

Compass to APM 4.0: From Maintenance and Reliability to Performance and Sustainability

Introduction

Across the industrial software sector, the asset performance management (APM) software market has exhibited resiliency to the COVID-19 pandemic, with operations and maintenance leaders turning to digital solutions to help optimize asset performance and intervention strategies to counteract demand shocks and supply chain disruptions. Over the last five years, the necessity for industrial firms to implement software to digitalize processes for monitoring asset health, predicting impending equipment failures and achieving sustainability objectives has become increasingly important. This study highlights the evolution of APM software and how traditional maintenance solutions can no longer meet market needs. Amidst rapid market changes, businesses can no longer afford to operate in a reactive manner, resulting in the introduction of proactive solutions such as APM 4.0. With APM solutions having previously been misrepresented and underutilized by asset-intensive industries, this report aims to discuss how the evolution from maintenance is reflective of market needs, and how APM is the protagonist to reaching sustainability and digital transformation objectives.

Research Methodology

To gain up-to-date insights into the APM software market while taking into consideration the rising interest in ESG, the tighter convergence of IT and operational technology (OT), and the demand for cross-functional value-add, we commissioned independent research firm Verdantix to undertake independent, anonymized phone interviews with 42 senior executives in engineering, IT, maintenance, operations and reliability management roles based globally. Respondents spanning eight industry sectors covering chemicals, food and beverage, mining, oil and gas (upstream and downstream), pulp and paper, pharmaceuticals and

renewable power generation worked for firms with revenues above \$250M USD. Verdantix conducted 42 telephone interviews (32 interviews were quantitative and 10 interviews were done qualitatively) with executives across process-intensive industries during March 2022. Verdantix probed these respondents about their past, present and future APM technology usage and plans, with the aim of understanding technology deployment priorities, APM software maturity, and investment decisions and barriers.

Past, Present and Future of APM Across Process-Intensive Industries

In recent years, industrial firms' asset management requirements have evolved from simply reducing maintenance-related costs to improving efficiency as well as performance and, more recently, achieving the firm's sustainability objectives. The increasing demand to do more with less, and the need to rectify existing process inefficiencies have resulted in a rise in the adoption of APM software. APM 4.0 goes one step further than conventional real-time, condition-based maintenance activities to incorporate machine learning (ML), artificial intelligence (AI), and Industrial Internet of Things (IIoT) devices. Together, they deliver predictive and prescriptive maintenance and reliability plans that analyze different scenarios to recommend the most effective way to move forward without under-maintaining or over-maintaining critical assets.



Effective Maintenance: The Origination of APM 4.0

Asset management solutions were traditionally large enterprise software tools that capitalized on asset data, enabling maintenance and reliability engineers to address asset reliability, maintenance and risk. When customers were asked why they were moving towards APM 4.0 solutions, Verdantix found that:

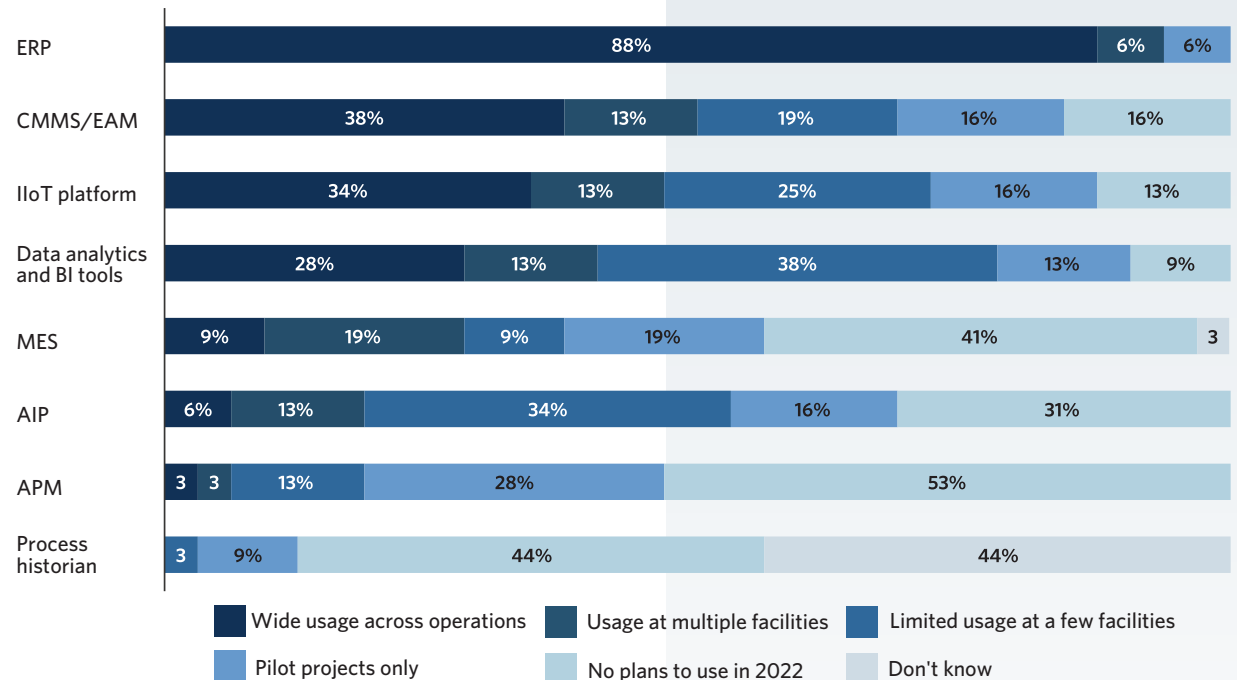
- **Traditional solutions to support asset maintenance activities are no longer sufficient.** Across asset-intensive industries, the use of APM software is still nascent with limited penetration across the market. Firms are still relying on traditional enterprise resource planning (ERP), computerized maintenance management systems (CMMS) and enterprise asset management (EAM) solutions to support reliability, maintenance and risk management activities. Across the surveyed industries, nearly 95% of respondents use ERP software widely across their operations or at multiple facilities, while over 50% use either CMMS or EAM solutions. Conversely, only 6% of respondents mentioned using APM software widely across their operations or at multiple facilities (see Figure 1). However, over 90% of respondents stated improving

maintenance along with quality and process safety as high priorities for their firms (see Figure 2 on next page). With conventional condition-based maintenance approaches no longer providing enough insight to effectively improve asset performance, firms are turning to solutions that offer predictive and prescriptive models offered by APM software.

“We haven’t got time to waste and therefore need our plants to be as productive as possible. APM solutions can help us optimize process performance.”

– Cluster Head, Manufacturing and Operations, Chemicals Firm, Asia-Pacific (APAC)

Figure 1 To what extent do you use the following commercial software products at your firm?

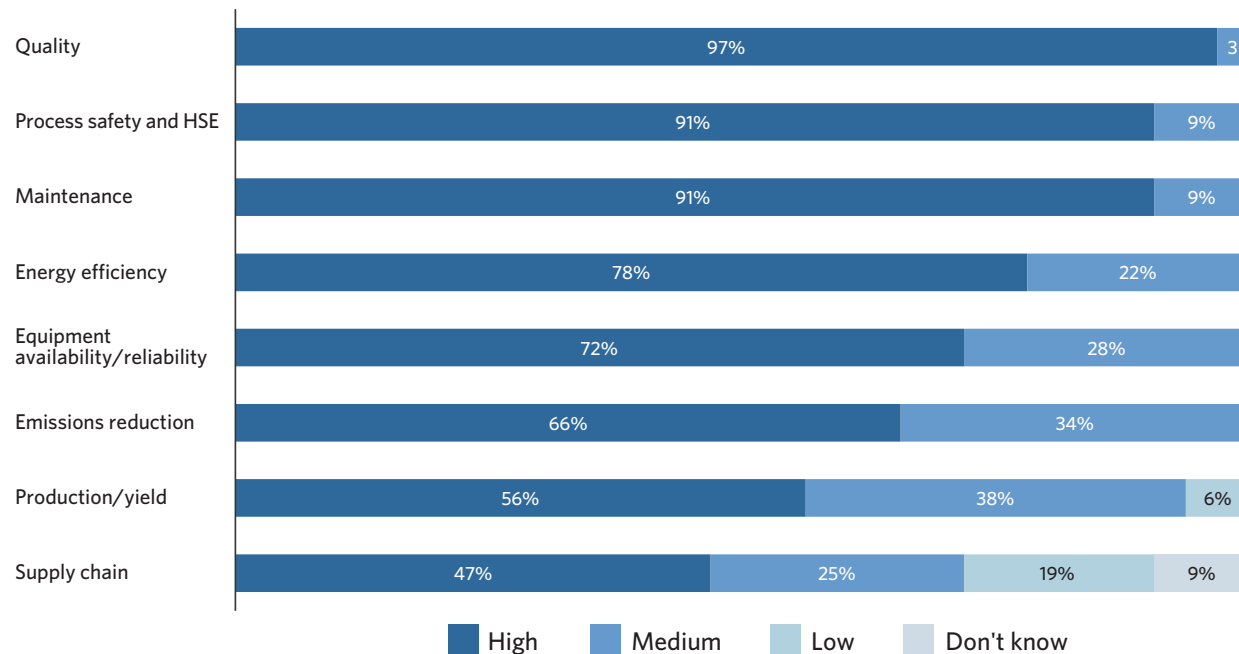


Data labels are rounded to zero decimal places; percentages less than 4% have been written as numbers
Source: Verdantix interviews

- Decision-makers originate from all parts of the business, not just reliability and maintenance. As more asset data are obtained and processed, firms are realizing that not only is APM software beneficial for maintenance and reliability departments but so too for operations, IT and other key stakeholders. Senior managers and C-suite executives are now calling for greater insight and cross-practice collaboration to improve process as well as asset efficiencies. With the availability of more advanced analytical technologies, stakeholders are looking to tackle the challenges associated with the increasing failure and risk complexities of the process industries.

Figure 2

What is the level of priority to improve the following key processes today?



Data labels are rounded to zero decimal places; percentages less than 4% have been written as numbers N = 32
Source: Verdantix interviews

“When investing in APM solutions, we create a team of people consisting of personnel from every single department who will be involved and who can benefit from the tool. This includes the end users all the way up to the executives and stakeholders. We are looking to create a business case that appeals to everyone.”

– CIO, Oil & Gas Upstream Firm, US



- **Firms are unaware of how to address challenges associated with maintenance processes.** Asset-intensive industries face mounting pressure to achieve business KPIs around improving quality, performance and efficiency as well as safety while navigating the challenges of restricted capital and operating budgets. Operations and reliability managers are additionally pressured with understanding how and when assets will fail, which failures are most severe and which would result in the greatest benefit when detected. These challenges convey a large degree of uncertainty, driving the need for solutions that can help operations and reliability teams better utilize data and provide insights.

The Expansion of Asset Performance: The Current Status of APM 4.0

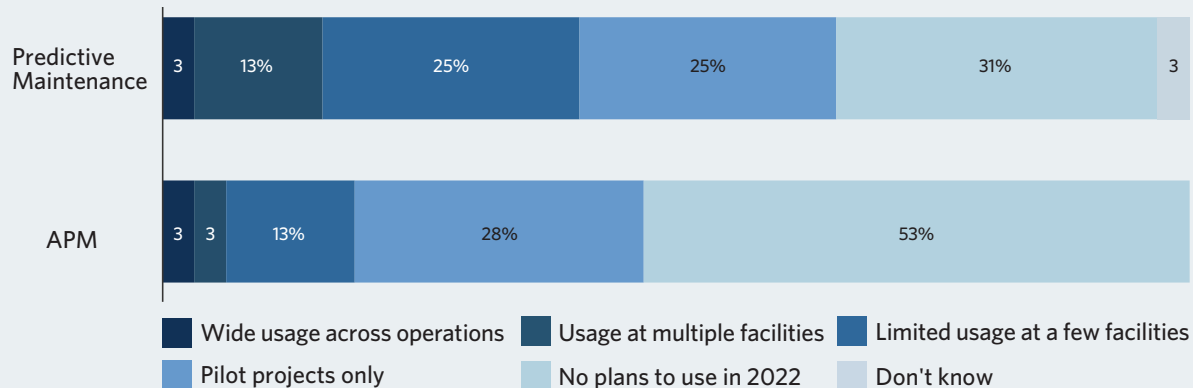
Asset-intensive organizations, particularly in the oil and gas, chemicals and utilities industries, have turned to ML/AI and IIoT technologies to help improve asset performance and meet business objectives. APM solutions enable integration and analysis of data with insights to drive improvements. When asking survey participants about APM software, Verdantix found that:

- **APM software is still viewed within the context of optimizing maintenance with little clarity on the wider business impacts.**

When asked about usage of commercial APM software, 47% of respondents stated

that it was used either widely across operations, at multiple facilities, at a limited number of facilities or as pilot projects only. However, 66% of respondents claim to be using commercial maintenance software for predictive maintenance, a core functionality of APM software (see Figure 3). This mismatch reveals a lack of understanding of APM capabilities. Firms need to know that the benefits of APM software go well beyond improved asset reliability and uptime to increased performance efficiency, optimized asset lifecycle costs and achieved sustainability targets. Without APM solutions, firms will likely see siloed data challenges continue.

Figure 3 APM software usage compared to commercial maintenance software used for predictive maintenance



Data labels are rounded to zero decimal places; percentages less than 4% have been written as numbers
Source: Verdantix interviews

N = 32

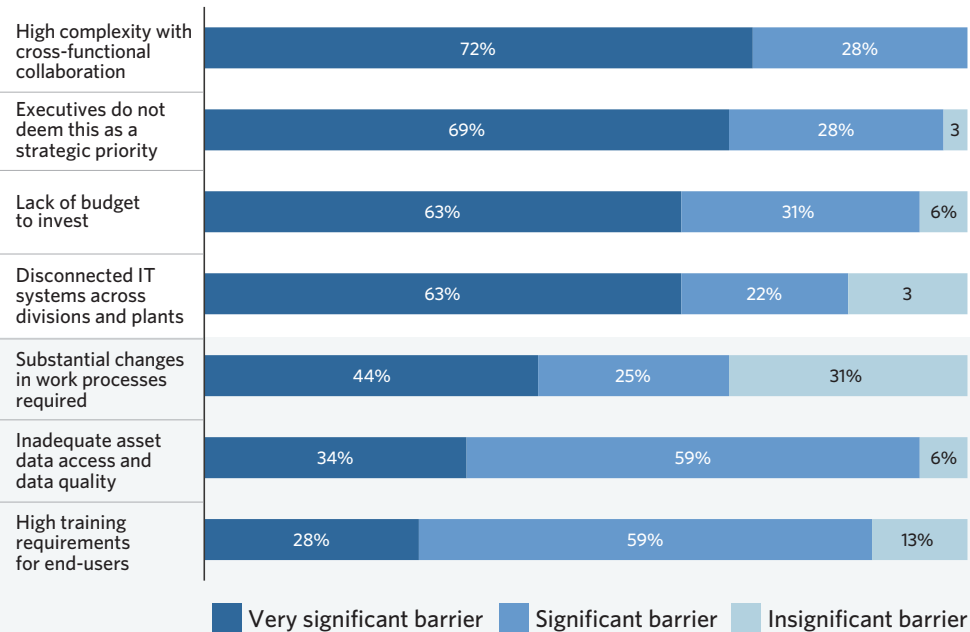
“We successfully redesigned the layout of our process to streamline maintenance activities, promote collaboration opportunities and increase process insights... By doing so, we increased production yield from 70% to 90% and reduced time to market by 25%.”

– Plant Operations Manager,
Chemicals Firm, US

“We are looking to deploy APM to help with maintenance of our assets across the entire plant. As a result, we can reduce downtime and increase time between turnarounds.”

– OpEx Director, Oil & Gas Downstream Firm, APAC

Figure 4 How significant are the following challenges that could prevent your firm from investing in APM solutions over the next 2 years?



Data labels are rounded to zero decimal places; percentages less than 4% have been written as numbers
Source: Verdantix interviews

N = 32

- **Complexity and lack of executive buy-in are the key barriers to investment in APM software.** As beneficial as implementing APM solutions can be, over 90% of respondents cited high complexity with cross-functional collaboration, lack of buy-in from executives along with restricted budget and inadequate as well as low-quality asset data, as the most significant barriers to investment in APM solutions over the next two years (see Figure 4). While APM can deliver a number of benefits, a lack of understanding has resulted in stakeholders allocating minimal priorities and budgets. However, with ongoing automated integration opportunities and the ever-increasing importance of risk and sustainability, firms can reposition APM as a holistic tool that will drive growth and innovation.

- **Over 95% of firms expect vendors to provide strong capabilities for asset lifecycle information management.** Asset information management, performance management and reliability centered maintenance were mentioned by over 50% of the respondents as the top three most important capabilities considered when evaluating APM software (see Figure 5 on next page). APM software helps firms improve reliability and availability of assets via condition monitoring, predictive and prescriptive maintenance, and asset integrity management, coupled with a host of data collection, visualization, and analytics tools.

“The biggest challenge isn’t just convincing management but also deploying the software. It is often difficult to set up such a solution, train users and manage the change.”

– Chief Digital Officer and Director IT Applications Data, Oil & Gas Upstream Firm, Europe

Beyond Maintenance Towards Sustainability: The Future of APM 4.0

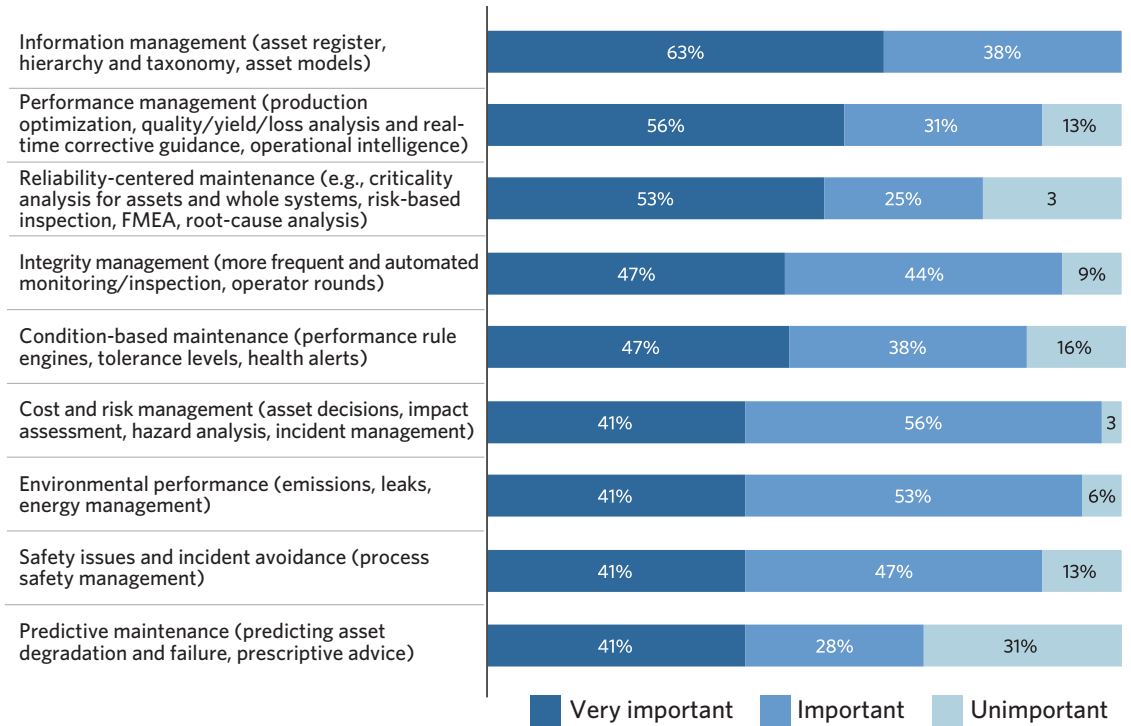
The lack of understanding around the benefits that APM software can deliver beyond maintenance optimization is affecting its uptake and penetration as compared to traditional maintenance solutions, such as CMMS and EAM. Nevertheless, with the continued investment into asset management digital transformation strategies and the need for capital-intensive sectors to improve productivity and sustainability at existing plants, there is clear evidence that APM usage is set to increase in the years to come. When asking respondents about their future outlooks and investment plans, Verdantix found that:

- **APM software is vital for achieving business goals.**

Fifty-six percent of firms believe APM is essential for the success of their business goals, while 44% believe it to be a high priority (see Figure 6). APM fits in the general operational excellence strategy of firms, enabling users to manage assets and prioritize business objectives alongside traditional asset reliability and availability activities. With the growing necessity for APM solutions, firms are expecting to work with solution partners with a deep understanding of their business operations and industry challenges.

Figure 5

How important are the following functional capabilities when you evaluate software applications for APM?

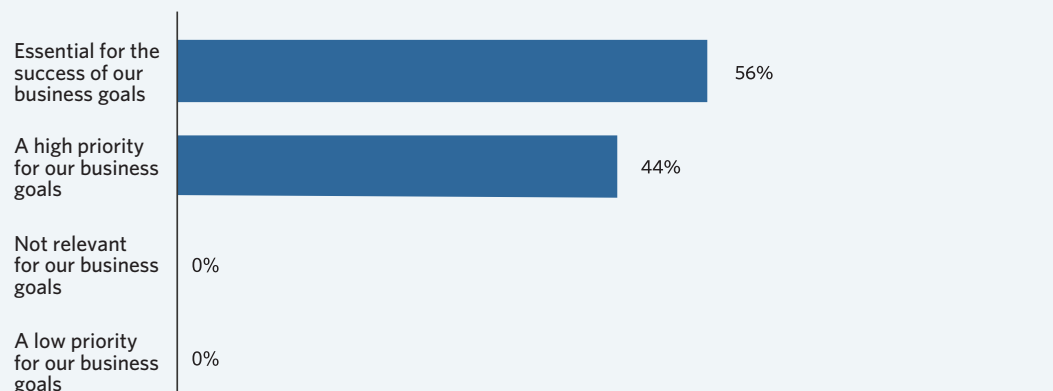


Data labels are rounded to zero decimal places; percentages less than 4% have been written as numbers
Source: Verdantix interviews

N = 32

Figure 6

Which statement best describes how asset performance management (APM) solutions are perceived by your function?

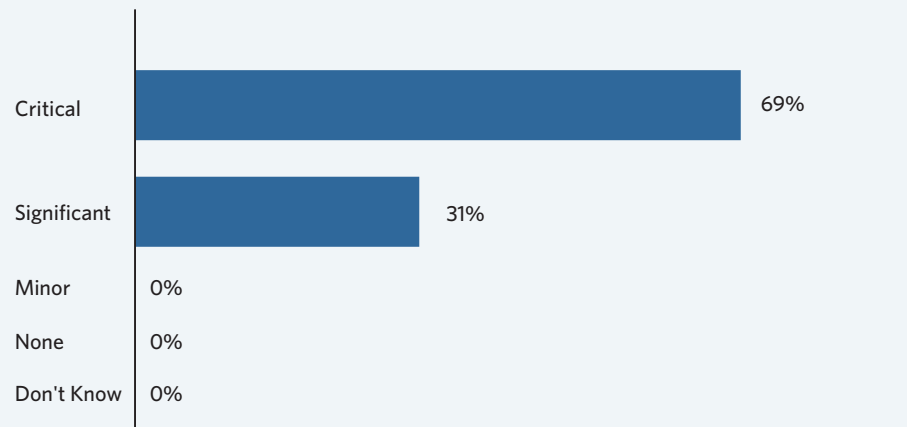


Data labels are rounded to zero decimal places
Source: Verdantix interviews

N = 32

- Over two thirds of firms plan to use APM software to achieve sustainability KPIs. The accelerated embracement of ESG metrics resulting from global initiatives such as COP26 and carbon neutrality targets coupled with new regulations is radically changing the way stakeholders position sustainability across the business. Quantifiable sustainability strategies are becoming key to business growth. APM software is the protagonist for such sustainability strategies, with all respondents citing APM software as playing a critical or significant role in achieving their firm's sustainability KPIs (see Figure 7). When probed about factors driving investment into APM solutions over the next two years, improving sustainability metrics was mentioned as a "very important" or "important" factor by 100% of the respondents (see Figure 8).

Figure 7 What role does asset management software play in achieving your sustainability KPIs?



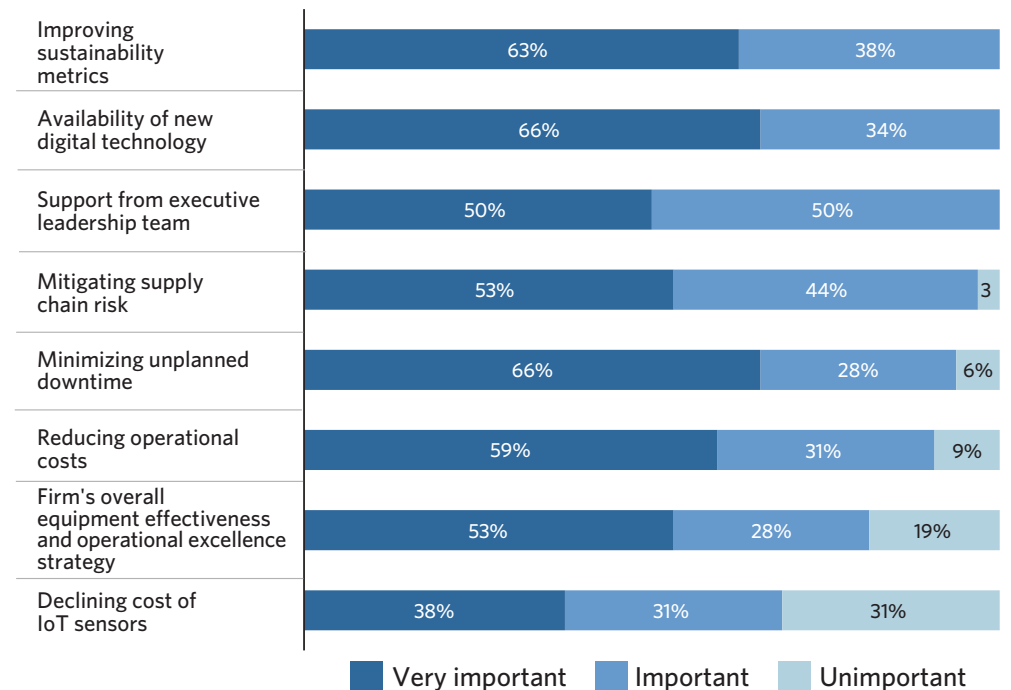
Data labels are rounded to zero decimal places
Source: Verdantix interviews

N = 32

“Data management is the main challenge. Without a proper data management platform in place, we will not be able to effectively access the right data and will struggle to achieve business objectives.”

– Technical Lead for Asset Integrity Management, Power Generation Firm, APAC

Figure 8 How important will the following factors be in driving your firm to invest in APM solutions over the next 2 years?




Data labels are rounded to zero decimal places; percentages less than 4% have been written as numbers
Source: Verdantix interviews

N = 32

“Undertaking maintenance for asset reliability is critical. You need to be good at this or you won’t be a world-class organization. We use APM software to really focus on reliability and improving downtime but also to increase production.”

– VP Engineering, Food & Beverage Firm, US



“Sustainability is new to our business but becoming increasingly important. We are now looking at technologies that we currently use such as APM software to support in the reduction of our carbon footprint.”

– Chief Digital Officer, Oil & Gas Upstream Firm, Europe

“We need to reduce energy consumption and emissions by 2025. Currently, reporting is done manually but integration of our APM software and extending the workflows with CMMS or EAM software would be very useful.”

– Operations Excellence Manager, Food & Beverage Firm, Europe

- **Achieving a reduction in emissions and energy consumption are strong APM objectives for firms.** Maintaining process and product quality has been the main focus for decision-makers in recent years, but over the next five years we expect a shift, with key stakeholders looking to incorporate ESG and sustainability performance metrics into the overall assessment of business performance. The interview results showed the biggest shift in priority to be for emissions reduction (+18%) and production optimization (+28%) (see Figure 9). Moreover, 66% of firms strongly associate using APM solutions with reducing energy consumption and emissions (see Figure 10 on next page).

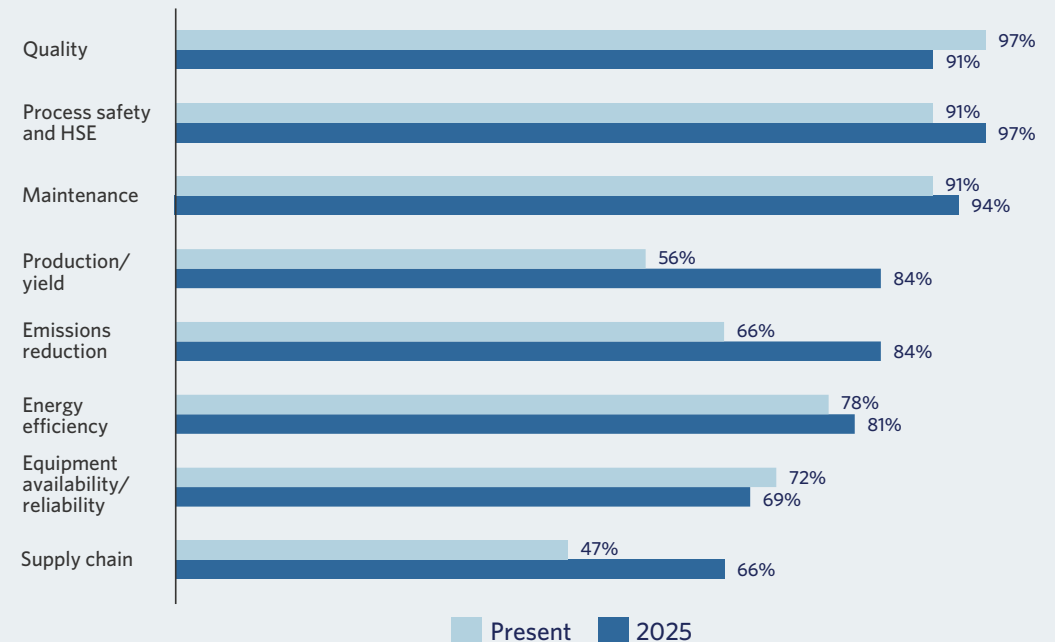
- **Reducing downtime and operational costs will continue to drive firms' investments into APM solutions.** Maintenance strategies will continue to evolve and broaden in the years to come, particularly with investment in IIoT technology encouraging data-driven decisions. With ongoing functional developments and advanced data analytics providing accurate forecasts on performance for better strategic and capital investment planning, APM solutions will continue to support transitioning business priorities while reducing downtime and operational costs. Over 90% of executives also indicated minimizing unplanned downtime and reducing operational costs as important factors driving investment into APM.



“APM will drive autonomous maintenance capabilities and provide us with user-friendly dashboards to be used across the business, allowing us to meet strategic goals. We plan to use data from pilot plants and AI algorithms to effectively roll out new management processes and remote assistance capabilities.”

– Operations Excellence Manager,
Food & Beverage Firm, Europe

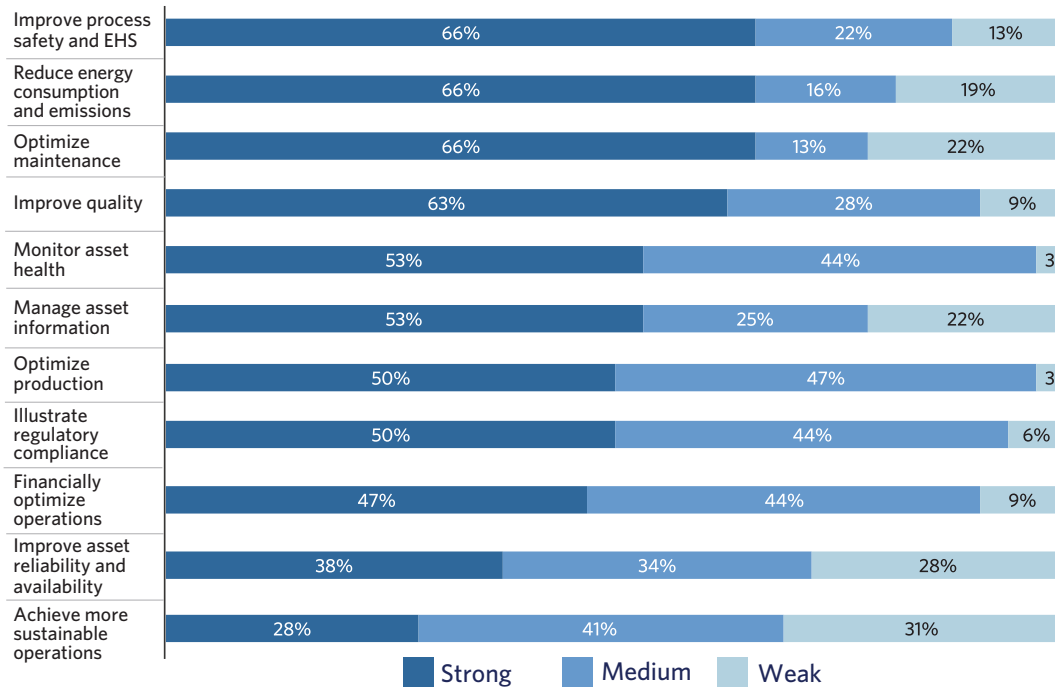
Figure 9 What is the level of priority to improve the following key processes over the next 5 years compared to today?



Data labels are rounded to zero decimal places
Source: Verdantix interviews

N = 32

Figure 10 How strongly do you associate each of the following objectives with APM?



Data labels are rounded to zero decimal places; percentages less than 4% have been written as numbers
 Source: Verdantix interviews **N = 32**

- Improving EHS as well as process safety and optimizing maintenance will remain as top APM objectives.** Alongside shifting priorities towards sustainable operations, firms will continue to prioritize performance efficiencies. When questioned on how strongly EHS, process safety management and maintenance are associated with APM, 66% of respondents stated strong associations between the two. APM solutions use advanced data analytics to optimize the performance of assets, increasing asset reliability and availability while optimizing maintenance, mitigating risks and bringing together siloed data. By understanding risk and asset lifecycles, firms can conduct detailed process hazard analysis, impact assessment, incident management, and management of change operations that support the implementation and maintaining of cost-effective regulatory compliance strategies.

“Currently, data science models can point to a machine in the future that will go out of limits, but they are failing to offer visibility over what is happening and why. Similarly, to the human body—the prescriptive part is very critical, especially for manufacturing assets where one failure can result in billions of dollars. We want to not only know where the issue is but also how to mitigate it.”

– VP Manufacturing, Oil and Gas Firm, APAC



Summary: Gearing Up for Success

The priorities of industrial firms are changing. While minimizing asset downtime and maximizing production as well as quality remains important, sustainability, EHS and operational initiatives are becoming intricate parts of a firm's strategic objectives. Evolving with the priorities of process-intensive industries, from maintenance operations to process optimization, lifecycle analysis and environmental performance, APM solutions are well positioned to support firms on their evolving digital journeys and objectives. APM 4.0 strategies connect engineering, operations and performance to streamline digital transformations (see Figure 11).

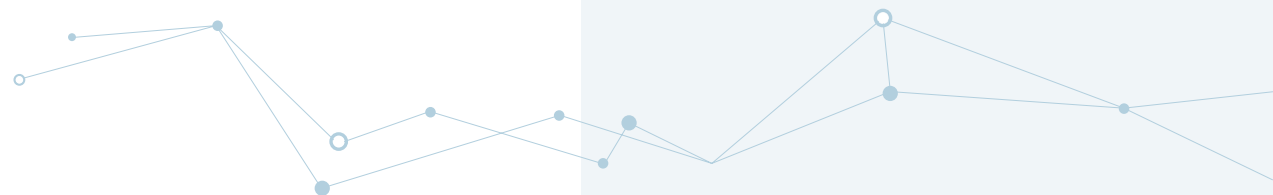
By working closely with APM software providers to understand the use cases, benefits and risks delivered by APM solutions, firms, no matter at what stage they are in their asset management maturity journey, can safely evolve maintenance strategies to improve asset reliability and performance, better predict and manage asset failures and simplify operations within a single platform. APM 4.0 is set to become the only way to manage the whole asset lifecycle while continuing to deliver value.

Figure 11

The Evolution of APM 4.0

	2000-2010	2010-2022	2022+
People	Reliability and Maintenance Managers and Technicians	Operations, Plant Managers, Investment Managers	Sustainability, Key Decision-Makers, C-Suite, Stakeholders
Process	Digitizing, capturing and monitoring data to support reliability, maintenance and risk	Condition-based and preventative analytics to contextualize performance and asset data (IT and OT) to support asset failure	RCM and prescriptive analytics to automate tasks impacting maintenance and operations
Technology	Historians, SCADA, DCS for data capture Predominantly CMMS for maintenance activities	Siloed solutions EAM/CMMS for maintenance Introduction of AIP for investment planning	APM technology for decision support Improved AIP tools Data Ops, digital twins and ML/AI for advanced data analytics Sustainability related solutions
Value Proposition	Manage maintenance tasks, scheduling and costs	Manage and track asset and equipment data Extend equipment life and asset value, multisite management, CAPEX planning	Complete asset lifecycle analysis, optimizing performance, availability, risk, investment planning, energy consumption and sustainability metrics

Source: Verdantix research and analysis





About Aspen Technology

Aspen Technology, Inc. (NASDAQ: AZPN) is a global software leader helping industries at the forefront of the world's dual challenge meet the increasing demand for resources from a rapidly growing population in a profitable and sustainable manner. AspenTech solutions address complex environments where it is critical to optimize the asset design, operation and maintenance lifecycle. Through our unique combination of deep domain expertise and innovation, customers in capital-intensive industries can run their assets safer, greener, longer and faster to improve their operational excellence.

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