A look at the context of and requirements for APM processes as this field evolves and incorporates the advancements of big data.

Digitalization and the future of asset performance management

“When we entered the age of big data, many of us assumed we had left the age of big risk. We didn’t have to guess anymore. We didn’t have to go out on a limb. We’d follow the numbers, the ‘truths.’ But time and time again we’re finding that it’s not that simple. No matter how good the research is, big data is nothing without big context.”[1]

Fortune tellers in ancient China used heated metal pokers to create cracks in bones or empty turtle shells. They would use the patterns in the cracks to predict the future, and by recommending actions they affected the fate and fortunes of states and their people. We now laugh at these primitive, superstitious methods of prediction, but we should recognize that even in their primitive form, fortune telling practices had an important benefit for these early civilizations: namely, organizing people around a common course of action in the face of uncertainty. In this age of big data, we should not forget that collaboration and alignment are still vitally important outcomes of our predictions.

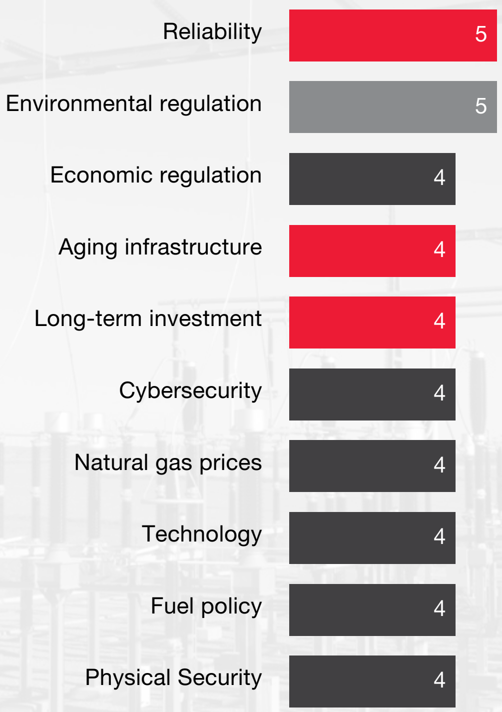
Sophisticated modern analytics have raised the bar on predictive precision, but they have not removed (or even reduced) risk and uncertainty from our decision making. Asset performance management (APM) solutions often focus on the technical details of data collection, processing, and presentation.

While these are important considerations, the APM solution in the era of big data should not be primarily a big data analytics solution. Instead, it should be a strategic tool for efficient collaboration. As one analysis puts it: “. . . the case studies show that organizational aspects of project prioritization and long range planning processes are every bit as important, if not more so, than the analysis techniques employed.”[2]

When individuals act together, they add context to data and automatically incorporate uncertainty and risk in decision making processes. Through this interaction, they reach organizational alignment on asset decisions, they learn from their peers, and they improve. This need for a collaborative process is consistently identified as a fundamental challenge to improving asset management.

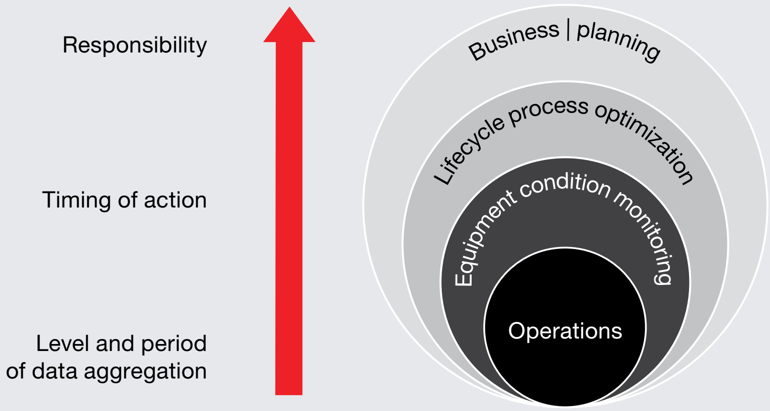
This paper will look in more detail at the context of and requirements for APM processes as this field evolves and incorporates the advancements of big data.

Top 10 industry issues (%)



Challenges to improving asset management(%)

Asset decision horizons



The core information challenge

"As data increasingly floods our brains, we lose our ability to solve problems and handle the unknown. Creativity shrivels; mistakes multiply."[3]

In recent decades, equipment operators and manufacturers have made significant progress in the early identification of equipment degradation before a resulting functional failure affects safety, operations, or other core objectives. The development of inexpensive sensor and communications equipment and analytics software has also accelerated the pace of innovation in predictive forecasting in recent years. Cost-effective predictive models – using more data, collected automatically, and at higher frequencies – now monitor equipment more effectively. Predictive models are becoming more prescriptive, recommending corrective actions versus simply identifying variations from normal conditions. Most equipment operators today are deploying a range of predictive solutions from various providers: for example, oil sampling services, newly installed self-diagnosing equipment, condition monitoring process automation software, advanced pattern recognition software, and others. This diversity in techniques and partner specialization has contributed to the rapid pace of innovation and will continue to be important, but it also introduces a challenge, as highlighted in a 2009 EPRI report:

"While organizations that practice CBM [condition-based maintenance] have set the foundation for a maintenance program that is highly focused on unit reliability, they still face difficult challenges. One such challenge involves taking all information generated during the condition assessment phase of the technical maintenance process and effectively utilizing this information as input to a systematic maintenance decision-making process. [...] Without a systematic approach to acquire and organize this information into a meaningful, consistent input for a maintenance decision-making process, much of the potential effectiveness of these condition assessment processes is lost and the maintenance process is compromised."[4]

In his article "Overloaded Circuits: Why Smart People Underperform", Edward Hallowell refers to a similar challenge at the individual level as Attention Deficit Trait. Conventional wisdom refers to this as the inability to "see the forest for the trees."

In the age of the Industrial Internet, when machines communicate through alerts and messages, preventing information overload and an organizational attention deficit becomes crucial. Logical presentation, alert prioritization, and rolling up data are key features of an APM solution. It is equally important to incorporate roles, "ownership", collaboration, and decision-making processes into APM applications. These roles and decision-making processes need to be supported by data roll-up algorithms that support decision making within role-appropriate time horizons. Moreover, these processes must be monitored using appropriate program indicators to ensure effectiveness and focus on each level.

A system perspective

"Connected data is always going to be more valuable to a utility than just big data that is siloed."[5]

"A system view is necessary to understand and manage complex work."[6]

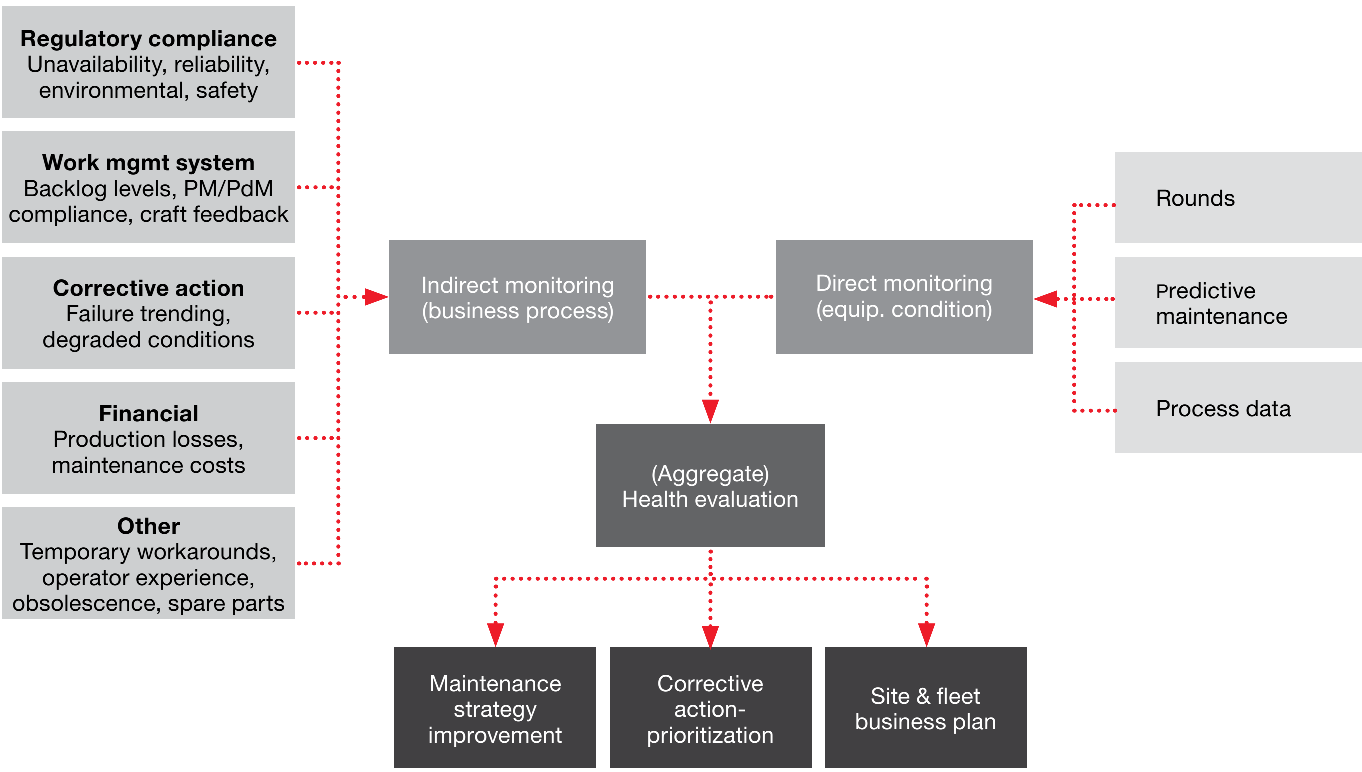
As the time horizon for asset health decisions extends into the future, and as organizations seek to optimize risk against total life cycle cost, it becomes necessary to develop an aggregate system perspective on asset health. Total system health or resiliency is more than the sum of individual assets' health. Multiple potential system configurations and dependencies that routinely change make such aggregation complex. Moreover, a system perspective requires more than an aggregation of direct condition data. It also requires a review of indirect business process trends. Reliability results from managing the equipment's physical condition and the way the organization operates and maintains equipment (in other words, business process reliability).

Trends in PM compliance, backlog size, obsolescence and spare parts availability, operator workarounds, near misses, and operating experience can complement direct information on current equipment condition and historic performance for a comprehensive, aggregate view of health on a medium to long-term horizon.

"[System health] provides the vision and structure to information management that will give organizations the ability to better manage their current assets and develop strategic operations and maintenance plans."[7]

System and plant health processes have proven to be a simple yet effective method to organize data flows and enforce accountability for medium and long-term reliability. The boundaries of a functional system will vary across industries, depending on the magnitude of the overall risks being managed and associated staffing decisions. Nevertheless, the basic concepts of rolling up direct and indirect data for aggregate evaluation at a functional system level, and the development of collaboration and action tracking processes at this level to manage the balance of risk to life cycle cost, are proven process solutions that must be incorporated into an optimized asset performance vision in the era of big data.

An aggregate health perspective



Algorithm acceptance and change management

"... researchers found that people are significantly more willing to trust and use algorithms if they're allowed to tweak the output a little bit."[8]

Over the next decade, we expect to witness an evolving predictive maintenance paradigm as individuals and organizations incorporate new communications and analytics technologies into their daily work. Similar to the evolution of operations process automation, the evolution of predictive maintenance will include a tipping point where automated algorithms cover key equipment and processes and are intelligent enough to take actions independently. At the current time, algorithms are ideal for specific tasks, but they are not yet sufficiently comprehensive to consider all aspects of risk. Consequently, many organizations are not ready to trust algorithms to make final decisions.

Counter-intuitively the functionality to "tweak" is key to the successful initial adoption of an automated predictive analytics framework. Such functionality allows users to add context and to complete the picture for enterprise-level decisions. This capability allows organizations to account for a risk not automatically identified, to reduce risk where algorithms did not incorporate mitigating factors, to define an alternative strategy to address a degraded condition, and other scenarios. This human interaction with the data process should be structured to provide opportunity for peer review and supervision. Within such structure, user activity will help algorithms to improve and become more comprehensive and independent in their analysis, recommendations, and automated actions.

Only action delivers results

"The most-often missed key to success with analytics is that you have to actually use the results; it must change the way you and your organization behave, or you are wasting your time."[9]

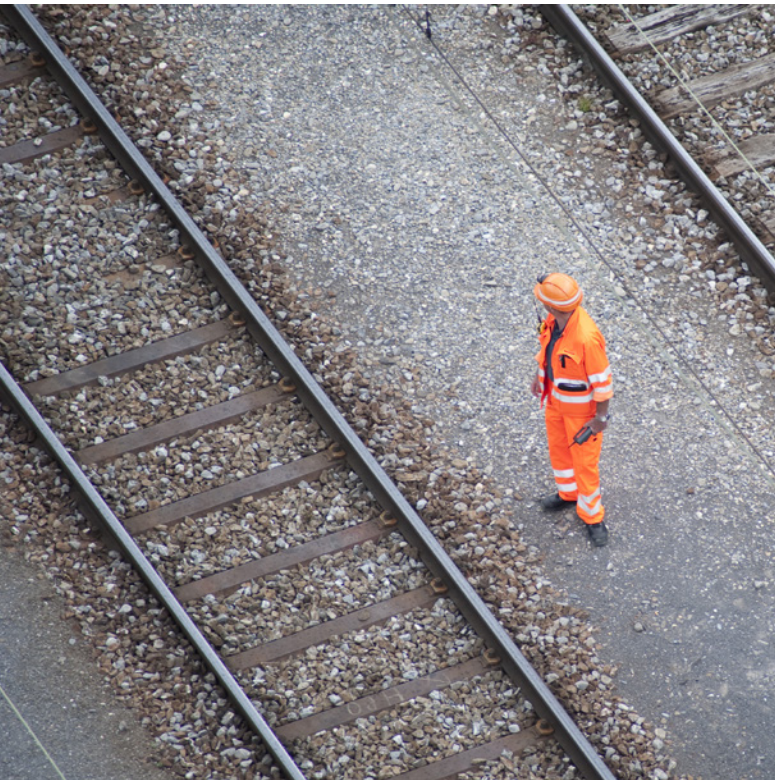
"Too often, identified problems become lost resulting in a failure to take action and, ultimately, unplanned downtime. Workflow improvements involving application integration for business process automation avoids lost alerts."[10]

No matter how sophisticated our predictive analytics and system health perspective, we tend to identify more risks and required actions than we can resolve or mitigate with our allocated resources. Thus, we have to make choices between which risks to address now and which to defer. As Goldratt has pointed out in The Goal, insufficient prioritization of work around our constraints has a negative impact on process efficiency and thus reduces our capacity to remove risk.

The workflow of risk identification and task prioritization typically spans various organizational silos. This workflow can offer some of the greatest opportunities for streamlined cross-silo collaboration. Connectivity among APM, work, and operations management tools is key to realizing value from an APM solution, as well as providing role-based interfaces to shared information and priorities. Allowing various groups to contribute to the full picture will simultaneously foster the buy-in needed to successfully complete actions. "Joint prioritization" requires a collaborative process. It requires a tool with simple and intuitive role-based interfaces, embedded collaboration processes, and a common, shared knowledge base that facilitates such collaboration.

"Eliminating cross-functional bottlenecks actually has less to do with shifting decision-making responsibilities between departments and more to do with ensuring that the people with relevant information are allowed to share it. The decision maker is important, of course, but more important is designing a system that aligns decision making and makes it routine."[11]

This collaborative process produces better decisions, and the resulting alignment and buy-in drives more effective execution. Nevertheless, because decisions are still based on predictive probabilities, hindsight will prove some of those decisions wrong. Over time, however, consistent application of such decision-making processes pays off in higher reliability and lower costs. The collaborative process encourages risk-based decision making as individuals are supported by peer reviews and other safeguards, and it discourages decision procrastination. After all, "procrastination in the name of reducing risk actually increases risk."[12]



Next steps

Guided by proven industry best practices (standardized in ISO 55000, PAS 55, and various industry-specific guidelines), and forced by liability, regulation, and competition, asset-intensive organizations are increasingly relying on APM and predictive analytics to help them optimize the performance of mission-critical assets. While these predictive technologies offer real benefits, it is important to keep in mind that equipment reliability is a technical as well as a managerial challenge. Simple technologies that facilitate structured collaborative decision making and drive actions are key to consolidating this information. These processes must be the core of a solution in which advanced algorithms and other techniques from various sources can be embedded or connected for increasingly automated asset intelligence.

As a leader in engineering and asset management process innovation, Hitachi Energy, in partnership with Microsoft®, a leader in analytics software solutions, stands ready to support your transformation to address the technical and managerial challenges of APM.

1 Big Data Demands Big Context, Jess Neill, Harvard Business Review Online, December 3, 2013 (https://hbr.org/2013/12/big-data-demands-big-context/)
2 Project Prioritization for Nuclear Plant Investments: Lessons Learned from Other Industries, EPRI, Palo Alto, CA: 2008 1016733
3 Overloaded Circuits, Why Smart People Underperform, Edward M Hallowell, Harvard Business Review, January 2005
4 Integrated Operations and Maintenance of Fossil Plant Systems: System Health Reporting, EPRI, Palo Alto, CA: 2009 1017528
5 Matt Croucher, Director, Demand Analytics, CPS Energy in Building the Data Core, ABB, 2016
6 Risk Management: Using Resilience Engineering to Develop a More Reliable Workforce, by Beth Lay in Power Magazine, January 1, 2016 (http://www.powermag.com/risk-management-using-resilience-engineering-develop-reliable-workforce)
7 Integrated Operations and Maintenance of Fossil Plant Systems: System Health Reporting, EPRI, Palo Alto, CA: 2009 1017528
8 Here's Why People Trust Human Judgment Over Algorithms, Walter Frick, Harvard Business Review, February 27, 2015 (https://hbr.org/2015/02/heres-why-people-trust-human-judgment-over-algorithms).
9 Utility Analytics, 2015 (Utility Analytics Institute)
10 Ralph Rio, Optimize Asset Performance with Industrial IoT and Analytics, August 17, 2015
11 Who Has the D?: How Clear Decision Roles Enhance Organizational Performance, Paul Rogers and Marcia W. Blanko, HBR, January 2006 (https://hbr.org/2006/01/who-has-the-d-how-clear-decision-roles-enhance-organizational-performance)
12 A leadership primer, slides by General Colin Powell

Hitachi Energy
marketing-update@hitachienergy.com
hitachienergy.com

9AKK106930A8300