SAP® Intelligent Asset Management – Powering the Digital Transformation of Asset Management

THE BEST RUN **SAP**

FOREWORD

As the world becomes more dynamic, complex, and data driven, it is more important than ever to be agile, especially in industries such as discrete and process manufacturing, utilities, or travel and transportation, where customers are demanding personalized products and ever-faster delivery. Essentially, all asset-intensive industries face disruptive challenges from changing business models and higher cost pressures. However, what does this mean for asset management?

The big imperatives have not changed: you still need to balance cost, risk, and performance, now in accordance with ISO 55001 and other new management standards. Moreover, you still need to focus on reducing cost and being more efficient, optimizing capital expenditure, avoiding incidents, and coping with revenue objectives and ever-evolving regulatory and compliance challenges.

What has changed are the massive amounts of data about assets that are being generated every day, minute, and second and are already available to safeguard mission-critical business processes. As we explore in this paper, this data provides a wealth of potential insight that can transform asset management in ways that help companies get more value from their assets. Nevertheless, to harness it, conventional maintenance management systems and processes are not enough. Asset managers need ways to turn Big Data into information, as well as enable information transparency throughout the entire asset lifecycle and within the ecosystem of operators, equipment manufacturers, and service providers.

This requires a seamless, digital representation of physical assets that allows for the digitalization of key processes – a digital twin. Practitioners as well as decision-makers can use this digital representation of assets to easily access all relevant information to conduct business wherever they are and in a format they can digest quickly.
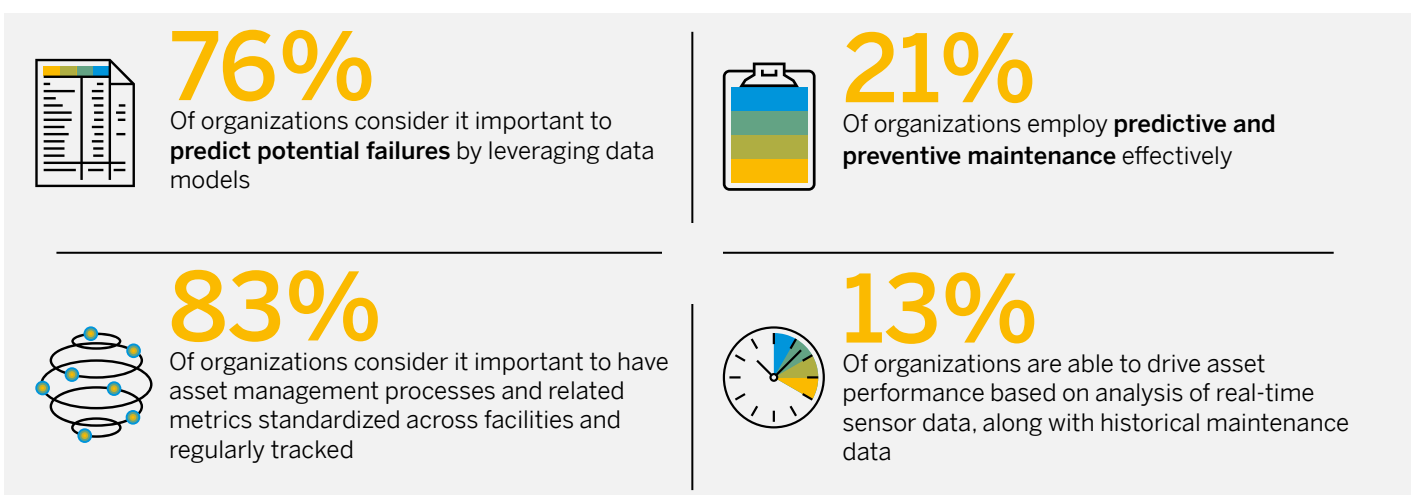
This digital representation is the key to the digital transformation of asset management. It allows you to reinvent your business models, business processes, and the way people work. Everything is connected in real time. In addition, everyone can access the right information about assets at just the right time and collaborate easily with each other because:

- Assets are connected, where needed.
- Asset system behavior is analyzed in real time, simulated, and predicted.
- Asset management information is shared easily in the cloud.

SAP can help you develop an environment in which you can manage asset-related information and processes throughout the complete asset lifecycle. The resulting transformation will positively affect the core business processes and systems that make your business more competitive, for example, by reducing maintenance cost, increasing asset uptime, and lowering operational risk.

Figure 1 below shows that while organizations have digital transformation as an important topic, only a fraction of organizations have achieved this.[1]

Figure 1: Strong Recognition of Need for Intelligent Asset Management

76%
Of organizations consider it important to **predict potential failures** by leveraging data models

21%
Of organizations employ **predictive and preventive maintenance** effectively

83%
Of organizations consider it important to have asset management processes and related metrics standardized across facilities and regularly tracked

13%
Of organizations are able to drive asset performance based on analysis of real-time sensor data, along with historical maintenance data

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1. SAP performance benchmarking, 2017.

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REDEFINING ASSET MANAGEMENT IN THE DIGITAL WORLD

Smart assets and new business models are generating massive volumes of real-time asset data that can be harnessed to redefine effective asset management.

As CEOs strive to grow revenues and profits while balancing risk and customer satisfaction, they can choose to compete within a core or niche market; compete on price, quality, or uniqueness of product; or compete by innovating new products and services to attract and keep customers. At the same time, they spend millions, and even billions, to design, buy, operate, and decommission equipment and other physical assets essential to achieving business goals.

Asset managers, in turn, are responsible for supporting the CEO's strategy by maximizing return on assets, for example, by ensuring asset uptime to reliably meet demand and control cost. Successful asset management that follows the latest guidelines of ISO 55001 maximizes return on assets consistently and reliably. It does this by optimizing cost, risk, and performance so that management can execute strategies and goals and fulfill customer orders on time and with expected quality.

This is no small task, as each day assets age, wear down, and break. New safety risks emerge, capital costs creep upward, and unexpected failures occur despite adherence to recommended maintenance schedules.

However, a tidal wave of change is upending the traditional world of asset management. Powerful technology innovations powered by the Internet of Things (IoT), predictive analytics, augmented reality, pervasive mobility, 3D and 4D printing of spare parts, and global business networks are enabling the creation and analysis of data that is an order of magnitude larger in volume than what was available just a few years ago. This data can be harnessed to transform asset management practices and support the creation of new business models and processes.

Imagine having streaming data from sensors, machines, and other assets connected through the IoT and then analyzing it to gain real-time transparency and decision support. Companies can share this data and drive collaboration across their ecosystem throughout the asset lifecycle for better asset outcomes. The possibilities are endless.

We call this intelligent asset management, and it is the future of asset management.

IT'S ALL ABOUT HARNESSING THE DATA

Intelligent asset management ensures that the right information technology (IT) and operational technology (OT) data and insights are available to the right people at the right time, across the ecosystem and the entire asset lifecycle. Since asset managers can trust that insights are based on clean, high-quality, and reliable data, they can move ahead with confidence to effectively manage cost, risk, and performance and thus ensure assets create maximum value for their organization. This data, which is vertically integrated (from shop floor to top floor) and horizontally integrated (across departments and the extended ecosystem), is the key to digital transformation.

To realize this goal, real-time data collection, analysis, and reporting must occur across the entire asset lifecycle from the OEMs and engineering, procurement, and construction companies (EPCs) to the asset owners and operators. Stakeholders responsible for each step in the asset lifecycle need timely access to data-driven insights so they can make decisions that will optimize asset performance all while balancing cost and risks.

From an IT perspective, this means new kinds of asset management solutions are needed – solutions that can connect all stakeholders participating in the asset lifecycle and make the right data available to them at the right time.

INNOVATIONS AND TRENDS SHAPING ASSET MANAGEMENT

The time to invest in digital transformation is now.

To enable digital transformation of asset management, you must be able to generate, collect, and analyze the necessary information in real time. As shown in Figure 2, the physical asset and the digital twin must be connected for a complete digital representation of assets along their lifecycle, delivering an embedded, collaborative, and real-time set of next-generation processes and systems.

This requires solutions that enable you to:

Connect to assets so you can bring together information from operational and business systems (IT/OT convergence) as well as use the IoT for scaling transparency without neglecting existing information sources.

Predict and simulate asset system behavior to avoid unplanned downtime and major operational consequences as well as discover patterns of failure and preserve operational integrity.

Share asset information and collaborate so you can activate the ecosystem of OEMs, EPCs, service providers, and operators; ensure there's one version of truth on asset information; and use a business network to enable integrated processes in the cloud.

As we discuss in the following sections, the convergence of business challenges and technology enablers is creating a perfect environment for meeting these requirements.

BUSINESS CONTEXT

New business trends, expectations, and ways of working are driving the need for asset management to be more effective, efficient, proactive, and agile.

Trend #1: Process Harmonization Across Industries

As globalization continues, companies are becoming more connected to other companies. It is common for manufacturers to source materials in one country, assemble products in another, and then distribute their products worldwide. The boundaries between industries are blurring. For example, oil and gas companies are now investing in renewable energy such as wind and solar, which was typically in the domain of utility companies. These products may need to meet the requirements and safety standards of multiple countries, which requires process harmonization across all companies involved in the product lifecycle. While achieving compliance with ISO 55001, ISO 14001, and ISO 45001 standards requires effort and investment, doing so enables companies to standardize management processes across industries.

Figure 2: Full Digital Representation of Connected Assets Along Their Lifecycle
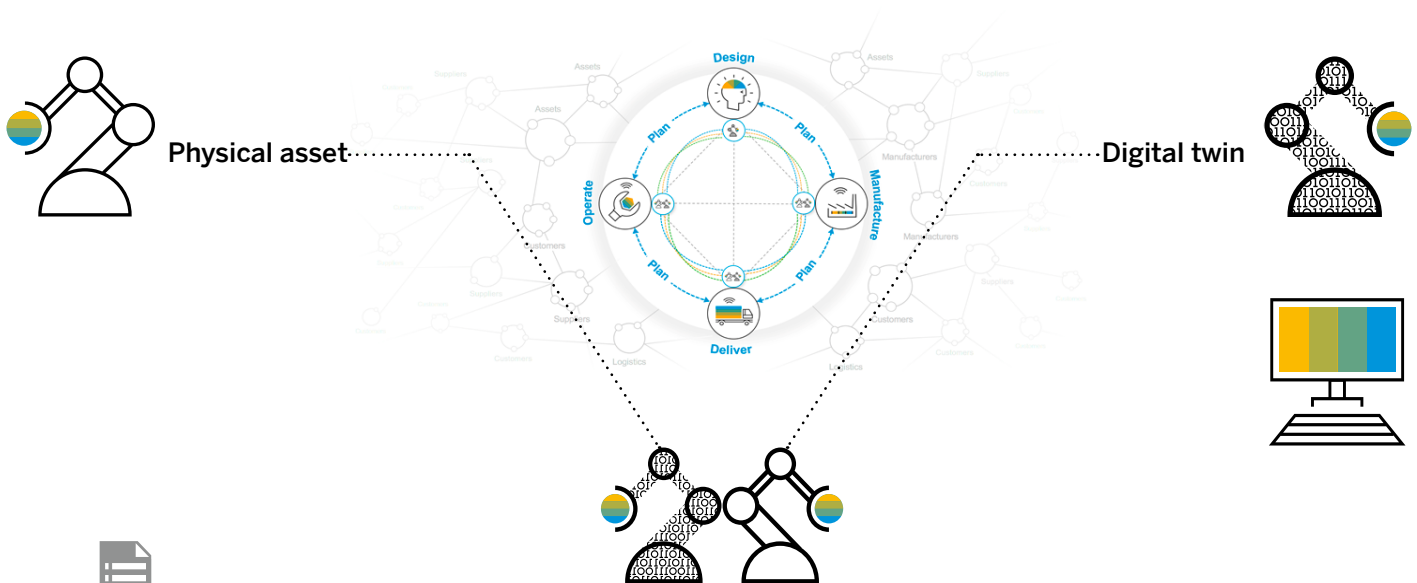
Trend #2: Holistic Management of Cost, Risk, and Performance

Organizations need to manage their asset-related cost, risk, and performance holistically, so they can focus on the most efficient ways to balance operating expenditures (OPEX) and capital expenditures (CAPEX) and optimize asset lifecycle cost.

Trend #3: Collaboration Throughout the Asset Lifecycle

Asset-intensive companies are striving for greater collaboration between EPCs, OEMs, service providers, and operators throughout the asset lifecycle. When integrated processes support this collaboration, companies can realize ever-higher levels of asset optimization. Consuming model or equipment data from OEMs can help ensure high quality of master data in the operator's system. Receiving back information about the actual performance of the asset helps manufacturers close the loop to engineering and design. Service providers can participate in collaborative scenarios optimizing service delivery.
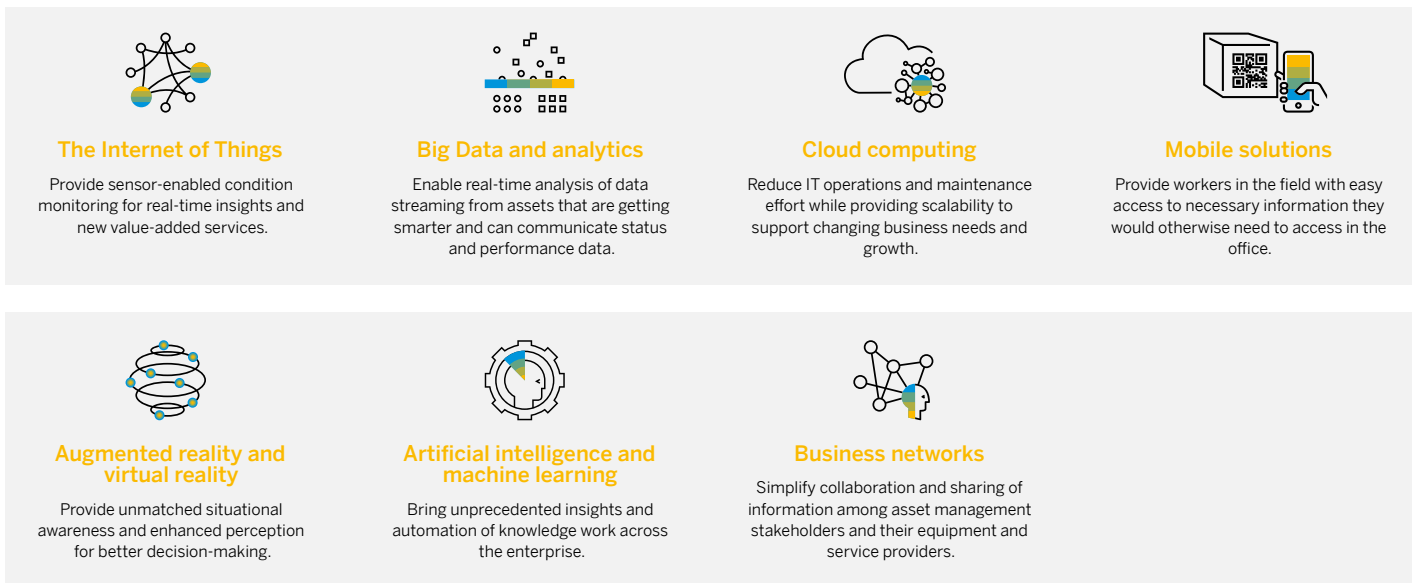
Trend #4: User Empowerment

One of the major indicators of maturity in asset management is how easy it is for practitioners and decision-makers to access all the information they need, when and where they need it and in a readily consumable format. Companies want empowered employees that can identify and address issues early and make informed decisions that optimize asset management over time. This demand is driving the need for an IT platform where trusted, up-to-date information can be easily accessed and shared by asset managers and other stakeholders.

Trend #5: Compliance and Cost Pressure

You can expect to see ISO 55001 certification required for companies that want to operate in certain countries and industries. At the same time, more stakeholders – including shareholders, customers, employees, and the public – expect that the companies they do business with are operating safely and reliably even under cost pressure. Therefore, achieving compliance will become a business imperative.

Figure 3: Main Technology Enablers for Intelligent Asset Management

The Internet of Things
Provide sensor-enabled condition monitoring for real-time insights and new value-added services.

Big Data and analytics
Enable real-time analysis of data streaming from assets that are getting smarter and can communicate status and performance data.

Cloud computing
Reduce IT operations and maintenance effort while providing scalability to support changing business needs and growth.

Mobile solutions
Provide workers in the field with easy access to necessary information they would otherwise need to access in the office.

Augmented reality and virtual reality
Provide unmatched situational awareness and enhanced perception for better decision-making.

Artificial intelligence and machine learning
Bring unprecedented insights and automation of knowledge work across the enterprise.

Business networks
Simplify collaboration and sharing of information among asset management stakeholders and their equipment and service providers.

TECHNOLOGY INNOVATIONS

Thanks to new technologies (see Figure 3), it is now possible to give people across the extended ecosystem the exact information they need in real time and in the right format. Moreover, this capability is opening doors to a completely new world for asset management.

Trend #1: Internet of Things

Today, the boundaries of asset management are no longer limited by the technologies used to link physical assets to business IT systems. Machines talk not only to other machines (M2M) but also to business systems using the Internet protocol (IP). Companies are, in effect, replacing or complementing proprietary, synchronous networks used to control machinery with asynchronous communication using IP. This brings standardization to the communication layer, enabling companies to publish information directly to the Web. As a result, every asset can become part of the IoT. At the same time, assets are getting smarter and more capable. For example, they can indicate their past and current status, send failure codes, generate alerts when maintenance or service is needed, and, in some cases, forecast when failure is likely to occur – all by using dedicated algorithms.

All this makes the information being sent through the IoT increasingly valuable for asset management. However, we are seeing ever-larger oceans of data being created – data that must be converted into valuable information and insights tailored for specific stakeholders. How, when, and where it is presented to users largely determines if they can use it to drive more-effective asset management.

Trend #2: Big Data and Analytics

Asset-intensive organizations collect vast quantities of data during the product and asset lifecycle. Some comes from suppliers providing data on their products and shipments. However, a huge amount of data comes from new assets that are getting smarter and can communicate status and performance data through the IoT. Even older machinery is being equipped with sensors that constantly churn out data from the shop floor. And customers that are taking advantage of new business models for outsourced maintenance (potentially only paying for the performance of the asset) are providing machine data to service providers and OEMs.

The amount of data generated in a typical industrial ecosystem today is truly remarkable, and it will only grow as the price of sensors, microprocessors, and wireless technologies continues to fall so that they can be deployed even more widely. Today, it's more affordable for companies to turn not just costly, sophisticated assets but also smaller machines and even household appliances into smart assets. Assumptions have been made that by 2020, there will be anywhere from 50 billion to around 200 billion devices communicating over the Internet. And much of this data will be shared over business networks, which could grow by as much as 20% annually.

Trend #3: Cloud Computing

While asset-intensive companies may still be reluctant to consume major IT functionality through the cloud, there are clear cost, speed, reliability, and security advantages for using cloud-based business networks to share information.

Commercial cloud providers can afford to spend more effort on IT security, data protection, and privacy compared to most companies due to economies of scale. This translates into companies having even greater data protection than they could implement internally.

Cloud-based computing also provides:

- Fast implementation time, providing quick access to functionality

- Reduced IT effort, because hardware and software operation and maintenance are the provider's responsibility

- Flexibility with subscription pricing

- Scalability to support changing business needs and growth

Given these benefits, cloud computing is being adopted widely by asset-intensive companies for both business applications and networks.

Trend #4: Mobile Solutions

Many asset-intensive companies are rapidly adopting mobile solutions to improve workforce safety and productivity, optimize asset performance, and transform service delivery. Workers can access information, best practices, requirements, and even visualizations of assemblies and repair steps and procedures anytime and anywhere on tablets and smartphones. This means companies can address the unique challenges of maintaining their mission-critical assets and even customer assets, many of which may be deployed globally and in remote areas. Mobile asset management solutions help reduce safety incidents, decrease outages, improve work quality and asset uptime, shorten work cycles, and boost user satisfaction.

Trend #5: Augmented and Virtual Reality

Having massive volumes of IT and OT data is useful only if decision-makers can access and understand it. That is why we are seeing more companies using augmented and virtual reality, also called mixed reality, to present information. These technologies can be embedded directly into a live view of the asset system or into an interactive, virtual 3D model that contains all necessary information. Users of these technologies can access information from anywhere and view combined IT and OT data in an environment that provides unmatched situational awareness and enhanced perception for better decision-making.

Trend #6: Artificial Intelligence and Machine Learning (Predictive Maintenance and Condition Monitoring)

Given that devices and assets are mission-critical parts of your business, it is essential to maintain full visibility into current asset health as well as predict and address future asset behavior to prevent failures and costly downtime.

With artificial intelligence (AI) and machine learning, we have the ability to process massive amounts of data more swiftly than ever. This gives companies an unprecedented chance to improve upon existing maintenance operations and move to predictive maintenance as a maintenance strategy. For example, machine learning can be used to analyze text information "lost" in maintenance notifications to propose suitable failure modes.

Predictive maintenance requires continuous monitoring of assets, which may include real-time analysis of Big Data streaming from assets. The IoT makes this possible, because it enables companies to connect and interact with assets and devices without barriers, in real time, and regardless of their location – and even as they continuously interact with other devices.

Predictive maintenance enhances pure condition monitoring, which has been used for many years to detect failure symptoms early enough to initiate maintenance and prevent breakdowns. But condition monitoring is still reactive in nature, whereas predictive maintenance is proactive. The goal of predictive maintenance is to determine the optimal maintenance schedule for assets, thus eliminating unnecessary maintenance without affecting assets' health or lifespan.

Trend #7: Business Networks

Imagine a single, cloud-based IoT platform linking all equipment and stakeholders in an ecosystem. Now visualize applications running on this collaboration platform to simplify maintenance and enhance cooperation for complex tasks. Add built-in analytics to inspire innovation for managing assets as a service or redesigning them based on performance. This is the power of business networks for asset-intensive companies.

Use of business networks in an asset management context is beginning to gain traction, just as it already has in business areas such as procurement and human resources. The adoption of advanced business networks could not have happened at a better time, now that companies are under pressure to transition to the digital economy. Business networks combined with the IoT and cloud technologies make automated data exchange fast and simple. As a result, they simplify collaboration among asset management stakeholders and their equipment or service providers – collaboration that is deeper and broader than ever.

Nearly every asset-focused stakeholder can benefit from simplified collaboration. For example, asset operators want to minimize capital investments, operational overhead, and risks. They may prefer to pay for the equipment or asset as a service.

In this scenario, instead of purchasing the asset and paying for service when needed, the asset operator pays a monthly fee. Although the asset resides at the asset operator's site, the OEM or provider retains ownership of the asset and is responsible for servicing the asset to ensure uptime.

OEMs want to increase revenue growth and sharpen competitive advantage with bundled products and services. And service providers want to offer value-added services enabled by technological innovations. Business networks are uniquely able to support the goals of each of these stakeholders.

REIMAGINING ASSET MANAGEMENT

Digital innovation is real.

The digital economy offers infinite new opportunities. In a connected world, where every company is becoming a technology company, smarter assets and products can transform asset management and enable new services and business models. Building on the business and technology trends discussed previously, it is now possible to do the following.

Create an IT foundation for operational excellence
that bridges the traditional organizational silos of engineering; purchasing; operations; reliability; environment, health, and safety; and other departments. This foundation needs to push out data structures, business processes, and user experiences not only across all of these departments but also beyond into finance, the supply chain, and human resources.

Manage asset-related cost, risk, and performance holistically
so people can focus on the most efficient ways to balance OPEX and CAPEX and on asset lifecycle cost.

Implement proactive maintenance strategies enriched with analysis of real-time data
as well as predictive analytics and other forecasting methods to increase return on assets and reduce unplanned downtime. Processes must be integrated from shop floor to top floor and encompass the complete asset lifecycle.

All the data generated can be shared in real time within the ecosystem to:

✓ Enable efficient collaboration among business partners

✓ Help asset operators minimize capital investments and achieve higher asset availability

✓ Let asset manufacturers centrally manage all information and build installed-base knowledge

So what can you do with all of these new capabilities? Reimagine everything.

As summarized in Figure 4, reimagined asset management transforms business models, business processes, and the day-to-day work performed by managers and maintenance professionals.

Furthermore, new ecosystems and business networks enable new business models for buying and selling digital services such as content packages, premium services, firmware updates, and specialized asset-specific applications on top.

Figure 4: New Business Models – Share Asset Information and Collaborate

Manufacturers (OEMs) · Engineering and construction · Service provider · Asset operator (owner)
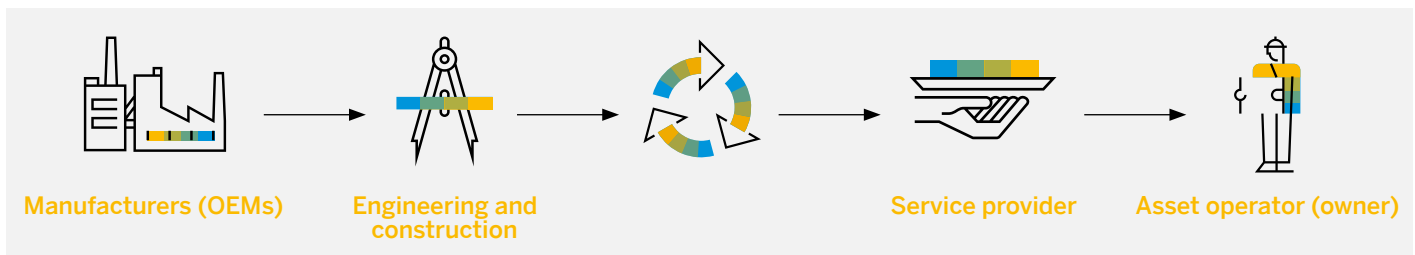
| From:	To:
Selling of equipment	**Pay per use** or equipment as a service
Untrusted asset information	**Collaborative**, single source of truth
Limited analytical capabilities	**Real-time analytics** with simulation
Reactive maintenance	**Prescriptive** maintenance

HOW CAN SAP INTELLIGENT ASSET MANAGEMENT HELP YOUR BUSINESS?

SAP Intelligent Asset Management delivers a cloud-based suite of solutions that help you achieve operational excellence; access accurate, real-time information about your enterprise; predict potential operational problems before they occur; and empower your workforce with the information needed to run operational processes smoothly.

Our asset management solutions software enables you to manage the entire lifecycle of your physical assets (see Figure 5). Find out more about the business capabilities supported by these solutions in the following section.

Figure 5: SAP Intelligent Asset Management Solutions – Business Capabilities
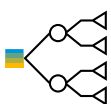
State-of-the-art business processes
Use new technologies to enable new asset-management business processes anywhere and anytime.

Real-time insights
Gain complete visibility on strategic, tactical, and operational levels.

Connected assets
Bring together information from operational and business systems using the Internet of Things (IoT) for scalable transparency.

The power of prediction, optimization, and simulation
Drive smarter decisions, improve reliability, and reduce outages.

Collaboration throughout the asset lifecycle
Share asset information, access one version of the truth, and collaborate on a cloud-based business network with integrated processes.

SAP® Intelligent Asset Management
Mobile asset management

- Asset strategy and performance
- Asset central foundation
- Asset network and collaboration
- Asset health prediction and optimization
- Maintenance and service management

SAP S/4HANA®
SAP Leonardo IoT
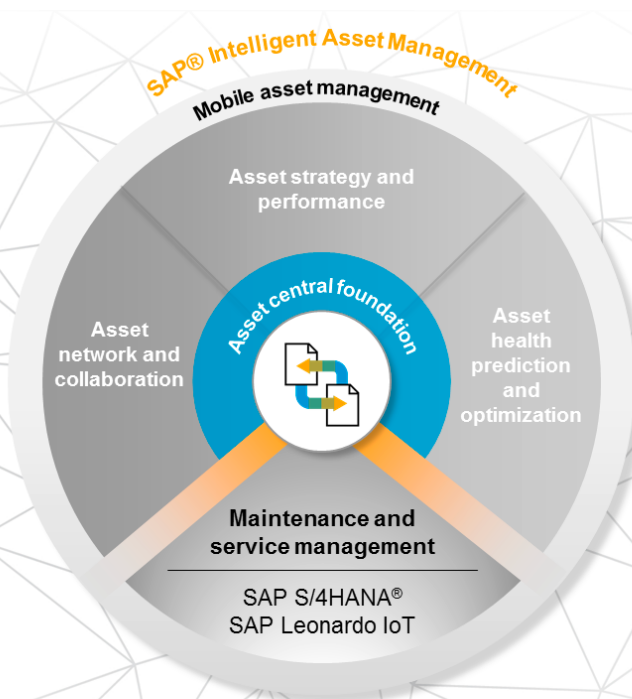
ASSET CENTRAL FOUNDATION

Asset central is the foundation layer of SAP Intelligent Asset Management, providing a full digital representation of connected assets along their lifecycle and delivering an embedded, collaborative, and real-time set of next-generation processes.

Asset central delivers a new, simplified technical object structure that allows greater flexibility and better modeling of both simple and complex assets. New object types such as models and systems have been introduced to support collaboration between OEMs and operators and, ultimately, to support a complete design-to-operate paradigm.

MAINTENANCE AND SERVICE MANAGEMENT

SAP S/4HANA® provides core back-office maintenance management processes. On-premise or cloud deployments are available and fully integrated with SAP Intelligent Asset Management solutions.

Now you can:

- Plan maintenance activities with the right person while providing the appropriate tools and resources
- Schedule proactive, preventive, or condition-based maintenance tasks
- Use integrated documentation for job execution and safety and gain a holistic view of asset status
- Execute planned and unplanned maintenance tasks to help ensure optimal operations
- Manage preventive and condition-based maintenance proactively
- Increase equipment reliability, increase asset use, and roll out safer maintenance processes
- Manage asset information for work orders, maintenance, measurements, inspections, metering, and inventory

ASSET NETWORK AND COLLABORATION

SAP Asset Intelligence Network provides a global registry of equipment – built and shared among multiple business partners and used across the industry by all stakeholders. The network enables new collaborative business models resulting in true operational excellence.

Through this global equipment registry, you can:

- Enable secure asset information collaboration across your business network
- Collaborate with manufacturers, operators, and service suppliers across the network on asset information
- Provide one network channel for electronic handover of technical asset and maintenance data to OEMs, service providers, and procurement vendors
- Improve data reliability, reduce master data maintenance, and maintain higher asset availability

ASSET STRATEGY AND PERFORMANCE

The SAP Asset Strategy and Performance Management application supports manufacturers and asset operators in defining, planning, and monitoring the optimal service and maintenance strategy.

With this application, you can:

- Segment assets based on risk, criticality, impact, and environmental factors to determine the best maintenance strategies at lowest cost and risk
- Adopt reliability-centered maintenance processes, considering failure mode effects and root causes
- Manage performance to optimize return on assets across lifecycles
- Monitor, review, and improve maintenance plans and budgets
- Reduce bottlenecks, improve decision-making, and prevent incidents using a holistic view of asset types and maintenance strategies

ASSET HEALTH PREDICTION AND OPTIMIZATION

The SAP Predictive Maintenance and Service solution, combined with the SAP Predictive Engineering Insights solution enabled by ANSYS, replaces time-based maintenance of industrial assets with predictive and prescriptive maintenance. This type of maintenance relies on information from physical sensors and physics-based analysis based on ANSYS simulation models to produce results in a 3D visualization. Optimize the availability of your assets by using predictive maintenance and service capabilities and the Internet of Things to take corrective actions early.

These two solutions enable you to:
- Collect and analyze sensor data from physical assets to predict operational failure
- Initiate preventive countermeasures that trigger service or maintenance orders
- Optimize asset performance with a closed-loop maintenance and service process
- Create physics-based digital twins of industrial assets based on a real-time and predictive engineering analysis

MOBILE ASSET MANAGEMENT

Designed for SAP Cloud Platform, the SAP Asset Manager mobile app provides online and offline access to context-rich visualizations and actionable insights to enable simple and timely execution of end-to-end enterprise asset management processes.

Putting the mobile app into the hands of your employees enables you to:
- Eliminate paperwork while reducing downtime and maintenance backlog
- Extend and improve asset life and reliability by shortening work cycles
- Turn capital spending into operational investments with a cloud deployment
- Manage existing work and asset data whether employees are online, offline, or occasionally connected

LEARN MORE

SAP Intelligent Asset Management solutions, combined with SAP S/4HANA, support asset-intensive companies in transforming how they manage assets, creating new and value-added services based on live data.

These solutions make it easier than ever for you to:
- Manage cost, risk, and performance throughout the complete asset lifecycle
- Empower asset managers with support for integrated, optimized processes
- Gain competitive advantage by boosting safety and quality while optimizing asset performance
- Facilitate better collaboration within your organization and across the extended ecosystem

To find out how you can meet any asset management challenge, visit us online.

www.sap.com/contactsap

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