



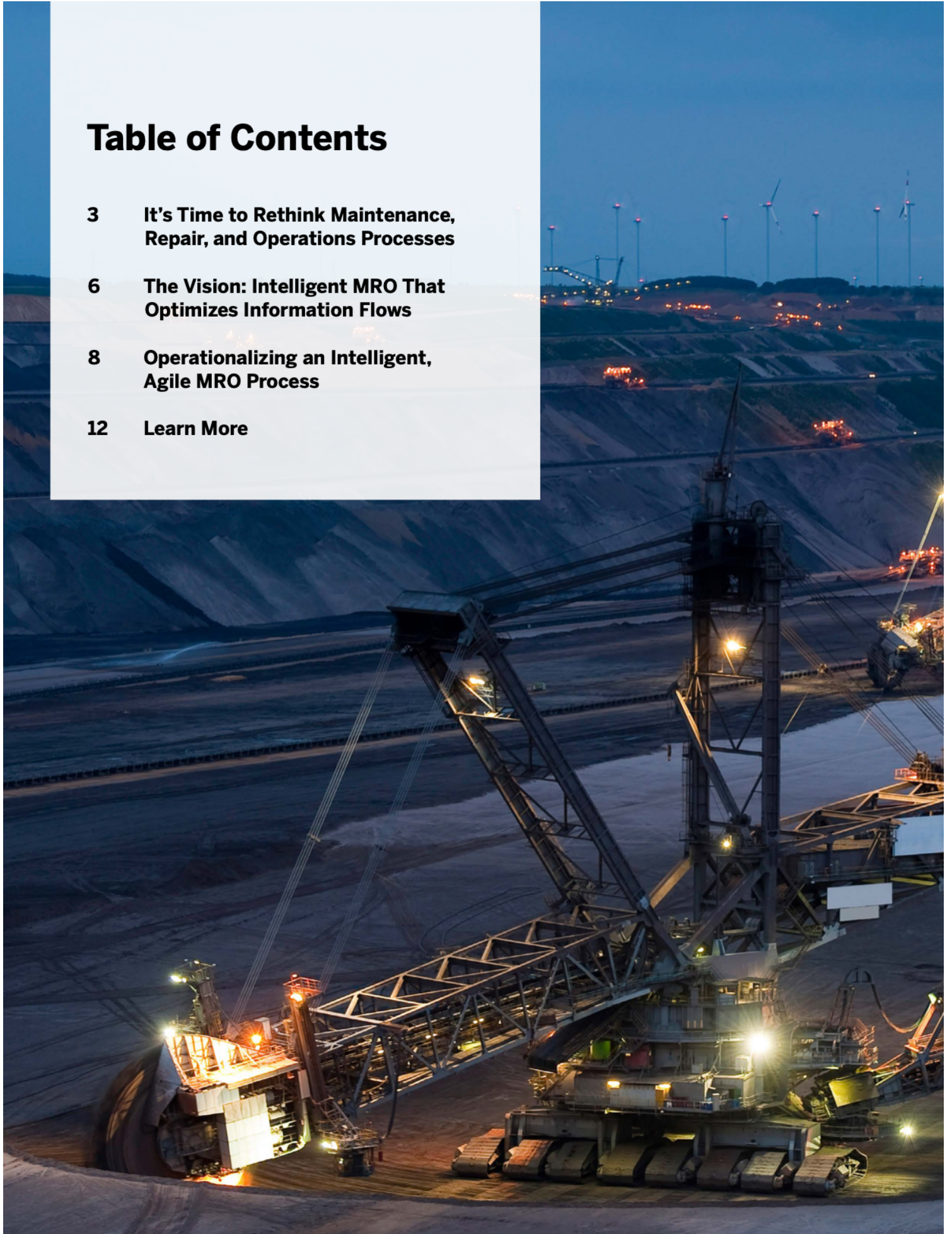
Intelligent MRO

The Intelligent Supply Chain for Assets

Predictive Spare-Parts Planning for
Asset-Intensive Industries

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It's Time to Rethink Maintenance, Repair, and Operations Processes

Businesses in asset-intensive industries such as mining, railways, and oil and gas have a relentless focus on **efficiency and continuous improvement** – and for good reason. Many spend a large amount on fixed assets to turn raw materials into finished products or assets that provide services. The ability to produce products at a lower cost than competitors is often the key difference between survival and failure.

The maintenance, repair, and operations (MRO) process refers to the “indirect procurement” of parts and tools needed to keep assets operating, and it has a big impact on both top-line performance and bottom-line costs. Businesses may not directly incorporate the countless purchases of parts, maintenance kits, services, and other related MRO items into any final product. But these purchases are what keep factories, mines, and other asset-intensive firms up and running.

When spare parts for these assets aren't readily available, the business impacts can be catastrophic. Analysts report that as much as 50% of unscheduled asset downtime can be attributed to the lack of spare parts.

THE SPARE-PARTS SUPPLY CHAIN IN ACTION

Ideally, MRO processes ensure you have the right spare parts and tools to do the right maintenance work at the right time and the right place. When you optimize in this way, assets are always ready and available to produce product and fulfill customer demand in a timely, reliable manner. But this is no easy feat, even in today's digital

business world. MRO can consume the vast majority of process expenses through sourcing, procuring, stocking, and managing MRO products, maintenance kits, and more that are needed to keep machinery, trucks, trains, and other assets maintained and functioning optimally. This is hardly a cost-efficient process, due in part to the lack of digitalization and automation. Consider, for example, that only 21% of organizations employ preventive and predictive maintenance effectively.¹ And only 13% of firms can drive asset performance based on an analysis of real-time sensor data and historical sensor data.²

In addition to being costly, traditional MRO processes weren't designed to optimize supplier collaboration around the actual needs of specific assets – both now and in the future. **Figure 1** summarizes the traditional MRO purchasing process, which is manual, time-consuming, and error prone. This same level of complexity is replicated across the entire MRO chain, from planning and purchasing to receiving and building the spare parts into an asset.

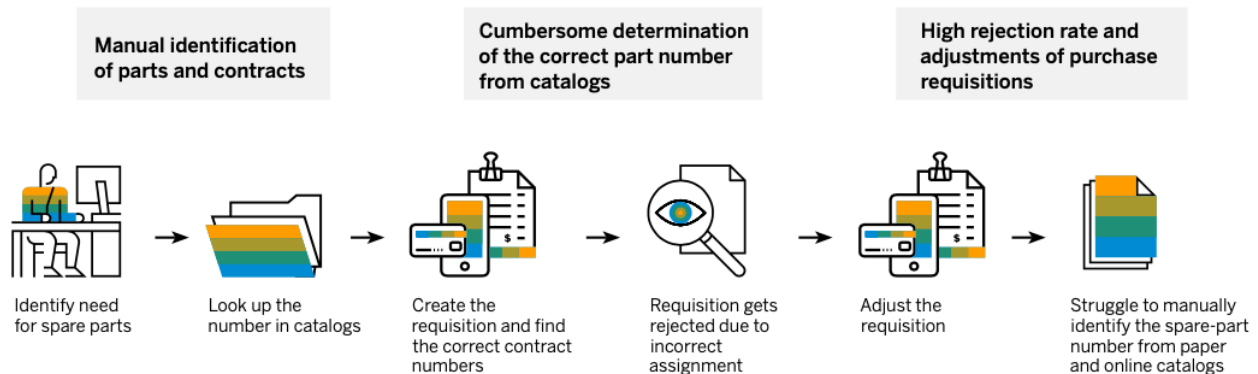


As much as **50%** of unscheduled asset downtime can be attributed to the lack of spare parts.

1., 2. SAP Performance Benchmarking, 2017.

Figure 1: The Complexity of Traditional MRO Purchase Processes

Traditional Scenario



Consider the example of a maintenance firm hired by an oil and gas company to maintain its oil rig machinery. In many cases, the oil and gas company will learn the exact requirements for parts and services after running its materials requisitions process (MRP). The company enters lead times into the MRP system based on either a contract-agreed term or a rough estimation calculated from historical data. The lead times are rarely based on forecasts of future production. Often, suppliers find the requested supply lead times difficult to adhere to, in part because many commodity-based companies, such as mining or oil and gas companies, operate in very remote locations.

Even more important, the estimated data in MRP systems rarely reflects which spare parts each critical asset really needs. Actual, day-to-day MRO requirements for spare parts must be driven by accurate and complete data that includes:

- **Forecast and spot product demand** – As product demand increases, you will need to increase the utilization of assets (for example, trucks to haul mined materials). More hauling means more wear and tear and thus the need for earlier, more frequent, and even more extensive service checks and parts replacements for these assets.

- **The current state of each asset** – This requires assets to have Internet of Things (IoT)–enabled sensors that continuously stream data about their current state, actual wear and tear, alerts, and more. Today, most high-value assets have these sensors, but the data isn't reaching parts suppliers and OEMs and suppliers who can use it to accurately forecast MRO needs for specific assets, fleets, and more.

Traditional MRO planning processes don't capture and flow accurate and complete information about forecasted demand, the current state of assets, and the spare-parts requirements they have both today and in the future. Without clear, continuous communication of this information to suppliers, how can they align their supply chain to stock the required parts and kits or deliver the required services at the right time and place? And without real-time, sensor-driven insights into what's happening – for example, on atypical wear and tear and pending failures – how can they meet immediate asset needs in time to avoid costly downtime or air shipments?

Put simply, they can't.

THE HIGH COST OF TRADITIONAL SPARE-PARTS PLANNING

Asset-intensive companies often feel compelled to carry large inventories of spare parts to buffer their maintenance system. But having large inventories of parts leads to higher working capital costs and inventory management costs. It's a vicious cycle that negatively impacts top-line performance and bottom-line costs.

Companies often try strategies to lower spare-parts costs by minimizing slow-moving stock, improving stock turns, and shrinking the inventory list. However, these strategies rarely result in meaningful, bottom-line cost improvements, as they fail to address breakdowns in the information flow between companies and suppliers. At the same time, maintainers push back hard on such efforts. Because they have limited awareness of the condition of assets, they want their materials as close as possible (ideally at the local warehouse so they can quickly and easily access what they need).

Meanwhile, companies bear the impacts of other unintended consequences of inaccurate, long-term spare-parts planning, including:

- **Lack of coordination with production**, resulting in too many assets simultaneously being taken out for maintenance, which slows production
- **Low asset-facing time for costly, hard-to-find maintainers** – often 30% or even less due to excessive administrative tasks and time spent handling spare parts and tools in warehouses. When maintainers lack accurate, detailed, and complete information about each asset, they can't determine which random parts and tools to bring when they are assigned to work on them.
- **Delays repairing or maintaining assets** because maintainers don't have the right spare parts or tools on hand to complete work or someone without the right expertise is assigned to an asset
- **Poor prioritization of MRO activities that leads to unexpected downtime** because owners and maintainers can't accurately assess the criticality of needs and incorrectly prioritize ordering of parts
- **Spare-parts inventory obsolescence** because too many parts are ordered based on inaccurate bill-of-materials lists and they expire while in warehouse inventory



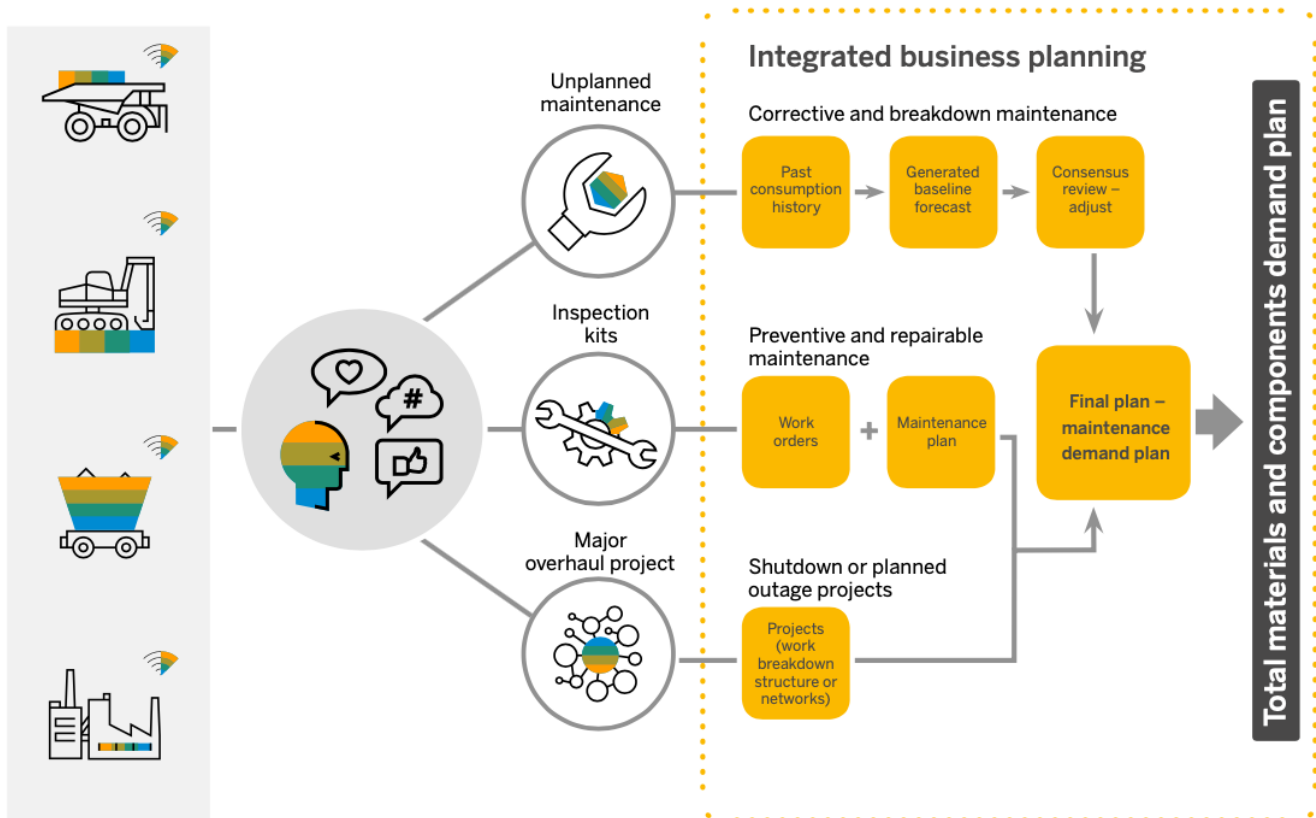
Actual, day-to-day MRO requirements for spare parts must be driven by **accurate and complete data**.

The Vision: **Intelligent MRO** That Optimizes Information Flows

Optimizing spare-parts availability while reducing overall MRO costs will require radically rethinking – and retooling – current processes to streamline information flows with parts suppliers. Leading companies are already on their way. For example, one of the most innovative mining companies in the world is collaborating with SAP to operationalize an intelligent, systems-thinking approach to capturing and understanding actual spare-parts requirements.

As shown in Figure 2, this new approach treats every asset as a “customer” that communicates specific and ever-changing requirements or maintenance and spare-parts needs. It captures the “voice of the asset” through streaming real-time sensor data and forecast production information or demand-planning data. Based on this combined information, it then generates a maintenance work order (as opposed to a customer sales order). By applying systems thinking, the work order is translated into maintenance requirements, complete with the necessary spare parts, tools, kits, and maintainer skill requirements needed to ensure a given asset remains operational.

Figure 2: Using the “Voice of the Asset” to Drive Optimized MRO Plans



This new, intelligent, data-driven process for determining spare-parts and tool requirements is more akin to a modern manufacturing process, as it aims to assemble “products.” In this case, the products are job lots or spare parts and tool kits, which the process specifically tailors to each asset and its communicated maintenance needs. It links a **real-world demand view** (or, what a company must produce within a given time) with a **real-time supply plan view** (that is, what MRO assets require to let the company meet this demand). And it gives a voice to assets using IoT-enabled sensors that communicate real-time information about their current condition and maintenance needs.

When this information flows continuously to an agile supply chain collaboration network, suppliers can optimize their plans to deliver the right spare parts and tools where and when they are needed. The process personalizes everything for each asset, or “customer,” resulting in an exceptional “customer service experience.” Early collaboration around shared information maximizes the flow of materials and services from MRO suppliers to the assets in need of them. Suppliers can even ship spare parts to site warehouses and group them into kits for faster maintenance work.



To operationalize your MRO process, you need an integrated, intelligent MRO solution built on an **intelligent enterprise framework**.

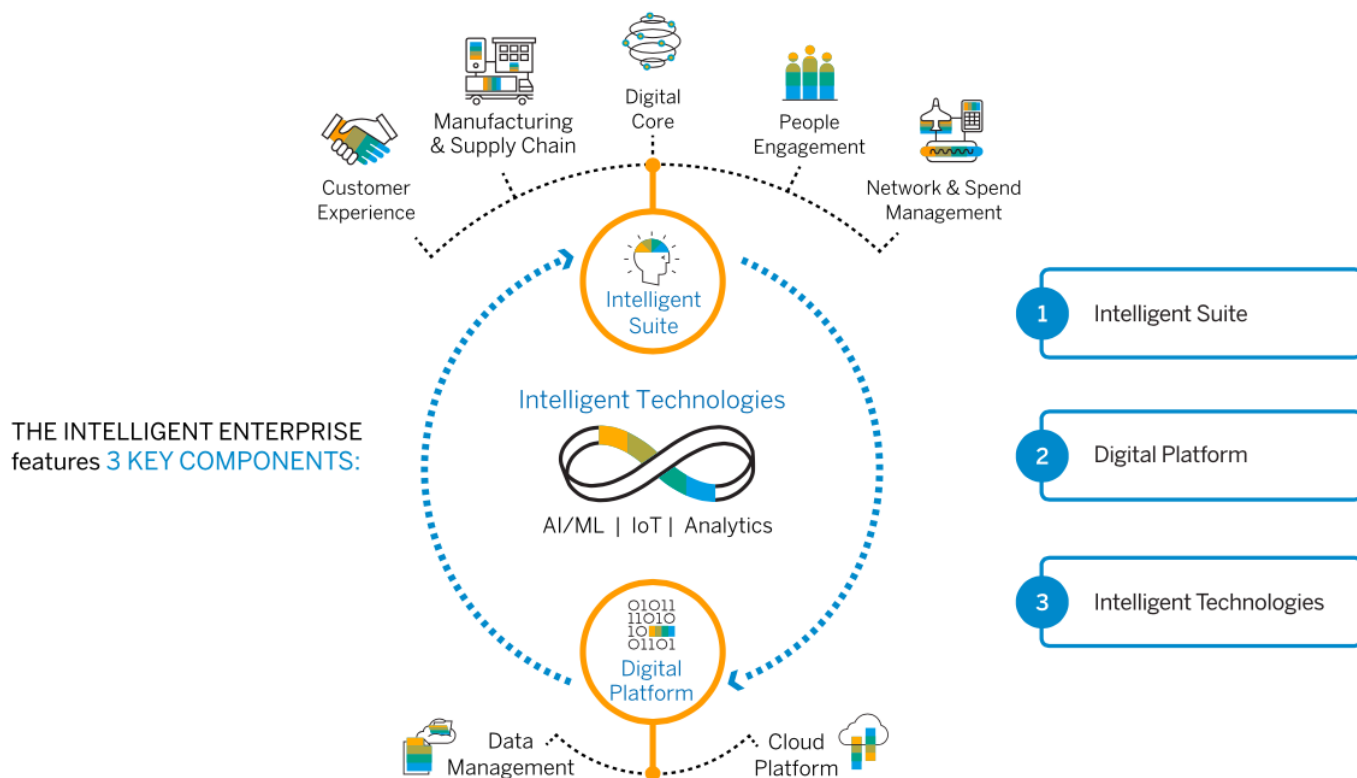
Operationalizing an Intelligent, Agile MRO Process

To operationalize your MRO process, you need an integrated, intelligent MRO solution built on an intelligent enterprise framework.

SAP® Intelligent Enterprise Framework, as shown in Figure 3, names a methodology for an end-to-end digital enterprise architecture that can digitalize business processes across 25 industries.

It includes a suite of intelligent business applications that use intelligent technologies and can be extended on a digital platform. This enables next-generation business processes to deliver breakthrough value to customers on their journey to becoming intelligent enterprises.

Figure 3: SAP® Intelligent Enterprise Framework



Automation frees up people to define and pursue innovative and transformative business models.

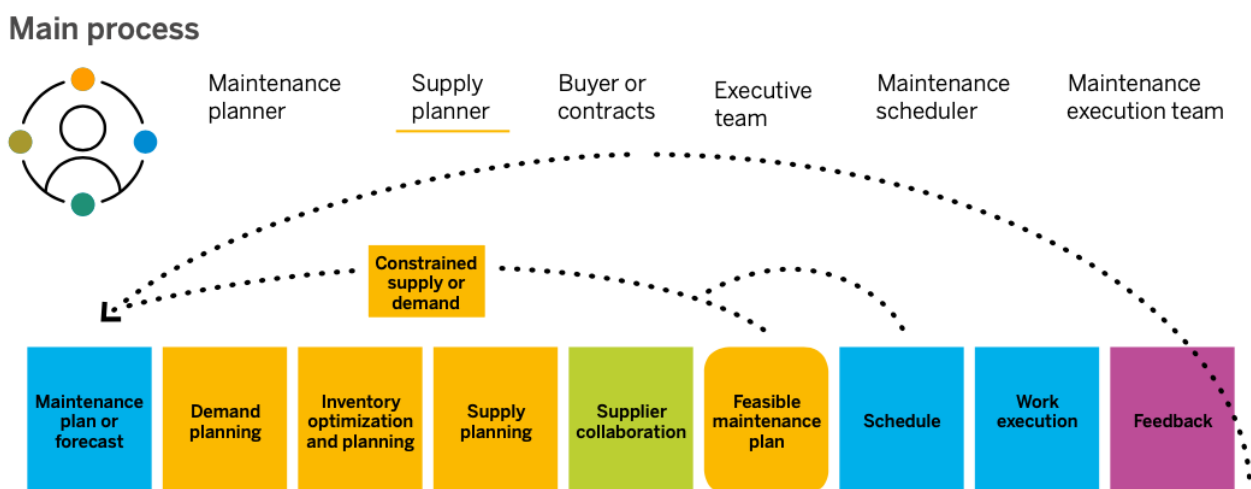
As your company becomes an intelligent enterprise, you will use redesigned processes enabled by machine learning that shift routine tasks from humans to business systems. This automation frees up people to define and pursue innovative and transformative business models.

The Intelligent Enterprise weaves together siloed processes, intelligent technologies, and real-world data threads from customers and the environment into flexible, end-to-end value chains that provide a transformative customer experience and support next-generation business models. For example, for mining companies, the Intelligent Enterprise offers unlimited innovation opportunities across the enterprise and opens up the path toward new frontiers beyond traditional enterprise boundaries. In addition, it delivers embedded intelligence within processes that transform companies by supporting new business models and revenue streams.

In this way, the application of intelligent technologies will help asset-intensive companies address their digital priorities, implement next-generation business processes, and become intelligent enterprises. As shown in Figure 4, the result will be a solution that can:

- Give connected assets a “voice” to communicate data about their current state and maintenance needs
- Integrate demand planning, asset maintenance, and supply functions across the time horizons of planning, scheduling, and execution to enable the seamless, continuous flow of accurate and complete information between assets, asset owners, suppliers, and OEMs
- Ensure parts requirements and delivery times across locations are well understood through early collaboration with suppliers
- Drive automatic, data-driven scheduling of parts, maintainers, and services so assets get the right maintenance work at the right time and place with the right parts available

Figure 4: An Integrated, Intelligent MRO Solution



There's growing demand for a solution that can deliver on this vision. According to digital readiness surveys conducted by SAP, companies clearly see the need to leverage their digital capabilities to optimize asset management.

AN INTELLIGENT SUPPLY CHAIN FOR SPARE PARTS AND TOOLS

To execute on this vision, SAP created a customer initiative for an intelligent supply chain for assets, which brings together SAP and our industry-leading customers to transform businesses in supply chain planning and asset management. SAP is co-innovating with customers to define best practices and new use cases in areas such as integrated business planning and intelligent asset management, including service parts planning for the asset-intensive industries.

SAP is enriching intelligent enterprise solutions by integrating demand, maintenance, and supply planning. Customers participating in the initiative will have the opportunity to benefit from SAP's recognized innovation in planning and asset management to identify the most valuable use cases related to assets and parts' lifecycles. They can also collaborate on improving functionality and refining best practices to bring true integration of information and material flow between assets and suppliers.

ENABLED BY AN INTEGRATED BUSINESS PLANNING PLATFORM

SAP has already built an integrated business planning (IBP) platform that can bring together demand planning, maintenance planning, and supply planning so that companies can share demand plans with their suppliers before releasing purchase orders. SAP plans to deploy and integrate the following SAP products on this platform to deliver holistic, integrated functionality:

- SAP Intelligent Asset Management
- SAP S/4HANA® for use in plant maintenance
- SAP Integrated Business Planning
- Ariba® Network
- SAP Ariba Supply Chain Collaboration for Buyers

Using an IBP for MRO planning can help ensure early collaboration with suppliers so you can better understand delivery times. SAP plans to enable automatic scheduling of parts and services to allow for the optimal supply delivery plan. This plan aims to maximize the flow of materials through the central receipting facility where parts and materials are assembled into kits (if not already done by the supplier) and shipped to the site warehouse.

Our goal is to further couple SAP Integrated Business Planning with SAP Intelligent Asset Management solutions and SAP Cloud Platform. This is projected to enable you to better predict events, reduce the uncertainty in the asset demand, and allow for even more effective optimization of the supply chain.



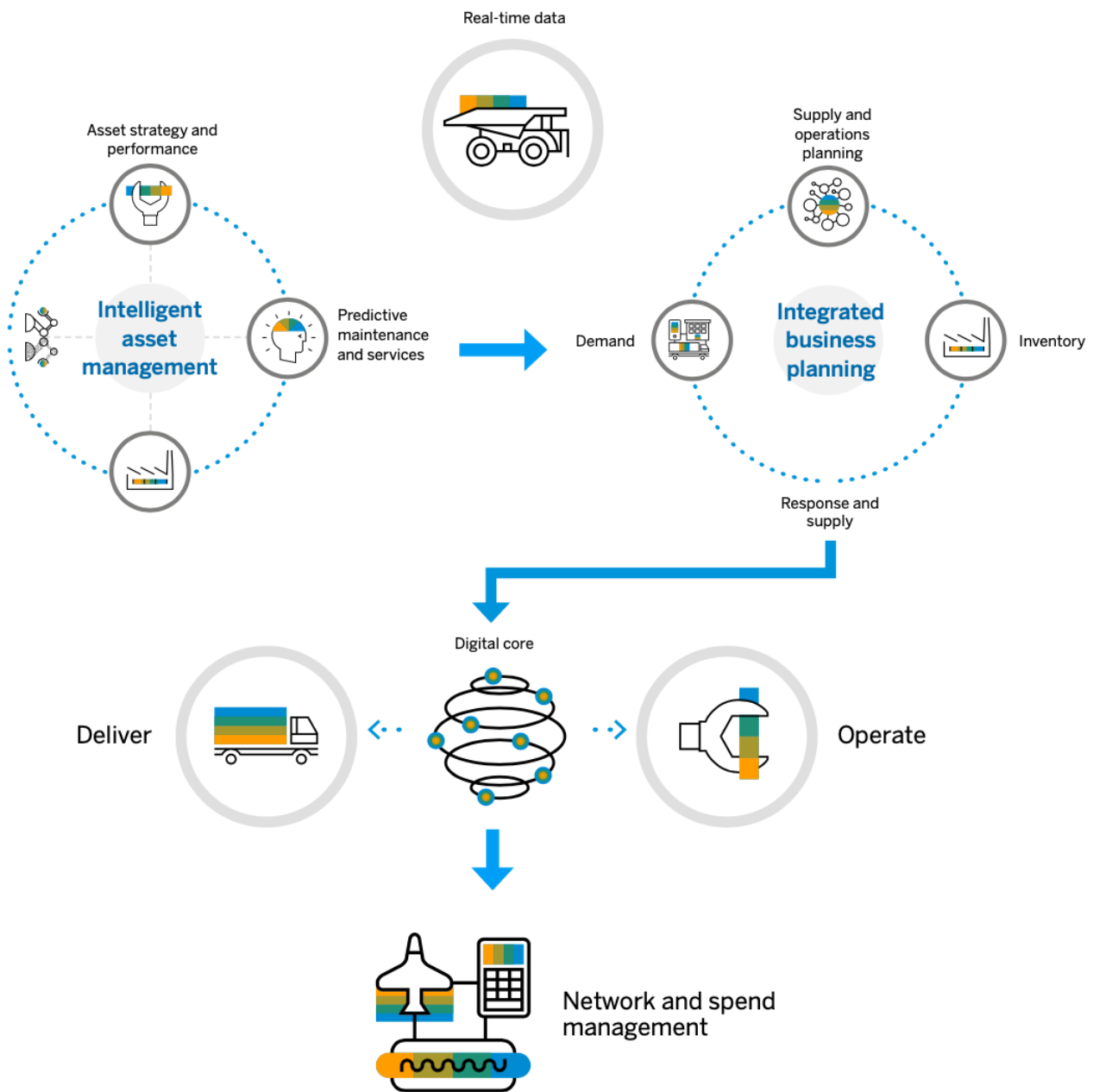
SAP is **enriching intelligent enterprise solutions** by integrating demand, maintenance, and supply planning.

A NEW SYSTEMS ARCHITECTURE

SAP plans for the new systems architecture to cover the three elements of the value chain: demand, maintenance, and supply. Figure 5

provides a high-level view of the proposed architecture that enables information to flow from demand planning to supply planning, then to scheduling, and finally to execution.

Figure 5: Integrated Process Flow for MRO Planning



DELIVERING BOTTOM-LINE BENEFITS

Once this planned integrated solution is ready for market and deployed, you can benefit from:

- **Reduced mean time to repair** – With procurement and logistics on the same page, you can drive greater integration with suppliers, making your supply chain more agile and responsive. The flow of information helps ensure workers are continuously busy working on assets rather than trying to find material in the warehouse, resulting in higher tool times and reduced repair times.
- **Increased mean time between failures** – The integrated supply chain for assets can help ensure assets perform better for longer. The goal is to develop a deeper understanding of each asset through sensor data, bring together accurate maintenance histories and performance analysis, and collaborate more closely with OEMs and service companies.
- **Reduced inventory days (the time inventory spends in the warehouse)** – Replace your “top off” replenishment-based inventory model for parts warehousing with a demand-driven model, which optimizes working capital by pulling parts from suppliers only when they are needed. With the integration of the SAP Enterprise Asset Management solution with the SAP Integrated Business Planning solution and the SAP Ariba Supply Chain Collaboration for Buyers solution, parts and materials no longer have to wait on a shelf. Instead, they can flow straight to the point of consumption by maintainers working on assets.
- **Reduced cost to serve (the cost of delivering work orders or maintenance)** – Advanced planning with greater certainty means that both you and your suppliers can remove waste from your supply chains. Examples include time spent hunting for parts and materials, money spent overstocking parts and materials, and last-minute transport fees to get parts where they need to be.
- **Improved planned-to-unplanned work ratio** – Unplanned work results in a high level of uncertainty. To allow for optimized scheduling that keeps unplanned work to a minimum, shift maintenance and supply systems from being reactive to proactive. You can accomplish this by monitoring assets in real time and applying condition-based maintenance practices as well as planning ahead based on accurate demand plans.
- **Labor planning** – Eliminating any labor constraints before the targeted maintenance date allows customers to make sure labor is used to carry out the spare-parts maintenance activities beforehand.

18%

Lower unplanned outages for organizations using a preventive-predictive versus reactive maintenance approach

Source: SAP Performance Benchmarking

LEARN MORE

Are you ready to transform MRO – one of the most critical processes and largest cost drivers in asset-intensive industries – to improve your company’s top-line performance and bottom-line cost? Visit us [online](#), or contact your SAP sales representative.

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