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Smart Innovators: Maintenance Analytics For Heavy Asset Industries

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OPERATIONAL EXCELLENCE

Smart Innovators: Maintenance Analytics For Heavy Asset Industries

The effectiveness of maintenance activities underpins the performance of industrial operations. If maintenance is not performed, assets break and production ceases, while if maintenance is performed too often, costs mount and the bottom line suffers. This report details the solutions on the market that provide insights into the effectiveness of maintenance programmes, and the means to improve them, using data from assets and work orders. Fourteen vendors participated in our research, providing demos and briefings. This report details their offerings, the varying approaches they are taking to solving customer challenges, and the innovations and methods now being deployed. It concludes with a view on the future direction of the market. Evolution in the market is being driven by macro-factors such as the global COVID-19 pandemic and generation shifts, as well as a convergence of technologies changing the way people interact with software solutions.

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Demand For Asset And Maintenance Work Insights Buoys The Analytics Market

The effectiveness of maintenance activities underpins the performance of industrial operations. If assets are not maintained properly, they could break and impact production, while if maintenance is performed too often, costs will mount and the bottom line suffers. This report details the solutions on the market that provide insights into the effectiveness of maintenance programmes, and the means to improve them, using data from assets and work orders. Verdantix undertook briefings, discussions and demos with 14 vendors in the market. This report details their offerings, as well as the innovations and methods currently being deployed, and ends with a view on the future direction of the market.

Industrial Firms Increase Spend On Analytics To Optimize Maintenance Activities

Heavy asset firms leverage analytics to gain insights into the health of assets and use data to optimize their maintenance programmes. Managers in operations, maintenance and engineering functions in industrial firms are:

- **Prioritizing asset reliability, integrity and performance measurement over the next two years.** Managers in operations, maintenance and engineering functions have a broad range of priorities for their businesses over the next few years. Amongst these are aims to enhance the performance of their assets. Of the 259 executives in operations, maintenance and engineering roles who participated in the 2020 Verdantix Global Corporate Survey, 38% mentioned that asset reliability and integrity would be a high priority for improvement for their firms over the next two years, while 43% said the same for asset performance measurement (see Verdantix Global Corporate Survey 2020: Operational Excellence Budgets, Priorities And Tech Preferences).

- **Using software for asset management and maintenance optimization.** Industrial firms have wide deployments of software for managing assets and optimizing maintenance. In the Verdantix 2020 Global Corporate Survey, 42% of executives stated that they used enterprise asset management (EAM) software, while 40% used maintenance optimization software across multiple facilities. Firms have deployed EAM software from suppliers such as IBM, Infor, iOffice and Pragma to plan, prioritize and action maintenance activities for decades (see Verdantix Market Overview: Asset Management Software Landscape).

- **Increasing spend on asset failure prediction and maintenance scheduling.** Of the 259 respondents in the 2020 Verdantix survey, 16% intended increasing spend on maintenance planning and scheduling by more than 10%, while 15% planned to increase their spend by double digits for asset failure prediction. These double-digit rises in spend reflect a need to avoid unplanned downtime and to enhance efficiency across industrial assets, whilst ensuring that expenditure stays low.

Firms Are Moving From Reactive To Proactive Maintenance Strategies

Managers across operations, maintenance and engineering plan to increase spend on software for optimizing maintenance. Common asset maintenance strategies encompass (see **Figure 1**):

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- **OEM-recommended planned maintenance for managing assets.**
  Regular, planned maintenance and replacement activities based on guidance from original equipment manufacturers (OEMs) are still typical across many industries. Eneco, the Netherlands-headquartered producer and supplier of natural gas, electricity and heat, has implemented a computerized maintenance management system (CMMS) from Ultimo to ensure that preventative as well as scheduled maintenance is carried out on time. After implementing EAM software from Arcadis Gen, DAA (Dublin Airport Authority) increased the proportion of its planned versus reactive asset maintenance activities, as well as the efficiency of its maintenance activities, by consolidating data from disparate systems, simplifying the reporting of issues and enabling the easy creation of work orders.

- **Condition-based maintenance – widely used amongst process industry players.**
  Firms can monitor the condition of an asset through visual, in-person inspections, or by remote means, with sensors providing information on key parameters such as vibration, temperature and pressure. When a predefined indicator shows that an asset needs maintaining, the operations teams will create a work order. Vale implemented ABB Ability's Asset Vista condition monitoring solution at its S11D complex to monitor the condition of more than 6,000 assets on site, achieving valuable maintenance cost savings and helping to extend the life of its assets.

- **Reliability-centred maintenance, taking centre stage at technologically mature firms.**
  Reliability-centred maintenance (RCM) goes a step beyond condition-based maintenance. Through RCM, firms ensure that maintenance tasks are performed in an efficient, cost-effective, reliable and safe manner. RCM accounts for a facility's entire systems and equipment life cycle, focusing on performing maintenance tasks in a way that enhances the safety and reliability of equipment. Effective RCM programmes leverage asset strategy modules from the likes of ARMS Reliability and AspenTech, to rank the criticality of equipment and model the impacts of run-to-failure events. This can then ensure that the correct maintenance approaches are applied to the right equipment – for example, applying preventative maintenance to equipment whose failure would cause plant downtime.

Introducing the Asset Maintenance Analytics Software Market

Heavy asset firms leverage a range of tools to provide insights into the health of assets and the performance of maintenance programmes, with the aim of driving optimization in their scheduling and execution. Verdantix defines maintenance analytics software as:

"*Software to explore and gain insights into data related to assets and workers, with the aim of informing decisions to optimize maintenance, determine asset strategy, and drive cost savings related to the upkeep of firms' industrial facilities."*

Maintenance Analytics Needs Of Customers Vary, Based On User

Multiple people within an organization make use of maintenance analytics software. Each user has different preferences, with:

- **Operations managers preferring black box solutions.**
  Frontline workers, especially in operations, maintenance and engineering functions, look to leverage black box analytics that require the user to enter inputs and then receive insights, with the software provider doing all the heavy lifting in terms of programming and training the analytics. Alcoa, an aluminium manufacturer, implemented Senseye's predictive maintenance software to enhance its operational efficiency and asset reliability (see Verdantix Alcoa Improves Operational Efficiency And Asset Reliability

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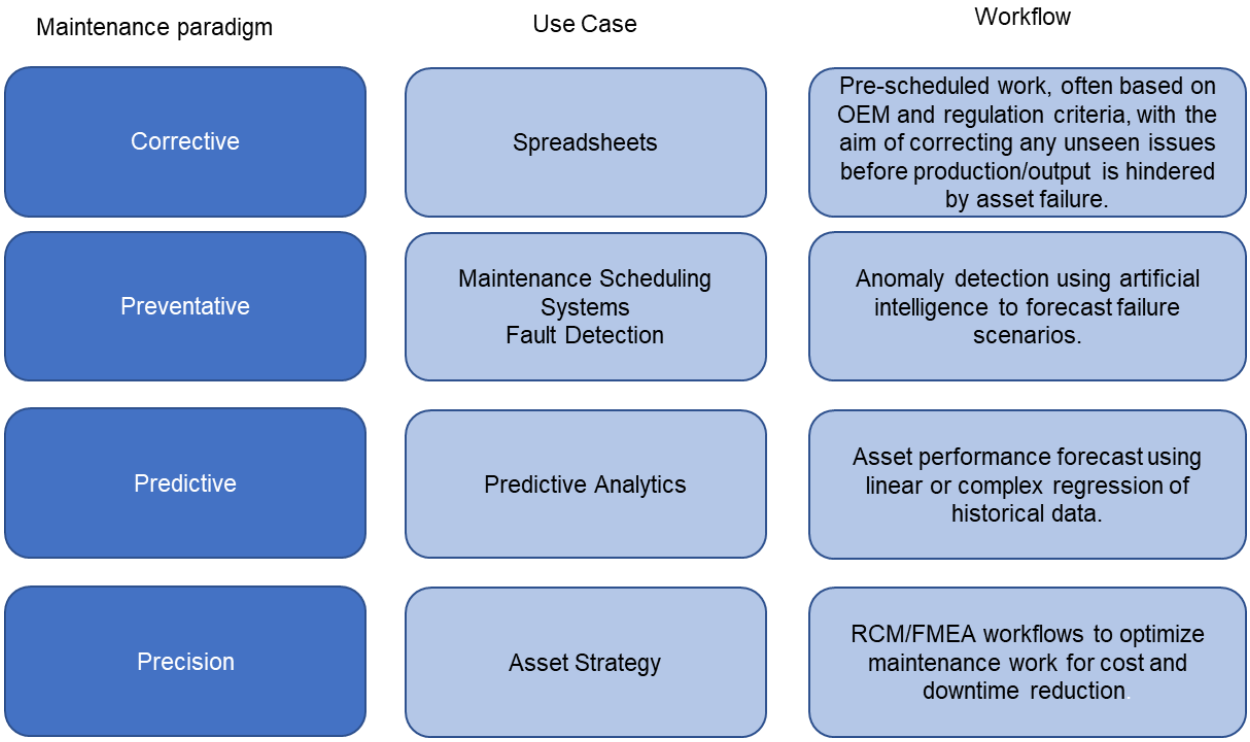
FIGURE 1

Maintenance Paradigms And Related Solutions



Source: Verdantix

With Predictive Maintenance). Senseye's predictive maintenance software leverages analytics developed using the vendor's expertise in discrete manufacturing, along with AI capabilities, to capture the client's know-how, bypassing the need for lengthy co-development processes.

- **Reliability engineers in large organizations leveraging low-code analytics.**
  Users who want greater flexibility in where they gain insights have the option of working with a low-code maintenance analytics provider. Reliability engineers who have strong domain expertise, but do not wish to code a new programme, can use solutions offered by the likes of AVEVA and GE Digital to gain insights into the health and performance of their assets. Anglian Water, a UK water utility, worked with AVEVA to implement a leak-detection solution that compares historical metrics with real-time network data to provide insights into water waste for regulatory compliance (see Verdantix AVEVA Complements Its Asset-Centric Software Portfolio With Worker-Focused Digital Solutions).

- **Data scientists using customizable, self-service, programmable software.**
  Firms that want to analyse asset data in multiple ways to gain insights for their firm-specific use cases can work with open analytics platform providers such as MATLAB, Python and Seeq, which allow data scientists to write code directly into the software and upload templates. Covestro, a Germany-headquartered process manufacturer, launched a process data analysis and visualization (ProDAVis) initiative that leveraged Seeq's platform, along with OSIsoft PI, to monitor processes within its operations.

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Different Analytics Providers Offer Varying Levels Of Sophistication And Customization

Users of maintenance analytics software require different levels of transparency and customization. To meet customer requirements, vendors offer a range of analytics, with varying levels of customization and sophistication (see **Figure 2**). Analytics providers have developed solutions to cater to diverse customer needs, by offering:

- **Data management capabilities, to ensure information is clean and usable.**
  The first step in successful maintenance analytics initiatives is management of the data being used. Information management systems ensure that data are accurate, contextualized with the correct tags, and accessible at the right frequencies. Some firms, such as Cognite, Hitachi Vantara and Uptake, offer automated data liberation and contextualization capabilities as well as analytics, to gain actionable insights. Uptake, a Chicago-headquartered industrial AI and Internet of Things (IoT) vendor, provides a suite of solutions to liberate and contextualize operational data, following its acquisition of ShookIOT in February 2021. The firm delivers insights via its Uptake Radar asset failure prediction and anomaly detection software, without its customers, which include Caterpillar and PepsiCo, requiring any data science skills (see **Figure 3**).

- **Varying levels of sophistication in analytics, to gain insights.**
  Firms can leverage analytics of differing levels that match their needs. Firms that look to model complex relationships between interrelated assets and work processes, by analysing large, disparate data sets, can deploy sophisticated analytics capabilities from providers such as ABB, AVEVA, Bentley Systems and GE Digital. EPCOR, a Canadian-headquartered power utility provider, worked with Bentley Systems to extend the latter's AssetWise deployment to include statistical-based failure curves, and to integrate supervisory control and data acquisition (SCADA) data to determine electrical loading information in near-real time (see Verdantix Bentley Systems Provides A Range Of Solutions To Create, Maintain And Operationalize Digital Twins For Process Industries). Not all use cases require sophisticated analytics. Firms can use analytics offered by EAM software providers such as Aptean, IFS, iOffice and Pragma that provide insights into past work order completions, cost and uptime. Pragma's On Key Insight leverages the Qlik business intelligence (BI) platform to help firms visualize as well as analyse data, in order to provide financial insights, set up health- and safety-related KPIs and undertake custom analysis for conditioning monitoring, lifecycle cost and spatial analysis (See **Figure 4**).

- **Differing approaches towards customizability of the analytics deployed.**
  A firm's requirements for customizability of analytics depend on its internal data science resources. Firms with small or no data science resources prefer plug and play analytics software, such as that offered by C3 AI, Falkonry, Senseye and TrendMiner, for pre-configured use cases. These are often low-code or no-code analytics. C3 AI has developed off-the-shelf analytics applications for some high-value use cases such as predictive maintenance, inventory optimization, production optimization and fraud detection. Similarly, Arcadis Gen's Water AI Pipe Predictor is an off-the-shelf analytics application targeted at firms in the water sector, which helps to predict pipe failures such as bursts, wastewater collapses and pollution incidents. If a firm has more robust data science resources to deploy for the development of maintenance analytics, it may choose to work with software providers such as Cognite or Seeq, which provide platforms for data scientists to write their own code and run analytics on their data sets (see **Figure 5**).

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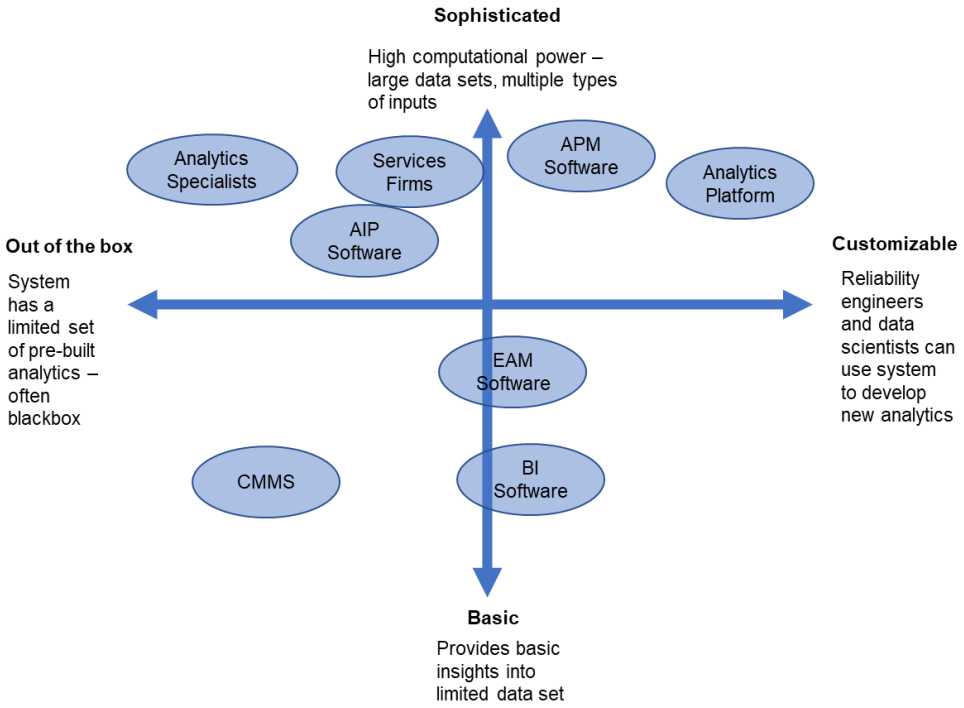
FIGURE 2

Maintenance Analytics Sophistication And Customization



Source: Verdantix

Maintenance Analytics Deliver A Range Of Insights

Successful maintenance analytics requires cleaned data, real-time data integrations, and appropriate workflows. Users of maintenance analytics leverage software to provide (see **Figure 6**):

- **Fault detection and diagnostics for alerts on asset condition.**
  Fault detection and diagnostic analytics, also called condition monitoring and fault diagnosis, provide users with updates on the condition of assets. Data from an asset – covering vibration, temperature and sound from equipment – are analysed to identify deviations from normality. Fault detection can occur through rules-based systems leveraging predefined deviations with alerts, or AI that analyses multiple data sets to provide insights based on behaviour between related assets that could lead to a failure event. Itus Digital's asset twin library covers 181 equipment classes, 1,396 failure modes, 845 maintenance activities and 1,514 condition-based protections. By leveraging this, firms can quickly create equipment-level twins to determine their risk profile and establish thresholds and critical indicators, as well as to proactively monitor asset health, while suggesting actions to be taken in case of an anomaly.

- **Asset failure prediction, to reduce unplanned downtime.**
  Asset failure prediction uses failure modes developed from historic data to forecast the likelihood of an asset failing and the length of time until that failure occurs. Firms develop failure modes based on past asset failures; in cases where an asset has not previously failed, domain expertise from a reliability or integrity engineer can be sought to identify data trends that match likely failure events. An offshore oil and gas firm worked with Falkonry to avoid the unplanned downtime of compressors and rotating machinery that was resulting in 36 hours of lost production, at $200,000 per day. Falkonry's Operational

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FIGURE 3

Data Management Functionality Assessment Of Maintenance Analytics Software Providers

Vendors	Data Management
ABB	◑
Aptean	◔
Arcadis Gen	◕
AspenTech	●
AVEVA	◕
Bentley Systems	●
C3	●
Cognite	●
Falkonry	◕
GE Digital	◕
IFS	◑
Itus Digital	◕
Lloyd's Register	◕
Pragma	◑
Seeq	◕
Senseye	◕
Symphony IndustrialAI	◑
TrendMiner	◕
Uptake	●

○ No functionality ◔ Limited functionality ◑ Solid functionality

◕ Differentiated functionality (e.g. real-time data integration) ● Market leading

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AI software identified patterns in the operations that preceded critical failures, to predict asset failures up to six weeks before they occurred.

- **Lifecycle costing, to enable a firm to plan expenditure for replacements and upgrades.**
  Leveraging asset, work and financial data to gain insights into the cost of an asset over its entire life cycle has risen up the agenda. Copperleaf, a provider of asset investment planning software, offers C55, an investment lifecycle planning application that streamlines the process of developing, approving and managing investments. Other vendors in this space, including Arcadis Gen, Cosmo Tech and DIREXYON, provide comprehensive insights by analysing larger amounts of equipment and modelling various scenarios to identify strategies that offer the greatest potential reduction in expenditure for replacements and upgrades.

- **Risk scoring, to highlight the likelihood of hazards.**
  An emerging maintenance analytics use case is quantitative risk scoring. These analytics forecast the likelihood of a failure and quantify the magnitude of the related hazard. AVEVA, Cognite and Lloyd's Register have all developed solutions that can traffic-light a 3D image of a site or facility, to highlight in red, yellow or green the level of risk in an area. This is used to inform operations teams whether work should, or should not, go ahead.

- **Spare parts demand forecasting, to inform purchasing decisions.**
  Maintenance work delays and stoppages are often caused by a site lacking the correct spare parts or equipment for a job. Spare parts demand forecasting analytics leverage data on expected end of life for assets, as well as work orders and historical demand data, to alert procurement managers and maintenance teams when new parts need to be acquired. Demand forecasting can also be used to identify when a key resource may decrease. Arcadis Gen has developed a tool for water utilities that takes water and water table data, along with historic water consumption data, to forecast demand for water and to identify areas that risk falling short.

Future Direction Of Maintenance Analytics Market

The maintenance analytics software market has developed over the last few decades as part of the asset management software landscape (see Verdantix Market Overview: Asset Management Software Landscape). Vendors offer a wide array of solutions to enable engineers and data scientists to gain insights into asset data and optimize maintenance programmes. Recent macro-trends have caused a surge of demand for new ways of working and methods to garner improvements from assets.

Global Macro-Trends Drive Innovation In The Maintenance Analytics Software Market

Maintenance analytics software requires a multi-phase approach and delivers multiple functionalities. Global macroeconomic trends drive new innovations, with:

- **COVID-19 fuelling a rise in demand for remote maintenance.**
  The global pandemic, which saw most of the developed world under lockdown in 2020, led to heavy asset industry firms trialling new ways of continuing operations while avoiding outbreaks of the virus amongst their employees. In March 2020 the US Federal Aviation Administration (FAA) released PS AIR-21-1901, a policy recognizing the value of remote technology for manufacturing and certification processes. The implementation of this policy was expedited during the pandemic, to provide additional tools for FAA inspectors and engineers to conduct safe investigations and perform regulatory oversights. This is just

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FIGURE 4

Depth Of Analytics Assessment Of Maintenance Analytics Software Providers

Vendors	Depth Of Analytics
ABB	
Aptean	
Arcadis Gen	
AspenTech	
AVEVA	
Bentley Systems	
C3	
Cognite	
Falkonry	
GE Digital	
IFS	
Itus Digital	
Lloyd's Register	
Pragma	
Seeq	
Senseye	
Symphony IndustrialAI	
TrendMiner	
Uptake	

No functionality

Limited functionality

Solid functionality

Differentiated functionality (AI/ML, simulations)

Market leading

Source: Verdantix

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FIGURE 5

Analytics Customization Assessment Of Maintenance Analytics Software Providers

Vendors	Level Of Analytics Customization
ABB	
Aptean	
Arcadis Gen	
AspenTech	
AVEVA	
Bentley Systems	
C3	
Cognite	
Falkonry	
GE Digital	
IFS	
Itus Digital	
Lloyd's Register	
Pragma	
Seeq	
Senseye	
Symphony IndustrialAI	
TrendMiner	
Uptake	

No functionality

Out-of-the-box

Low code

Partial customization

Fully customizable

Source: Verdantix

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one example of the increase in remote maintenance, with services firms such as Golder using unmanned aerial vehicles (UAVs) for remote inspections and manufacturing firms leveraging augmented reality (AR) headsets for senior engineers to provide advice to frontline maintenance workers (see Verdantix Smart Innovators: Augmented Reality Solutions For Remote Assistance).

- **Demographic shifts driving new maintenance requirements.**
  According to Data USA, a data provider, the median age of male maintenance workers is 45.4 years, and for female workers, 41.4 years. The aging population of maintenance workers has caused a steep demographic shift, with a large portion of the workforce set to retire in the coming years. New, younger employees coming on board lack the knowledge, skills and experience that senior workers have relied upon to maintain industrial operations. Analytics providers have created systems to capture knowledge from older workers and make it available to future generations of workers. These systems gather knowledge of failure modes, and save history on processes and workflows that new engineers can access further down the line.

- **New breed of engineers with data science skills changing the landscape.**
  Traditionally, data science was carried out by data scientists, while reliability engineers focused on plant upkeep and ensuring assets did not fail. For some, this is changing. Much of the work of a reliability engineer can be enhanced through sophisticated analytics, such as modelling the relationship between assets to identify new failure trends. This is driving a wave of engineers to enhance their programming skills in languages such as Python. These engineers can then carry out in-house and in-team work that previously required reliance on external experts from firms such as Tridiagonal Solutions to build Python templates for the analytics.

Maintenance Analytics Providers Adjust Offerings To Fulfil Customer Needs

Global macro-trends surrounding COVID-19, demographic shifts and new skills in the workforce are driving innovation in the maintenance analytics market. Customer requirements have also altered, and this has led maintenance analytics providers to:

- **Partner with clients to explore new analytics value propositions.**
  Some vendors have found a path to growth by partnering with heavy asset firms to co-develop new analytics use cases. Cognite, an Oslo-headquartered industrial software provider, received investment from Aker BP, an oil and gas firm, and worked closely with the latter on multiple projects to develop soft sensors for wells, as well as maintenance tools and interactive 3D models of equipment (see Verdantix Aker BP Lowers Operating Costs And Increases Productivity With Its Digital Transformation Initiatives).

- **Leverage front-end apps to enhance usability.**
  Maintenance analytics are only as useful as the improvements firms can leverage from the insights gained. Moreover, these insights need to be accessed and communicated in an easily understandable way to promote usage. Joy Global, part of mining machinery manufacturing firm Komatsu Mining Corp, selected a frontline worker mobile application from Prometheus Group, a maintenance optimization platform provider, to enhance the efficiency of field service work. Joy Global's Chilean employees use the Prometheus mobile app to log data while fixing equipment at their clients' sites. The data captured are uploaded directly to a platform provided by SAP to ensure that they are full and accurate.

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FIGURE 6

Use Case Coverage For Maintenance Analytics Software Providers

Vendors	Fault detection & diagnostics	Asset failure prediction	Lifecycle costing	Risk scoring	Demand forecasting
ABB	■	■			
Aptean		■			
Arcadis Gen	■	■	■	■	■
AspenTech	■	■	■		■
AVEVA	■	■	■	■	■
Bentley Systems	■	■	■	■	■
C3	■	■	■		■
Cognite	■	■		■	
Falkonry	■	■			
GE Digital	■	■	■		■
IFS		■			
Itus Digital	■	■	■	■	
Lloyd's Register	■	■		■	
Pragma		■	■		
Seeq		■			
Senseye	■	■			
Symphony	■	■			
Trendminer	■	■	■		
Uptake	■	■	■	■	■

Source: Verdantix

- **Improve data quality through new liberation and contextualization approaches.**
  Firms can only leverage useful insights from maintenance analytics if the data used are of a high enough quality. If rubbish data go in, then rubbish results will come out. Different industries face separate data quality challenges. In process industries, firms have the requisite data, but these have been siloed in different systems, often with contextual tags lost. HighByte, an industrial DataOps software vendor, raised $1.4 million over three rounds to simplify and accelerate the modelling of large quantities of data points in a process environment. Meanwhile, discrete manufacturing firms struggle to have enough data for the analytics they wish to perform. For discrete manufacturing, Senseye works with services firms to improve the digital maturity of their clients, while Falkonry partners with sensor providers to ensure their clients can liberate data from their machinery and equipment.

- **Deploy solutions to create or access alternate data sources.**
  Some firms have looked beyond data analytics to find improvements in their maintenance operations.

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DNV, a Norwegian-headquartered industrial software and services provider, leverages natural language programming (NLP) to automate the conversion of maintenance reports into actionable data. NLP was used to identify variations of the same word in handwritten reports, reducing the time needed to find common issues amongst the data. Other firms are using video analytics to gain insights into operations. Drishti, a US-headquartered firm, offers analytics that sit on the back of closed-circuit television (CCTV) footage and can identify stoppages in production based on the video feeds. Both AVEVA and Cognite utilize video analytics to take scans of assets and use the insights to update digital twins for their clients.

- **Collaborate with other vendors to fill solution gaps.**
  Vendors that lack the full breadth of analytics and data management capabilities requested by a customer can find partnerships. Lloyd's Register partners with Movus, an Australian headquartered predictive maintenance specialist, to enhance AllAsset's access to real-time data, and the former also partners with Falkonry to embed Clue, which it terms an operational AI digital twin solution, to provide users with alerts on suspect and undesirable behaviour of assets. Bentley Systems partners with Isograph, a reliability, safety and availability software vendor, to offer the latter's lifecycle cost software within its broader suite of solutions.

Firms Planning To Deploy Maintenance Analytics Need To Follow Five Steps For Success

Maintenance analytics vendors have a range of offerings and innovations. For a firm's maintenance analytics initiative to be successful, it should:

- **Identify critical maintenance programmes for optimization.**
  Leveraging analytics to enhance maintenance programmes can be a time- and resource-intensive exercise. To ensure that their firm's analytics initiative is successful, executives should identify the most critical areas for improvement. These could be maintenance of critical assets, or enhancing productivity of expensive turnaround activities. GE Digital's EAM software offers the functionality to rank assets based on their criticality and impact on plant operations and considers historical financial information to determine which maintenance activities have a history of high cost and low performance.

- **Assess internal analytics resources to inform software requirements.**
  The next step in the successful deployment of maintenance analytics is an internal assessment of resources and stakeholders. This step has two parts. The first, as with any change management project, is to identify the internal stakeholders who can determine the success of the deployment, and their preferences for software development versus working with a third-party vendor. These stakeholders may include VP Operations, head of maintenance, and VP Innovation, along with senior data scientists and IT professionals. The second part is to assess whether internal teams have the requisite skills and time to develop maintenance analytics internally, or to co-deploy a solution, or whether time and skill requirements mean that all of the deployment should be outsourced. By combining the stakeholder view with an assessment of internal resources, a firm can make an informed decision as to the most effective approach for deploying maintenance analytics.

- **Ensure data sources are integrated, contextualized and clean.**
  Firms should ensure that data are accessible and integrated. Such data are likely to include operational data from equipment, work order data and financial data from EAM and enterprise resource planning (ERP) systems. The data then need assessing to ensure they are collected at the right frequencies and have the necessary tags. Executives in heavy asset firms can work with organizations with strong information management capabilities, such as Bentley Systems, Cognite and Uptake, to ensure that data are stored in accessible systems and have the requisite tags.

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- **Develop a robust knowledge management approach, to ensure continuity.**
  A challenge some firms have faced is that having developed analytics in-house, they then lose the key resource who understands how the analytics work, leaving the firm without the capability to make changes. This can often lead to a previous analytics effort being scrapped and a firm having to start again from scratch. Ensuring standardized approaches for programming the analytics is one way to avoid this, while another is to partner with a third-party provider such as Arcadis Gen, who commits to maintaining and upgrading the analytics over time.

- **Decide on a deployment model that meets both cybersecurity and analytical requirements.**
  The sophistication of maintenance analytics will determine the amount of computing power required for them to run. An on-premise deployment may struggle to handle the running of a more advanced simulation, while a cloud deployment might rise concerns about cybersecurity. In May 2021 Colonial Pipeline suffered a ransomware cyberattack to its computerized equipment managing the pipeline, which led to a shutdown of its operations. However, cloud deployment is on the rise, with 62% of the 259 respondents in the 2020 Verdantix Global Corporate Survey stating availability of software in the cloud to be either 'very important' or 'important' criteria when evaluating software applications for asset management (see Verdantix Global Corporate Survey 2020: Operational Excellence Budgets, Priorities and Tech Preferences).

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