor tweaks for your existing firm's business model, not a costly "start-from-scratch," or "one-size-fits-all" solution.

Applying prescriptive analytics increases equipment reliability and decreases unplanned downtime. It offers recommendations to improve maintenance strategies and optimize maintenance schedules. By understanding operational data, predictive maintenance can classify assets as over-, under-, or well-maintained, and provide insights into factors that contribute to, or

detract from, asset reliability. This enables reliability engineers to continuously improve their maintenance practices and resources. Aberdeen research shows that Best-in-Class manufacturers experienced a 15% drop in unplanned downtime after they implemented smart manufacturing. This result is three times better than what All Others experienced.

Better Decisions Equal Better Quality

Analytics and IoT allows manufacturers to use real-time data to assess their product quality efforts, targeting problem areas and identifying systemic issues too broad for manual efforts to identify. Also, automated visual inspection techniques employing cognitive computing techniques (image comparison algorithms, classification, machine learning) allows product quality assessment directly on the high-speed production line, earlier and more definitively than manual inspection. Best-in-Class organizations experienced a 7% increase in quality after they implemented smart manufacturing (2.3 times better than All Others).

Better processes and more efficient operations also mean more agility and responsiveness. Aberdeen research reveals that Best-in-Class firms:

- ➔ Are almost twice as likely as All Others to have real-time visibility into quality and compliance data
- ➔ Are 75% more likely than All Others to dynamically update their business practices as new best practices emerge

Takeaways

Top-performing firms, driven by their need for operational efficiency, are utilizing their manufacturing asset data better by combining IoT data collection and advanced analytics. This combination results in better manufacturing decisions in asset maintenance and quality of products, processes, and operations.

Manufacturers are employing IoT to get the real-time data they need from equipment, processes, and operations. IoT systems collect manufacturing data in a transparent, comprehensive, and interactive way, forming a body of information suitable for data- and insight-mining. IoT-collected data forms basis for both manufacturing visibility and the virtual factory.

To increase asset reliability and decrease unplanned downtime, the new frontier in is prescriptive. Prescriptive analytics and maintenance have a solutions focus, integrating data and knowledge from multiple sources. They make visible new patterns in IoT data, driving insights to optimize assets, products, processes, and operations. Manufacturers are also using cognitive technology to solve problems by enhancing human expertise.

Advanced analytics based on IoT increase quality by ensuring certainty. Decisions once made on conjecture and theories melt away and are replaced by sound decisions based on advanced analytics. The result is higher quality (product, process, and operations) based on yield and productivity.

In the face of Industry 4.0, the industry is now undergoing tremendous change and renewal. Best-in-Class manufacturers have made the leap to smart manufacturing, deploying IoT, advanced analytics, and cognitive computing to make better decisions by improving asset maintenance and operational quality, agility, and responsiveness. All Others will benefit from doing the same.

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About Aberdeen Group

Since 1988, Aberdeen Group has published research that helps businesses worldwide improve their performance. Our analysts derive fact-based, vendor-agnostic insights from a proprietary analytical framework, which identifies Best-in-Class organizations from primary research conducted with industry practitioners. The resulting research content is used by hundreds of thousands of business professionals to drive smarter decision-making and improve business strategy. Aberdeen Group is headquartered in Waltham, MA.