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Scaling Asset Performance Management Across the Enterprise

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Keywords

Scaling Asset Performance Management, Machine Learning, Data Science

Overview

ARC Advisory Group recently conducted a global survey of asset performance management (APM) best practices. Survey results included 180 respondents from industry practitioners and several one-on-one interviews with industry end users from the energy, chemicals, food and beverage, and mining industries. This research was conducted to provide a better understanding of how industry leaders address APM scalability. An APM system is considered scalable when it doesn't need to be redesigned to maintain effectiveness during or after deployment across a variety of unique assets, or across multiple plants. ARC found that 17 percent of survey respondents cannot scale APM across different assets at the same plant, regardless of resources. A staggering 53 percent of respondents also indicated that their APM deployment was scalable, but not without tremendous effort and resources. Lack of data science alignment was also cited as a top challenge.

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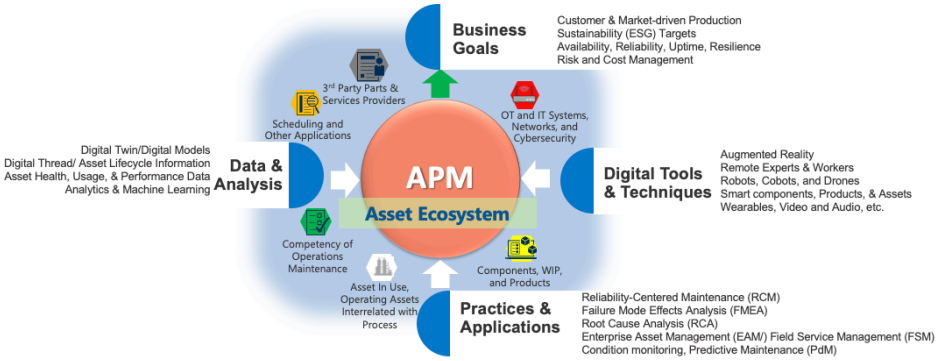
Clearly, there is need to address the resource-intensive nature of APM projects and heavy-customization of APM solutions. Considering the fact that most of our respondents already have an APM program, there was a surprisingly low adoption of machine learning (ML) and artificial intelligence (AI) tools. To help improve the scale out of APM, leading industrial users are:

- Addressing the resource-intensiveness of many APM solutions by minimizing the customization of APM implementations.
- Creating better harmony between APM project teams, the maintenance organization, and with the data science organization.

What Is Asset Performance Management?

Asset performance management (APM) is an approach to managing assets that prioritizes achieving business goals in addition to traditional asset reliability and availability goals. Industrial companies rely on APM as one of the primary enablers of digital transformation. APM optimizes the performance of physical assets in their operating ecosystem, typically employing a digital thread throughout the asset lifecycle, supporting digital twins for assets or asset groups, supporting connected workers, and maintaining a network of parts and service providers. By leveraging an ecosystem of data from connected assets and applying digital models, advanced analytics, and machine learning, modern APM solutions seek to support market or customer-driven production intelligently and sustainably by improving asset reliability and availability while reducing risk and cost.



Asset Performance Management: Asset Ecosystem

Business goals: Through digital transformation in asset and risk management, and improvements in asset availability and uptime, users achieve higher revenue and profitability while improving customer satisfaction with on-time delivery and quality.

Asset ecosystem: The ecosystem for assets extends beyond the plant floor and facilities to include a wide range of applications across asset-intensive industries that leverage sophisticated OT, IT and engineering systems and related production, maintenance, and engineering personnel. It also encompasses third party partners and other providers of parts and services.

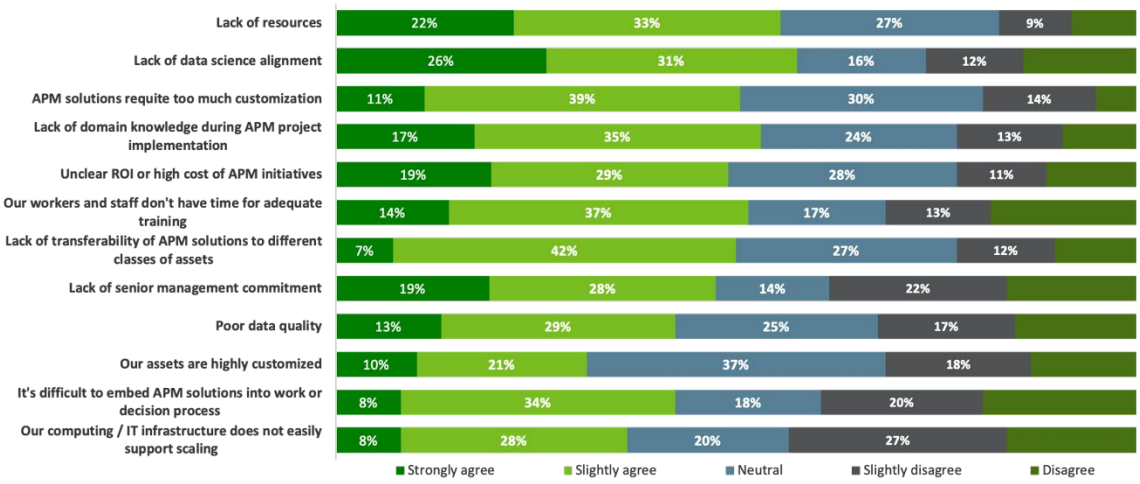
Digital tools: Apply modern technologies across a range of tools like smart devices, augmented reality, and mobility to improve business processes and create new methods for asset management.

Data & analysis: Enable greater depth of collaboration across the asset ecosystem by using digital twin, digital thread, and other modern information assimilation and management approaches.

Practices and apps: Traditional practices and applications become more effective when enhanced with data, digital tools, and support for business goals.

Challenges Companies Face in Rapidly Scaling APM Solutions

Given the breadth and complexity of APM solutions, it is not surprising to find the lack of resources, data science alignment, customization, and domain expertise to be top challenges when scaling APM solutions. With the recent sharp rise in machine learning (ML) and artificial intelligence (AI) solutions in the industrial market, asset owners and APM practitioners face the challenge of addressing the vast number of vendors going to market without industry expertise. Asset owners expect that APM ML and AI solutions are proven and adaptable to various asset classes and processes - and these solutions will not be used as a training or test project to prove some generic AI solution.

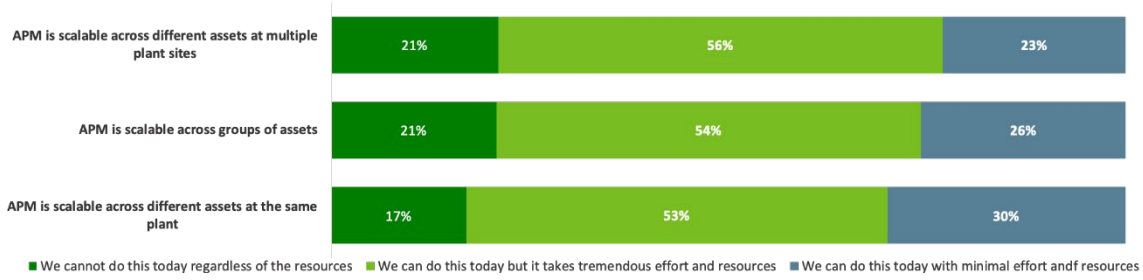


What challenges does your company face in rapidly scaling APM solutions?

APM vendors often go to market with generic asset profiles or templates. While these are helpful to look at the asset performance in a testing or OEM facility, they don't help much to help bridge the gap between a discrete asset (pump, chiller, exchanger, column) and how the asset operates in the context of the process it supports. A strong connection between process models and

asset profiles is required to reduce the time needed to build models and copy-paste them to other asset classes.

According to APM practitioners, it is still quite difficult to copy and paste models from one plant to another plant or site. There are many unique characteristics to the assets at each location. For example, even process licensors have subtle variances in processing technology. Each process has differences in constraints, limitations, and operating procedures and is subject to many different process disturbances, making it tricky to adapt and scale an APM solution. It is a resource-intensive activity to gather the tags manually associated with an asset. Most of this work is a manual process, which must be done before any ML is applied. When the asset is a pump, each pump has a unique signature depending on the environment and its operation. The chart below illustrates the inability of APM practitioners to scale out APM effectively. Seventeen percent cannot scale APM across different assets at the same plant and a staggering 53 percent can scale APM but require tremendous effort and resources.



How is APM scalability impacted by resources?

APM implementation requires knowledgeable resources with diverse capabilities, which are even more scarce at the plant sites. When APM combines with ML and AI, the resources needed to scale APM include plant-resident reliability and maintenance, data science competency, IT and database experts, and an array of data analysis skills.

Often data analysis activities need to deal with measurement systems which may be inadequate. In many cases, the instrumentation or sensors may not exist or be accurate, increasing the length of time to complete a project and a higher cost. Data may not be adequately prepared and cleaned and ingested with a solid data governance model.

Industrial manufacturers are very dependent on people and culture. Project success requires companies to have the right people interested in moving an

APM project forward and an open mind to new methods, systems, and processes. Staff need to be skilled and trained, and the workers need to look at things differently and apply some experimentation. Experimentation is not customary in the industry. Once the people and culture are prepared for APM, work processes must be properly engineered to embed the solution and drive a decision process. All APM stakeholders must be working from the same data, not just a few subject matter experts (SMEs) working in silos, to ensure the sustainability of the system.

While impact of resources on the scalability of APM is undoubtedly compelling, it is helpful to consider the underlying data, technology fit for the industry and application, and how to prepare and align the organization responsible for scaling out and sustaining the APM system. According to the APM experts we surveyed, there are a few technology factors that are important when scaling out APM.

APM Technology Factor	Relative Importance
Automation of the bulk and time-consuming data processing tasks	#1
Functionality to help Domain experts identify the correct training data	#2
Intelligent Software agents or machine learning profiles without costly programming	#3
A library of reusable asset and equipment profiles or templates	#4
Ability to leverage first principles models and rules	#5

Key APM Technology Factors to Scale Deployment

LG Chem Scales APM

One example of an industrial leader in the deployment of APM is LG Chem. LG Chem is a leader in the digital transformation initiative. The company has led the entire adoption process and selected AspenTech's Predictive & Prescriptive maintenance software Aspen Mtell software for its technological capability, ease of use, scalability, and ability to mitigate unplanned downtime via accurate alerts.

The company faced challenges in deploying APM using traditional maintenance methods relying on the individual capability of operators. The initial deployments were not successful. Model-based solutions were costly to scale and machine learning-based solutions produced excessive false alerts. Inadequate tuning resulted in failure of adoption.

Aspen Mtell helped achieve the project goals for a quick deployment. Failure prediction was accurate with higher lead time detecting failures and the solution was scaled across all types of equipment. LG Chem's initial study was live in three weeks resulting in an increased uptime of 2 percent and revenue by $6 million at an Ethylene Vinyl Acetate plant. In just a year, Mtell was deployed across 2 sites (47 assets) through transfer learning. This function uses software agents to analyze sensors across the full equipment boundary, detect failure signatures, and transfer these to similar assets helping to scale out APM.

Recommendations

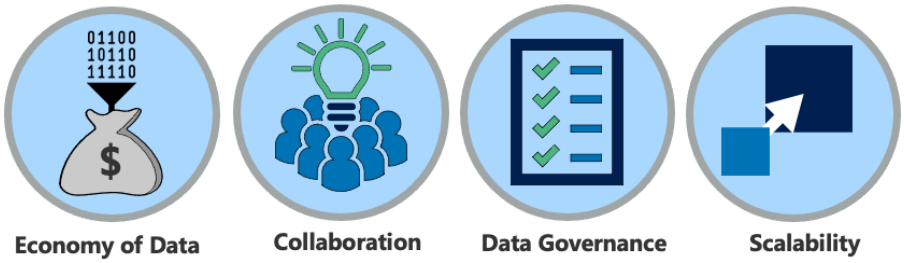
Asset performance management is far more than improving the asset utilization or uptime. APM brings the promise of proactive management to ensure optimal performance of all aspects of asset performance through work process improvements and a collaborative, skilled workforce. Where asset decisions must be made APM can provide judgement over the cost and risk of such choices, not just on a single asset basis, but in relation to any effects on other assets, the production performance costs, and its interactions with logistical events, weather issues, etc.

Asset performance management is evolving from its roots in reliability and maintenance with the goals of providing an assurance of uptime or asset utilization to ensure the greatest productivity. Today, the approach changes to support more than simple performance and centers on improving overall equipment effectiveness (OEE) and availability.

The APM predictive alerts and prescriptive analytics enable early warnings of process and mechanical issues with sufficient time to change the process operation to correct issues and avoid poor asset yields and quality, and to evade process-induced degradation of mechanical equipment. Where maintenance service is inevitable, predictive alerts give enough time to plan safe and environmentally conscious intervention, avoiding sudden and sometimes catastrophic breakdowns.

APM assures all equipment is available and performs its full intended duty and can lower costs incurred by off-spec product and poor yields, reduce unplanned downtime, and optimize labor usage and equipment performance. Through predictive and prescriptive analytics, companies will be able to implement asset strategies to avoid unplanned downtime for their

most critical assets, while also deciding which preventive or corrective asset strategy is the best course of action to take for their less vital equipment.



Based on ARC research and analysis, we recommend the following considerations for APM subject matter experts and other technology users to consider when scaling out APM:

1. **Economy of Data**: Seek better tools to identify training data across multiple processes to automate data processing and preparation and provide automated data cleansing.

2. **Collaboration:** Create harmony with the data science organization, automated maintenance diagnostics for users, and collaborative operator tools to provide sufficient early warning and adjust the process.

3. **Data Governance**: Consider reusable and reliable data models requiring less specialized skills and implement data security policies and tools.

4. **Scalability**: Avoid any customization, better integration with process models, workflow integration, and look toward a microservices platform for deployment at the edge and cloud.

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