Condition-based monitoring (CBM) using sensors, video cameras and other real-time data tracking tools represents one of the greatest leaps forward for industrial production facilities in the quest for smarter, more cost-efficient asset management. The manufacturing sector has a long way to go before it meets prognosticators’ vision of a plant where every piece of equipment has a smart sensor on it, but the growing adoption of CBM tools means that plants are able to make more-informed, more timely decisions than ever before about maintenance tasks and allocation of resources.

Plant managers increasingly are recognizing and seizing on CBM’s potential to play an integral role in their strategy for equipment management. But condition monitoring can be invaluable, too, in helping optimize use of arguably a plant’s most important (and probably most expensive) asset: its workforce.

How so? The real-time data generated by condition monitoring systems can help asset owners and service providers 1) enable faster and more accurate responses from customer support teams, leading to improved customer satisfaction, 2) maximize the efficiency of on-the-floor or in-the-field workers, and 3) promote cross-functional collaboration and knowledge transfer.

Let’s consider each of these three workforce applications of CBM data in more detail.

3 ways to use data to drive productivity
Customer support
One highly valuable application for condition monitoring data is in the area of aftermarket customer-support services. By deploying an information architecture as part of a purchase/licensing agreement with customers, equipment manufacturers and other industrial service providers can help track and deliver promised ROI to customers.

Is Product X delivering promised results? An automated data-gathering platform tracking Product X can deliver clear answers. This integrated information architecture can offer a real-time view into how products are performing in a given customer’s facility, enabling the manufacturer’s customer support team to quickly pinpoint and discern how to resolve any performance issues and optimize use of the product. Improved productivity for not only the client but also the manufacturer’s customer support team is the result.

Speedier resolution of issues = more-satisfied customers, and a more-satisfied customer base is likely to make for more-satisfied customer support team, offering the chance for cost savings via reduced employee turnover.

Condition monitoring may represent the future of asset performance management, but contextualizing the data gathered—whether it’s adding the critical lens of operating environmental conditions to asset performance information or plotting real-time data against historical trending data and performance objectives—is essential to realizing CBM’s full benefits. Furthermore, understanding how condition monitoring can help optimize productivity not just of physical assets but also of the workforce can help manufacturers unlock CBM’s true potential: as an unparalleled competitiveness-boosting tool.

Efficiency in the field
One of the top challenges for plants when it comes to data management is that maintenance information from the floor still often is logged by hand. In fact, a recent Plant Services/ARC Advisory Group survey of plant maintenance, engineering and management professionals found that paper remains the most widely used tool for data collection.

Manual data entry holds huge potential for error and misinterpretation, both in recording and reading asset data. Manual data entry is even more complicated in challenging physical environments—low-light areas, for example. A software system integrated with equipment sensors allows for automatic, accurate data capture and dissemination of this data to all relevant parties—technicians, facility managers, procurement directors and more.

Why is this so important? Understanding how a particular piece of equipment is performing both right now (thanks to real-time data capture) and over time (thanks to data aggregation and easily generated trending-performance reports) helps plant managers and reliability pros make better decisions about when to deploy technicians for maintenance tasks. And when all relevant parties are able to have the same view of the same data sets at the same time, there’s less room for miscommunication or misinterpretation. Decision-making can be faster as well as more collaborative.

Field technicians can focus on performing assigned maintenance without having to also devote significant time to entering data readings and documenting their work. Time saved on data entry means greater time available for other predictive or precision maintenance tasks. A well-built information infrastructure that enables automatic data capture frees technicians to do what they do best and get more done in less time.
This kind of productivity possibility isn’t just theoretical, either. For example, BP Alternative Energy, which focuses on the wind, solar, and biofuels markets, found that handing over the tasks of data gathering/analysis and report generation on its wind farms to a computerized performance management system saved the cost of one full-time employee. The finding was reported in a 2011 presentation in which BP participated along with Inexcon Technologies, developer of the Ekho Performance Management System (built using San Leandro, CA-based OSIsoft’s proprietary PI System). BP reported also that the software system produced such significant time savings that the company saw a 90% reduction in manual labor in several areas.

Shon Isenhour, a partner at educational training provider Eruditio, discussed with Plant Services how he sees data analysis technologies helping plants fill a skills gap and more efficiently make use of data that they gather. “By using wireless and route-based collection of the data with general maintenance technicians and remote analysis,” he says, “we can reduce the need for high-skill PdM technicians at each site and pull together multiple sites’ data remotely for analysis by a single well-qualified individual.”

Beyond equipment sensors, wearable devices also can be part of the workforce efficiency (and safety) puzzle. Sensors that track where workers are on-site can help those in the control room identify who’s best able to respond when a critical issue arises, for example, possibly preventing costly unplanned downtime. And if equipment sensors detect an emerging environmental hazard and relay that data, supervisors can act quickly to notify workers in the area and move them out of harm’s way.

**Cross-functional collaboration**

“Collaborating around similar information is powerful,” says Enrique Herrera, market principal for connected services at OSIsoft. The buzz surrounding Big Data focuses on the potential for more and better data to inform smarter action—decisions can be grounded in metrics and real-time information, not hunches or estimates. But there’s a critical human element to making the best use of Big Data that receives less attention, and that’s the collaboration that Herrera notes.

Data enables more-informed decision-making, but the most effective and efficient solutions are arrived at when multiple stakeholders are able to bring their unique perspective and insights to the table.

Maintenance and reliability technicians who have worked on the floor for five or 15 years and have intimate familiarity with a plant’s machines offer perspective that managers in the control room or procurement directors thousands of miles away don’t have, and vice-versa. Data-sharing platforms that allow workers to pull up key dashboards and performance metrics on a mobile device in the field or from a desktop computer in the office let all relevant players be at the table, so to speak, without having to physically bring everyone together.

Manufacturers increasingly are seeing the benefits of software architectures that allow for sharing of data across a company’s facilities. This means that plants can—as needed—crowd-source solutions to an immediate maintenance problem and collaboratively identify opportunities to improve processes or seize on potential equipment efficiencies. Collaboration can invite corroboration, too: Data provides a framework for decision-making, mitigating the potential for disputes about whether and why something should be done. Moreover, involving multiple parties from a plant’s workforce in the decision-making process promotes a sense that varied perspectives are valued—and in an age of concern about retaining newer members of the manufacturing workforce, this kind of employee engagement is vital.
Eager to embrace condition monitoring but concerned about data storage and other practical issues? Cloud-based solutions are coming to the rescue.

Cloud-Enabled Software
Cloud access to CBM solutions allows for a more holistic view of asset health. GE and Meridium’s Production Asset Reliability (PAR) platform, which combines GE Measurement & Control’s System 1 condition monitoring software with Meridium’s enterprise performance management and asset strategy solutions, joins asset and production data collected from multiple plants with the alarms and events from condition monitoring solutions. The platform triggers actions based on customer work processes and preferences.

The cloud facilitates data sharing “across sites and even country boundaries,” says Erik Lindhjem, executive product manager of GE’s Bently Nevada software. He adds: “Leveraging this new deployment model enables us to engage with our clients in a more real-time model.”

“With enhanced asset management and data analysis, plant operators and executives can derive a true picture of asset health, optimize production, better understand the asset life cycle, improve safety and manage risk,” adds Sunith Roy, Meridium VP of integration and development.

The @ptitude Connect cloud service from SKF also provides plantwide or enterprise-wide access to machine condition...
data via the Internet. It enables secure, real-time access to subscription-based SKF condition monitoring software and avoids the time and costs required to implement and manage the software infrastructure in-house.

“One of the strongest benefits we hear from our customers is how it eliminates their dealings with IT personnel, which can be a nightmare, and allows them to instead focus on keeping their machines running,” says Luis Econom, manager of cloud services and solutions at SKF. With OSIsoft’s PI Cloud Connect, authorized users can subscribe to receive data from PI Systems (a real-time data and event management tool), to allow for collaboration among personnel at multiple sites as well as trusted service providers, contract manufacturers, and others who need access to the production data.

“A cloud-based approach removes technical barriers that exist in on-premise operations,” explains Michael Moore, global solutions architect at OSIsoft.

Service Advantages
Online condition monitoring services provide ready access to asset experts. Azima DLI’s reliability service offerings span all CBM areas and utilize certified personnel who have diagnostic expertise. “Deploying our Watchman Services over a cloud-based infrastructure improves the ability to maintain a large distributed system,” remarks Laurent La Porte, Azima DLI director of technical services.

The transparency that cloud-based systems offer can drive better performance, adds Dave Geswein, Azima DLI product engineer. “If many stakeholders can see that an asset is overdue for data collection, then that asset is likely going to receive the attention it needs,” he says.

Siemens’ Asset Analytics Services offering aims to increase machines’ and production lines’ availability and reliability. Large volumes of physical and process data are recorded and transmitted to a Siemens operations center for analysis; customers receive results via a Web portal or report. Automatic alarms are generated for critical conditions.

“We have met with customers who decided to use their own in-house expert to develop a condition monitoring program,” says Martin Brucherseifer, Siemens’ U.S. practice lead for asset analytics. “Some programs failed for a simple reason – the expert either left the company or took another job. A cloud-based service is an improvement because it provides access to many dedicated experts who can provide continuity and sustainable results.”
People, processes, and technologies are connecting and collaborating as never before. Converging information technologies and operational technologies are driving this transformation – creating the Connected Enterprise – and are having a huge impact on global productivity and competitiveness. Because the Connected Enterprise leverages enhancing technologies such as the Internet of Things, there are virtually no limits to the ways in which collaboration can take place. It can and will continually evolve and improve to meet the needs of the user.

The challenge for manufacturers and industrial operators is providing connections and collaboration that are nearly frictionless for machine- and user-focused capabilities across operations without making major investments in new equipment. Capital expenditures are limited across many industries, requiring companies to focus their efforts on connecting and optimizing their assorted mix of equipment that’s already in place.

Think about digital photography. The move to digital didn’t change what makes a good photograph, but the ability to easily tag an image to a location or another member of a social network has changed how we use and value photography in incredible ways. It has created new products, businesses and trends, from Facebook, Instagram, and the “selfie” to user-generated food images driving customers to (or away from) restaurants the world over.

Information Software in Your Toolbox

Provide new levels of productivity and connectivity to existing assets

by Ryan Cahalane, Rockwell Automation
For manufacturing, integrated control and information software similarly can be a game-changer, allowing collaboration capabilities to be relatively easily infused into legacy assets. For example, new mobile capabilities are being introduced across platforms such as FactoryTalk® VantagePoint® v6.1 software from Rockwell Automation, an enterprise manufacturing intelligence (EMI) software tool that provides unseen “frictionless” levels of customization, delivers data analytics, and lets users track performance metrics. Users can now customize content across desktop and mobile devices to track data in ways that are unique to specific viewing preferences, roles, and business priorities, and then share it instantly with collaborators. For example, plant managers can view production rates across all lines on a single screen so they can quickly react if production targets are at risk. A reliability manager might use the software to keep a close eye on performance metrics of specific equipment types – such as variable frequency drives – across a site or multiple sites, so they can ensure uptime of crucial assets and assist in predictive maintenance activities.

This new software trend departs from the traditional define-and-dictate model, in which the system is preprogrammed with specific definitions that dictate what users can and cannot do, in favor of a more open, lean, and modular system. This flexibility empowers all levels of employees, giving them the freedom to develop the performance-tracking definitions that are most relevant to their specific operations and then to change them as needed, all without having to burden IT and OT with additional development. For example, maintenance personnel might be focused like a laser on uptime and have their dashboards show them line or machine uptime metrics, whereas plant managers might define their view by production rates or asset utilization.

Energy management is another area in which information software is allowing manufacturers and industrial operators to take advantage of the Connected Enterprise and get more out of their legacy equipment.
Energy intelligence software that integrates with a plant’s existing drives can monitor energy usage and help operators better understand and compare energy costs. It allows them to track equipment lifecycles and identify where investments—in maintenance or replacements, for example—may be necessary.

This software infusion is transforming how end users access and use information, but it’s also changing how developers create and upgrade their offerings. Equipment and software can’t be developed as independent or isolated products, or on timelines that don’t allow for quick iteration and upgrades. Everything can now be connected within the Connected Enterprise, meaning that products must be developed to live as part of a larger ecosystem with a focus on delivering value to different user groups. They must be considered within the context of other products and multiple roles in a plant.

They also have to keep up with the end user’s evolving needs through regular updates and the introduction of new features based on user preferences. For example, users have shown a preference for device-agnostic mobile capabilities, so software applications have shifted to dynamically display the application and best fit for the mobile device being used. Through continual software updates, manufacturers should be able to expect that their control and information software investments will continue to deliver incremental value with each new release that is backed by user data.

These changes are leading to a greater emphasis on system-level thinking, cross-team collaboration, and use of lean startup principles during the software development process.

The Connected Enterprise can help manufacturers drive exponential value out of their existing equipment and new investments. Five years into its own Connected Enterprise journey, improved collaboration and processes have allowed Rockwell Automation to lower inventory and realize 30 percent savings annually in capital avoidance, reduce supply chain lead times by 50 percent, reduce parts per million defects by 50 percent, and improve annual productivity by 4 to 5 percent.

The information is there, in existing and new manufacturing infrastructures. Now it’s about connecting the right data points, people and processes to unleash exponential value from these systems.
Just How Big Is Your Data?

Better business decisions come from in-context analytics

by Mike Bacidore, former editor in chief

“Big data” has become the phrase du jour. To transform data into something valuable, companies must use analysis to develop information that can be extracted as business intelligence (BI), which yields a measurement of how the organization is faring. This in turn lends itself to creating KPIs to quantify progress in efficiencies and productivity.

In July, IFS North America (www.ifsworld.com/en-na) released “Built-In Business Intelligence,” a study it conducted jointly with Advantage Business Media to determine the extent of BI strategies and how they’re used in ERP systems. Survey respondents included 174 manufacturing executives at medium to large companies.

Most participants said they have a BI strategy in place or in progress (64%), while 36% said they had none. The top reasons cited were because it was too expensive and too complicated. Those companies that have implemented a BI program (57%) said that it’s significantly improved their business operations. Companies with revenues of at least $2.5 billion were most likely to have a built-in BI program already in place.

Of the companies that indicated they had a BI strategy in place or in progress, almost two-thirds of them said they’re using BI to measure and improve operations. The next highest-rated department was sales, which trailed operations by more than 15%. ERP systems are designed to automate these transactions, so companies can benefit from in-context analytics that are built-in to an ERP solution.

Almost half of respondents (42%) are using a data warehouse to pull data from their ERP solutions for BI purposes with analytics tools not integrated with their ERP solution. This suggests that the full value of real-time BI insight may not be fully achieved. Only one-fourth (24%) have their BI functionality built-in to their ERP solutions, providing in-context BI with operational processes.

Most companies (74%) are using Excel and operational reports for data, which can create data-security and synchronization problems. This disconnected information begets a clunky process when trying to apply intelligence where it’s needed, and this often dissuades users from turning big data into big profits. At best, they’re only able to see the large wake of missed opportunities left behind.

Overall, the survey revealed that most companies use BI to determine what has already occurred and hopefully understand why. This helps to make future process improvements, but it falls short of the agile approach that BI can effect. A more proactive application of BI, with the ability to make decisions in real time, can demonstrate immediate improvements.

Having timely intelligence in the context of immediate production needs helps to make better bottom-line decisions. Combining historical warehouse data with real-time operational data allows organizations to gather analytics in-context with business decisions when they need to be made.
A Cisco Consulting Services Study from 2014 found that 86% of manufacturers are investing in the Internet of Things (IoT) as they go after an estimated $4 trillion in benefits for manufacturing applications.

Why now? The cost of sensors, networking, storage and computing has dropped dramatically. New architecture models and technologies have emerged that ease deployment and accelerate time to value. Operations can increase overall equipment effectiveness and create new value through insights culled from existing control systems and by adding new sensors to track asset health and processing conditions.

Traditional automation architectures will continue to evolve to make machines and process skids grow smarter. However, there is a complication: These equipment assets need to be connected to the plantwide enterprise to unlock data and allow for wider scale and more innovative analytic approaches. This plantwide network fabric is critical for advancing IoT.

Meanwhile, new approaches to acquiring sensor data through wireless mesh networks have been developed. These sensor networks do not connect directly to critical automation control systems but instead connect to computing resources close to the edge and to private/hybrid cloud resources. These new network architecture models advance what we can collaboratively achieve as end users and vendor communities.

What is the key to faster and larger return on investment? It lies in leveraging reference models, architectures, and ecosystems to go from opportunity assessment to pilot project to full-scale value creation. The exciting part about these new IoT approaches is the potential to innovate on an ongoing, sustainable basis with access to deeper, richer data and more powerful, flexible data analytics for system-level insights. Let’s look at three key areas to grow your IoT architecture.

Connecting Plant and Enterprise. A foundational IP network fabric that follows a validated architecture with security and scalability will enable the connection of people, processes and technology. This requires collaboration between IT and OT to execute. Maturity models exist to help frame the task at hand. A holistic architecture provides the power and flexibility to take advantage of innovations in sensing, computing, and mobile data access that are transforming value creation. Use the Converged PlantWide
Ethernet (CPwE) architectures to provide the foundation for connecting the plant floor to the enterprise with defense-in-depth security, including an industrial demilitarized zone (iDMZ).

Scaling sensors with wireless mesh networks. Emerging wireless mesh solutions that connect to the IP network fabric provide the ability to cost-effectively deploy many wireless sensors across a plant floor. The inherent robustness, flexibility, and ease of deployment can be real game changers when calculating ROI or return on assets. The ability to cost-effectively add more sensors on desirable variables can provide predictive diagnostics and system optimization inputs that could only be dreamed about in the past, without requiring rip-replace or risking complications to existing automation systems and networks.

Computing at the edge. Analyzing data close to the machine or process is not a new concept, as evidenced by the continued success and evolution of industrial controllers. For IoT, the need to process data in industrial real time means that latency must be reduced in the computing and storage strategy for data from new wireless sensors and other new connected assets such as video. The approach of sending all data to a public cloud for processing may not prove timely enough for most manufacturing environments, to say nothing of the bandwidth and storage issues as well as costs that this may generate. Thus, intelligent gateways and routers can provide computational services that enable local real-time decision-making capabilities.

Consider how you will assess and explore these new models and technologies in order to innovate and compete. Market leaders have started down this path already, so you will not be alone. Great ways to start include obtaining education and training from organizations such as the Industrial IP Advantage (www.industrial-ip.org), becoming involved in organizations such as the IoT World Forum, and developing your own proof of concepts with ecosystem partners. Manufacturing is changing rapidly and will never be the same so the time to act is now.
Want to learn more about how a comprehensive information infrastructure can power productivity, efficiency, and uptime in your plant? Check out these customer case studies from OSIsoft.

**Read Syngenta's Story:**
Customer Presentation Brief:
Syngenta's Journey to an OSIsoft Connected Services Agreement

**Syngenta: Our Evolution to Connected Services**
Find out how Connected Services enabled Syngenta to extend their solutions out to their customers which lead to greater collaboration, and resulted in a trusted partner relationship.

**Controls and Data Services: Remote Diagnostics and the Collaborative Supply Chain**
Learn how Connected Services allows companies to realize the harder-to-reach value of condition monitoring across vendors.

**Kongsberg: Applications to Enhanced Performance Using the PI System**
Discover how Kongsberg was able to allow continuous access to data and provide an increased service value to their customers.

**Black and Veatch: Using Data Analytics and Connected Services to Remotely Monitor and Optimize Energy Usage**
Discover how Black and Veatch combined expertise, technology and Connected Services to integrate complex data silos for water utilities.