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AI-Driven Enhancements for Optimal Asset Performance

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Overview

Many process manufacturing enterprises need help to apply artificial intelligence (AI) and machine learning tools to improve asset performance. ARC Advisory Group's research identifies that while condition-based maintenance is most prevalent, leaders have successfully built the AI capability to improve asset performance practices through in-house platforms, commercial solutions, and a combination thereof. Today, a small percentage of users leverage AI to identify maintenance and process issues and expand the scope of their traditional maintenance practices.

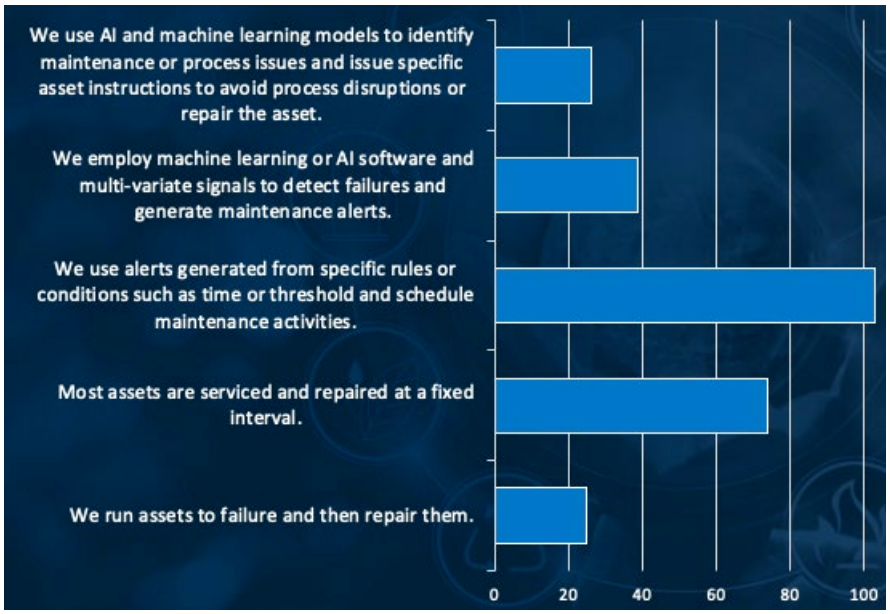
AI functionality in asset performance management needs to provide early warning to minimize process interruptions, provide information to adjust the process, prevent a failure, and ensure the right assets are available to match the performance goals of the plant.

AI functionality in asset performance strategy provides early warning to minimize process interruptions, information to adjust the process, and ensures the right assets are available to match the performance goals of the plant. Most companies use internal data science teams and in-house platforms to develop AI capabilities. This approach, however, comes with the price of higher technical debt.

Asset performance strategy focuses on maximizing reliability, process efficiency, and achieving the best possible return on investment from the assets. In the past, users supplemented the strategy with rudimentary real-time data collection and seldom involved IT. A broader skill set is required to link a proactive asset performance strategy with AI/ML, achieved through Scaled Agile Framework (SAFe). SAFe addresses the challenges of procuring multiple commercial AI/ML solutions and integrates these into internal platforms, reducing technical debt and improving interoperability.

The Current State of AI and Machine Learning

ARC Advisory Group recently conducted research to gain a better understanding of how process manufacturing industry leaders are using Artificial Intelligence (AI) and machine learning tools to improve uptime, process health, and return on assets. A global web survey of 155 experts and in-depth discussions with several subject matter experts (SMEs) across different industries identified compelling best practices and reasons for industrial organizations to rethink their current approaches to AI.



Which statement most closely aligns with your asset management strategy?

While condition monitoring and rules-based tools were most prevalent in the industry, we found 63 percent of industrial process company respondents have a program in place to improve asset performance using advanced analytics and AI. Of those surveyed, 25 percent claim they can use AI to detect failures and generate maintenance alerts. However, 16 percent use AI and machine learning models to identify and address maintenance or process issues to avoid disruptions, thereby expanding the scope of asset performance strategy from traditional maintenance practices.

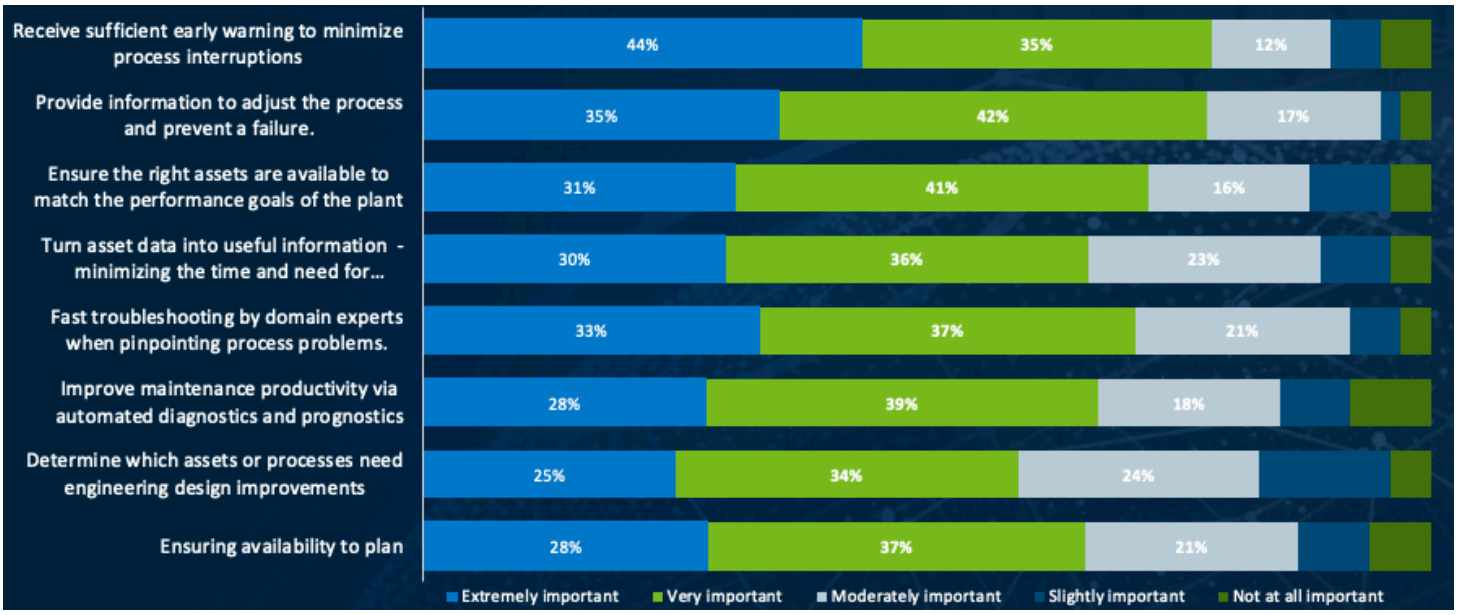
We also surveyed users to determine which functional organizations use the output of current asset management tools, and the results were alarming. 36 percent of users claim the Internal IT or Data Science organizations use the output of advanced tools like AI and machine learning and only 13 percent of maintenance and operations organizations benefit from current AI tools.

Much Needed Functionality in APM Software

The survey results show a high maturity level in understanding the capability of AI tools. Users understand the importance of modern tools for

leveraging data insights across various functional roles, spanning from maintenance and reliability to operations to improve asset performance. In order of importance, the top three software functionality needs were:

- Receive early warnings to minimize process interruptions.
- Provide information to adjust the process and prevent failures.
- Ensure the right assets are available to match the performance goals of the plant.



Which asset management software decision support functionality is important?

Expanding the Scope of Traditional Maintenance Practice

Oleoducto de Crudos Pesados (OCP) Ecuador is a midstream oil and gas company that transports, stores, and ships crude oil. The company prides itself on providing reliable, safe, efficient, and environmentally committed crude oil transportation operations, with a capacity to transport 450-517K barrels/day from the Amazon to the marine terminal in coastal province of Esmeraldas. As the country's production fell, OCP Ecuador was forced to operate its facilities at reduced capacity (just 30- 50 percent of maximum capacity) while ensuring reliability of spare assets. However, transportation fees and tariffs are typically fixed for pipeline companies regardless of utilization.

The company performed calendar-based and condition-based maintenance activities across its assets installed in remote locations along the 485-km

pipeline. This strategy had inherent issues, and could not predict and prevent equipment failures from happening. Faced with the pressures of tightening regulatory requirements, past historical failures, and a goal to exercise control on operating costs, OCP Ecuador decided to enhance its existing maintenance strategy. This fast-tracked project would succeed only if the solution could be implemented in six weeks across 31 crucial assets.

OCP Ecuador selected Aspen Mtell® from several solutions for its ability to work with both equipment and process data, provide early and accurate warning of potential issues, and deploy quickly at scale. Aspen Mtell's ability to predict and prevent potential operational disturbances made a great impact at OCP Ecuador by reducing maintenance spend, managing spares effectively, allocating limited resources efficiently, contributing to a healthier planet, and protecting maintenance personnel.

For example, Aspen Mtell, leveraging its AI/ML based failure and anomaly detection capabilities, detected an increase in the charged air temperature and stalling at four of the company's main engines. Because increases in air temperature can lead to poor combustion and higher carbon monoxide (CO) levels, this was a critical "find" by Aspen Mtell. A field inspection based on the alert resulted in removing one of the engine's motors from service due to water leakage. Aspen Mtell prevented excessive damage of the engine, improved combustion, and reduced carbon monoxide emissions.

Delivering AI and Machine Learning as Organizational Capability

Organizational capability refers to an organization's capacity and ability to effectively and efficiently perform tasks, activities, and functions required to achieve its strategic goals and objectives. It encompasses a wide range of elements, including the organization's human resources, processes, technologies, culture, knowledge, and overall capacity to adapt and respond to changing operational and business conditions. When considering AI and machine learning as a capability, there are some key differences in how organizations address both smaller-scope and larger-scope projects involving both similar and multiple asset classes. Most companies still develop AI capability using internal data science teams and in-house platforms. This approach, however, comes with the price of higher technical debt.

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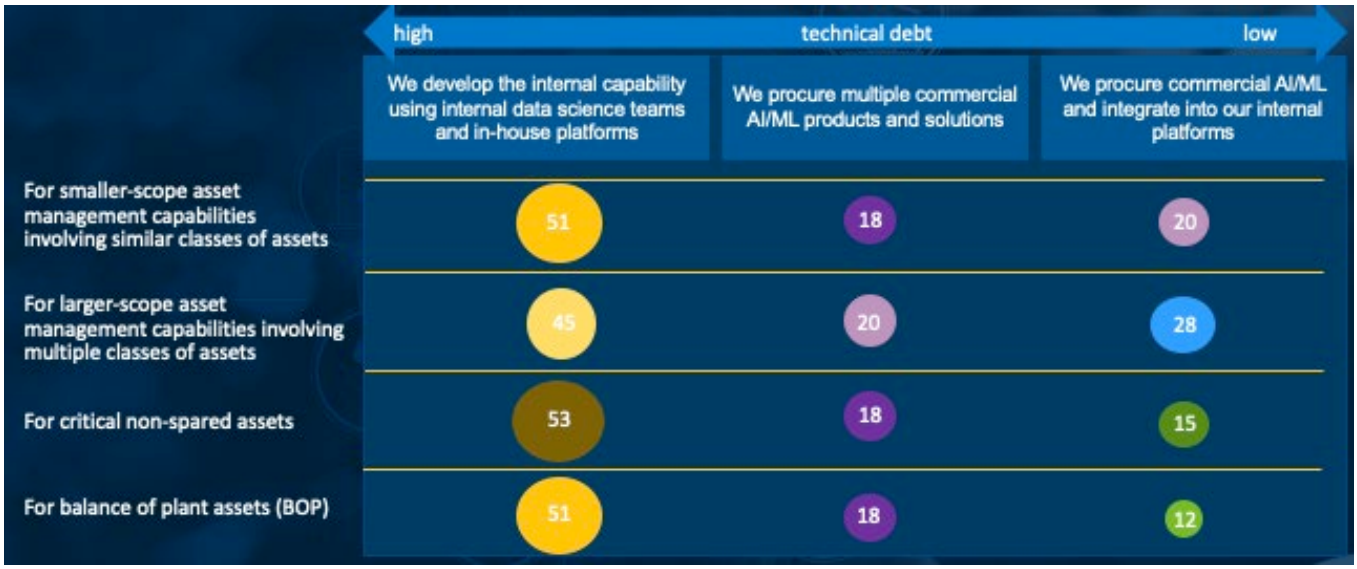
Technical debt refers to the concept in software development where shortcuts or suboptimal solutions are knowingly or unknowingly taken during the development process. It represents the accumulated consequences of choosing quick and easy solutions in the short term, which may lead to additional work or problems in the future.

Technical debt arises when developers or teams make tradeoffs regarding code quality, architecture, and interoperability, or other aspects of software development to meet immediate deadlines or deliver software quickly. Leaders prefer to procure commercial AI/ML solutions, integrate them into internal platforms, and maintain a robust process to integrate operations, maintenance, and reliability teams with IT and data science groups.



How does your company deliver AI and machine learning capability to improve asset performance?

Asset Performance Strategy Development and AI/ML Development

Developing an asset performance strategy involves creating a comprehensive plan to ensure the optimal performance and longevity of equipment and systems within an organization. This strategy focuses on maximizing reliability & process efficiency and achieving the best possible return on investment from the assets. Major activities include asset criticality assessment, defining maintenance objectives and performing failure mode effect analysis (FMEA), RAM analysis, and reliability centered maintenance (RCM).

In the past, at best, users supplemented a strategy with rudimentary real-time data collection and condition-based maintenance often without involving IT or other specialists. With the application of advanced AI, machine learning algorithms, modern frameworks and methodologies are needed. A broader skill set is required to link proactive asset performance strategy with AI/ML, and this can be achieved through Scaled Agile Framework (SAFe).

The Scaled Agile Framework (SAFe) is a widely used set of principles, practices, and guidelines designed to help IT-OT organizations scale Agile methodologies to larger and more complex AI projects or across entire enterprises. SAFe provides a structured approach for implementing Agile practices at scale while maintaining alignment with business goals, improving IT-OT collaboration, and delivering value to customers more efficiently.

For IT-OT organizations, SAFe addresses the challenges of procuring multiple commercial AI/ML solutions and integrating these into internal platforms, thus reducing technical debt and improving interoperability. Agile methods bring together large organizations with various competencies, each with their dependencies with coordinated planning and execution, which is different from traditional waterfall projects.

To build AI capability and align AI/ML with a performance strategy, operations, reliability and SAF must be linked through effective IT-OT teams. Adjustments to most IT-OT organizations are required. Building a more centralized capability for agile transformation, centralized enterprise architecture, and portfolio management will help better screen and deploy new AI technologies for asset performance.

Recommendations

Improving asset performance requires a strategy far greater than improving asset utilization or uptime. Leading practices bring 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, AI can help analyze the cost and risk of such choices, not just on a single asset basis but its effects on other assets, production performance costs, and its interactions with logistical events.

Asset management is evolving from its roots in reliability and maintenance to provide an assurance of uptime or enhanced asset utilization to ensure the process is fully optimized. AI 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 product quality, and evade process-induced degradation of mechanical equipment. Where maintenance service is inevitable, predictive alerts give enough time to plan safe and environmentally conscious interventions, avoiding sudden and sometimes catastrophic breakdowns.

We recommend the following considerations for owner-operators and other technology users to consider when building AI capability into asset performance management. ARC Advisory Group has written about Scaling Asset Performance Management Across the Enterprise, addressing the resource-intensiveness of many AI solutions by minimizing the customization of AI implementations and creating better harmony between project teams. The report can be found here in the ARC client portal.

Based on ARC research and analysis, we recommend the following actions for owner-operators and other technology users:

- Organizational frameworks and workflows such as the Scaled Agile Framework should be adopted by IT-OT organizations.
- A robust process to incorporate SAFe into asset performance strategy and programs is required.
- Users should seek vendors and solution providers with the ability to work with both equipment and process data, provide early and accurate warning of potential issues and deploy quickly at scale.

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