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AI in Action

Transforming Maintenance & Diagnostics with Intelligent Solutions

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Abstract

In today's fast-paced manufacturing landscape, reducing unplanned downtime, meeting rising production targets, and staying compliant with evolving safety standards have become non-negotiable. Traditional maintenance models, which rely on fixed schedules or react after failures occur, are no longer sufficient in this dynamic environment. The result is often costly downtime, inefficient resource use, and avoidable safety risks.

Emerging technologies like Artificial Intelligence (AI) and Generative AI (Gen AI) are fundamentally reshaping how organizations approach equipment maintenance and diagnostics. By integrating real-time sensor data, historical service logs, and even unstructured inputs like technician notes and manuals, AI enables a shift from reactive to predictive and prescriptive maintenance. Gen AI takes this further by offering contextualized insights, suggesting possible root causes, recommending corrective actions, and even simulating future scenarios to optimize decision-making.

This Point of View rests on a key hypothesis:

If manufacturers embed intelligent diagnostics into their existing maintenance workflows using AI and Gen AI, they can significantly reduce unplanned downtime, enhance asset longevity, and drive operational efficiency—without needing to overhaul their core infrastructure.

This paper explores how AI-driven intelligent maintenance transforms isolated, manual processes into connected, insight-rich systems. It addresses common adoption challenges—like siloed data, integration complexity, and lack of specialized talent—and proposes a phased implementation strategy tailored to business maturity. More than just a technological trend, intelligent diagnostics represents a strategic shift towards proactive, data-informed operations that enhance resilience, safety, and sustainability across the manufacturing value chain.

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Introduction:
Why intelligent maintenance matters now

Today's manufacturing landscape is evolving rapidly, marked by tighter production timelines, increasingly sophisticated machinery, and stricter compliance mandates. In this environment, traditional maintenance methods are no longer sufficient. You need systems that not only respond to issues but anticipate them. That is where intelligent maintenance and diagnostics processes powered by artificial intelligence (AI) and generative AI (Gen AI) come in.

This POV delves into the transformative potential of intelligent maintenance and diagnostics. It explores how AI and Gen AI technologies can enhance operational efficiency, reduce downtime, and predict failures with unprecedented accuracy.

The combination of AI and Gen AI enables a shift from traditional reactive maintenance to a more proactive and predictive model. Through advanced algorithms and real-time data analysis, you can identify issues before they become costly problems. This helps you not only extend asset lifespan but also optimize resource use and reduce operational interruptions.

This document outlines clear business benefits, including cost savings, enhanced safety, and improved performance, while also recognizing practical adoption challenges. You will gain a roadmap for integrating intelligent maintenance into your operations and preparing for the future of asset management.

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Current business challenges in maintenance operations

Manufacturing organizations face significant maintenance challenges that directly affect productivity and profitability. Unplanned equipment downtime is responsible for nearly 80% of disruptions, resulting in halted production lines, delayed deliveries, and increased operational costs. These interruptions also degrade product quality and create supply chain bottlenecks. Key concerns include:

01

High frequency of unplanned downtime and reactive repairs

Unexpected equipment failures continue to disrupt production, strain maintenance teams, and inflate repair costs due to emergency interventions.

02

Limited access to reliable asset data

Inconsistent or incomplete data, especially from legacy systems, prevents effective analysis and undermines the transition to predictive maintenance strategies.

03

Increasing compliance burdens

Navigating a complex and evolving regulatory environment adds pressure to ensure maintenance practices meet safety and quality standards, especially during tech upgrades.

04

Dependence on outdated infrastructure

Aging equipment and legacy IT systems restrict flexibility and make it difficult to deploy modern, data-driven maintenance solutions at scale.

05

Complexity in integrating new technologies

Bringing advanced maintenance tools and platforms into existing operations often requires costly integration efforts and specialized skills that are not always readily available.

06

Shortage of skilled maintenance professionals

A shrinking pool of trained technicians is slowing down digital transformation efforts, making it harder to implement and sustain next-gen maintenance practices.

To combat these challenges, organizations are increasingly adopting predictive maintenance, which uses Internet of Things (IoT) sensors and AI-driven analytics. These tools allow you to monitor equipment in real time, detect early signs of trouble, and intervene before breakdowns occur. Additionally, preventive maintenance inspecting and repairing assets before issues arise can cut maintenance costs by up to 30% and increase uptime by as much as 75%.

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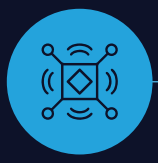
A day in the life of a production operator

As a production operator or supervisor, unplanned downtime can disrupt delivery schedules, compromise product quality, and impact your bottom line. It also affects safety, overall equipment effectiveness (OEE), and team productivity.

The time spent on maintenance during unexpected downtime often increases due to:



Sensor data overload

Analyzing large volumes of time-series sensor data to find abnormalities takes significant effort.

Review service history records

You often need to search and review the service history record to understand how similar issues were handled.

Consulting original equipment manufacturer (OEM) manuals

Review the OEM manual for unique issues and request support from OEM to solve the same. In some cases, bringing the bringing the experts from OEM vendor also delayed the process.

Delayed maintenance response

- The operations team typically becomes aware of the issue only after failure occurs.
- Troubleshooting, part procurement, and maintenance activities start only post-incident, increasing lead time.

To address the challenge of unplanned downtime, an intelligent maintenance and diagnostics solution can help predict potential failures and suggest step-by-step investigation guidance. By combining AI and Gen AI capabilities, the system alerts your maintenance team automatically, enabling you to plan interventions in advance and avoid breakdowns.

You will find this concept in a nutshell below in figure 1.

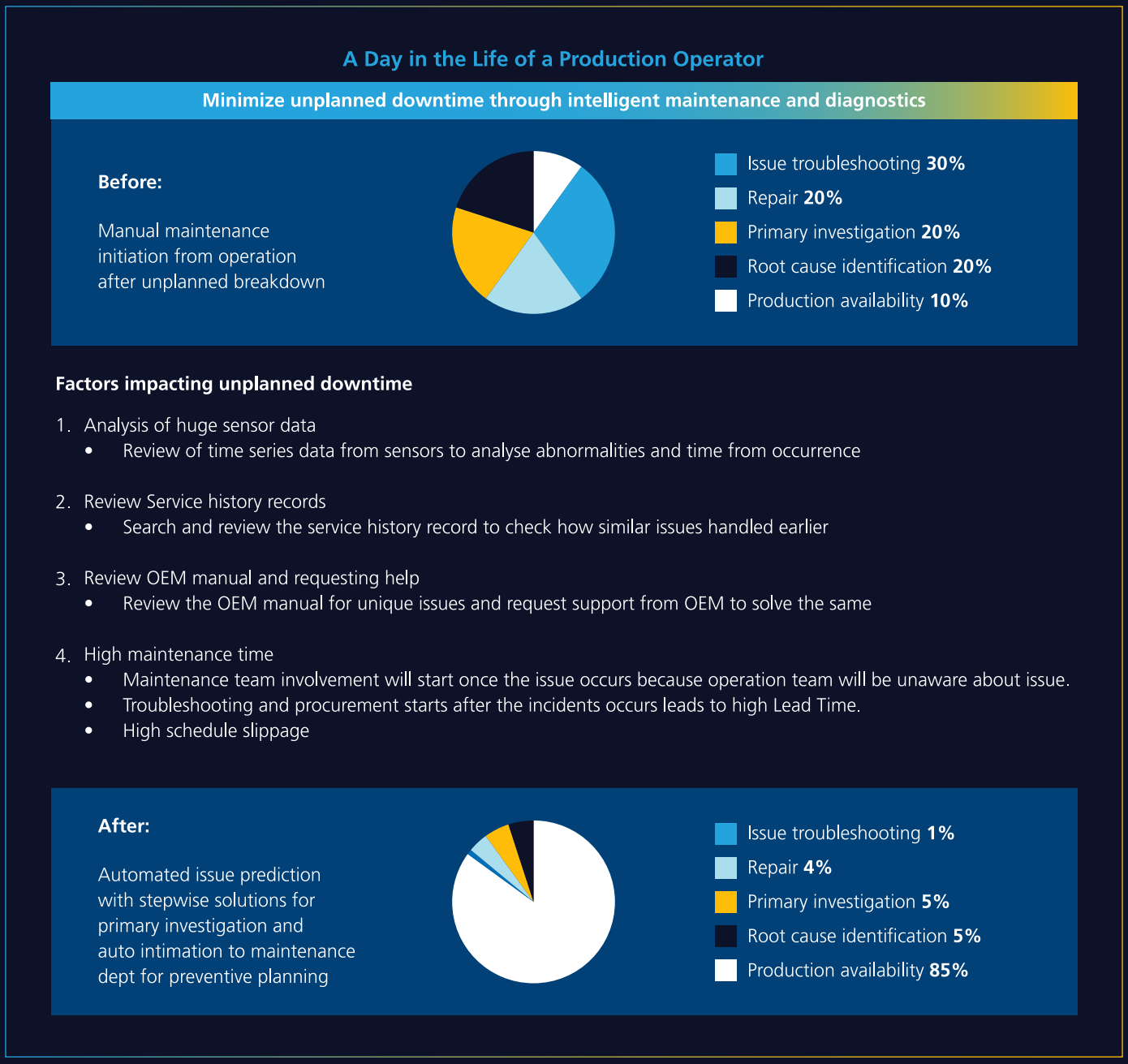


Figure 1: Impacts of intelligent maintenance and diagnostics on operational performance

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Intelligent maintenance and diagnostics:
A solution to prevent unplanned downtime using AI

The solution aims to reduce unplanned downtime by predicting issues and performing preventive maintenance, thereby increasing overall equipment effectiveness (OEE). It provides continuous monitoring, anomaly detection, and issue prediction through AI/ML models. With real-time updates, guided mitigation steps, and automatic alerts, you can respond faster and more effectively.

Here is a breakdown of the benefits:

01

Predictive and preventive maintenance

This solution is designed to enable the operations team to get predicted results and prevent minor or known issues from the outset. By doing so, it reduces reliance on the maintenance department and minimizes the necessity for planned downtime.

02

Seamless monitoring and anomaly detection

- Continuously monitor critical parameters from sensors for key equipment
- Identify abnormalities in critical parameters using trained AI/ML models
- Predict equipment status and issues in real time

03

Faster issue resolution through intelligent prediction

- Quickly scan service history for predicted issues using Gen AI similarity check
- Access to OEM knowledge base for validated solutions
- Summarized issue reports with estimated resolution time
- Automated notifications to your maintenance team

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04

Improved process control

- Real-time issue prediction for the operations team, including steps for primary investigation and resolution
- Efficient planning for the next production run and shift for the operation manager and planner
- Prevents schedule delays and scrap generation due to equipment issues
- Reduced overall production cycle time

The following is a high-level process flow illustrating how the solution works, as shown in figure 2.

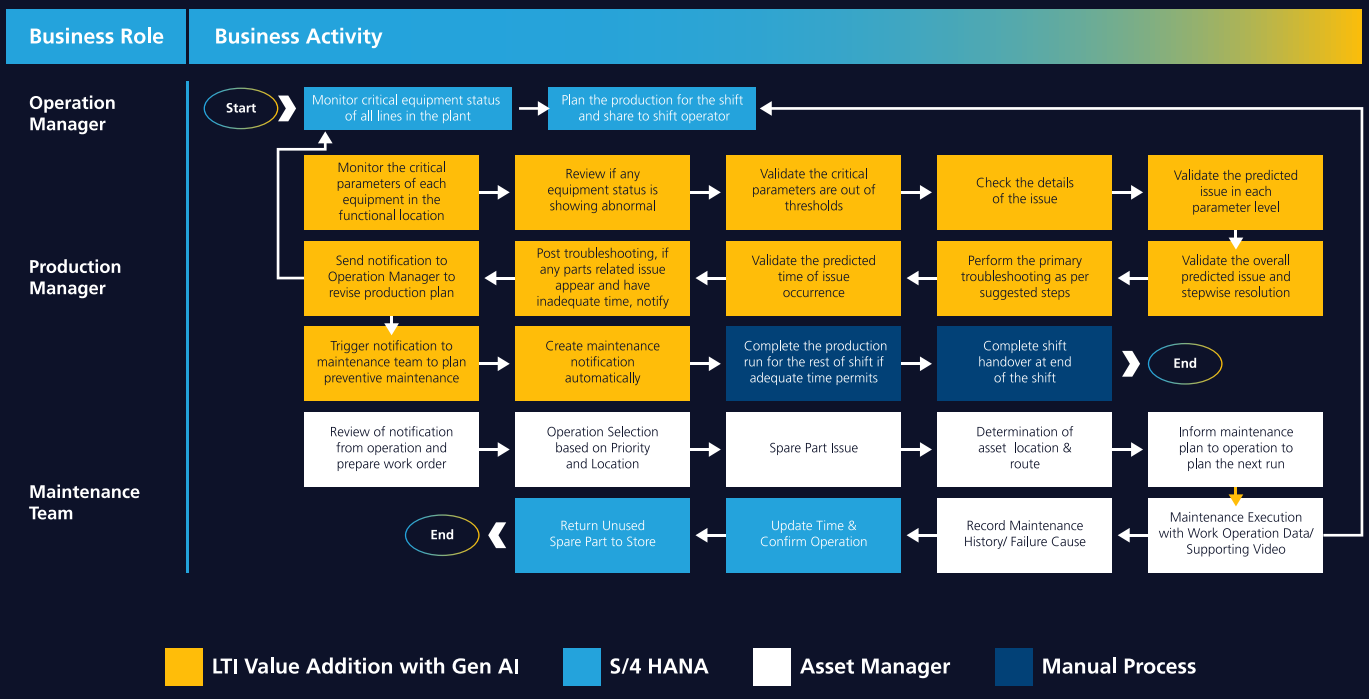

Figure 2: High Level process flow of Intelligent Maintenance & Diagnostics

You can find illustrative examples of these capabilities in figures 3, 4, and 5.

Figures 3 through 5 provide illustrative examples of how these capabilities look in action.

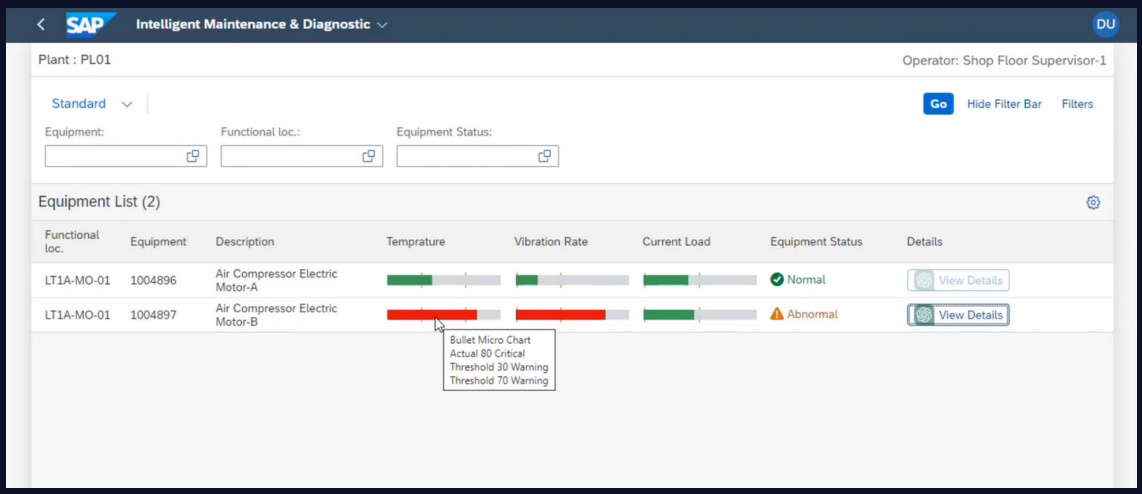

Figure 3: Screen showing the overall status of the critical parameters of the equipment

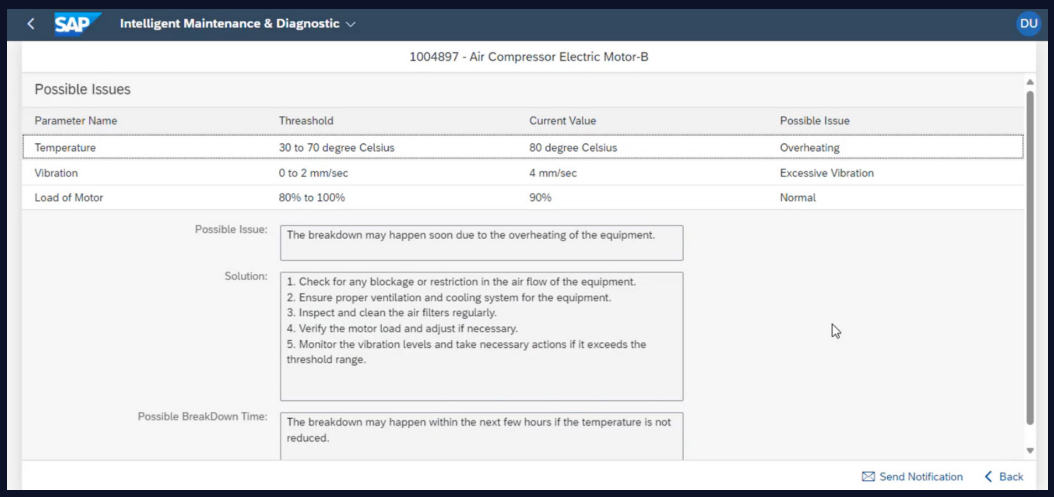

Figure 4: Gen AI based identification of key issues and predicted solutions with expected time

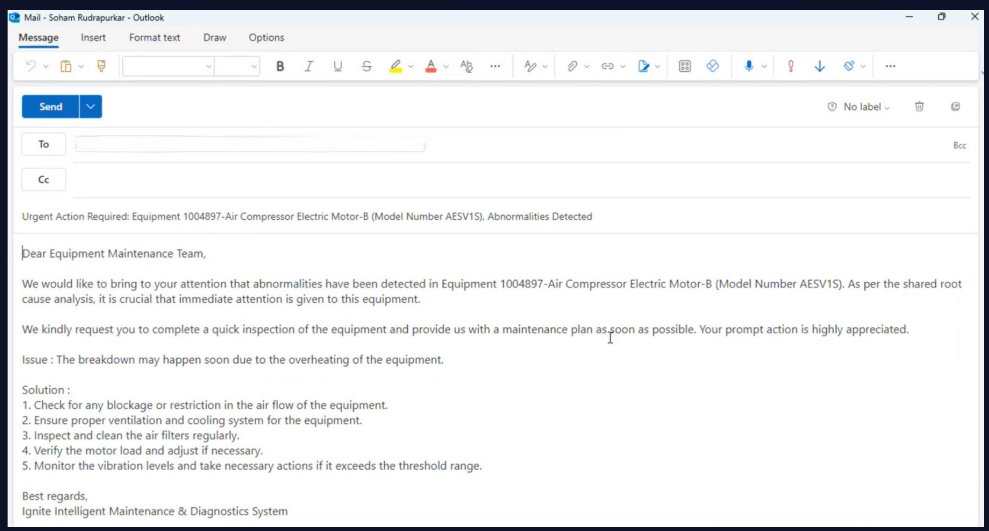

Figure 5: Auto generated mail for the maintenance Department using Gen AI

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Business values and impact

The business value of the intelligent maintenance and diagnostics solution is substantial and multifaceted. Here are the key points:

01

Reduction of unplanned downtime

By predicting issues and enabling preventive maintenance, the solution significantly reduces unplanned downtime. This ensures that equipment is available and operational when needed, leading to higher productivity and efficiency.

02

Increased overall equipment effectiveness (OEE)

The solution enhances OEE by ensuring that equipment operates at peak performance. This is achieved through continuous monitoring, real-time status updates, and predictive maintenance.

03

Seamless monitoring and anomaly detection

The solution provides continuous monitoring of critical parameters from sensors on bottleneck and critical equipment. It identifies abnormalities based on trained AI/ML models, allowing for timely interventions.

04

Efficient issue and solution prediction

The solution uses Gen AI to quickly scan predicted issues in service history records and validate possible solutions from the OEM knowledge repository. This ensures that issues are resolved efficiently and effectively.

05

Enhanced process control

Real-time issue prediction and stepwise mitigation instructions are provided to the operation team. This enables efficient planning for the next production run and shift, preventing schedule slippage, production loss, and quality issues due to equipment performance.

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06

Cost savings

By reducing downtime, improving equipment availability, and optimizing maintenance processes, the solution leads to significant cost savings. This includes reduced maintenance costs, lower scrap rates, and minimized production losses.

07

Improved decision-making

The solution provides real-time data and insights, enabling better decision-making for maintenance and operations teams. This leads to more informed and strategic planning.

08

Scalability and integration

The solution integrates easily with existing AI/ML models and enterprise platforms like SAP ECC 6.0 or S/4HANA 1610 or higher. This ensures that it can be scaled and adapted to different organizational needs.

Overall, the **intelligent maintenance and diagnostics** solution delivers significant business value by enhancing operational efficiency, reducing costs, and improving equipment reliability and performance.

Conclusion

By shifting from reactive to predictive maintenance with AI and Gen AI, you gain more control over asset reliability and performance. Intelligent Maintenance & Diagnostics enables you to reduce unplanned downtime, improve OEE, and make smarter decisions through real-time insights. Its integration with leading enterprise platforms like SAP ECC 6.0 or SAP S/4HANA ensures flexibility and long-term value.

Adopting this solution allows you to use your resources more effectively, minimize operational risks, and position your organization for sustained performance in today's demanding industrial environment.

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Authors' bios

Suman Mukherjee

Associate Director

Program & Project Management
SAP

Suman is a SAP manufacturing specialist with over 15 years of experience, primarily in the energy sector. He leads business transformation initiatives that leverage artificial intelligence (AI) and generative AI (Gen AI) to modernize manufacturing processes. Suman has earned accolades in enterprise hackathons for his Gen AI-driven innovations and is recognized for his thought leadership as the author of a book on SAP MII. He also contributes as a technical reviewer for SAP publications and holds certifications as a Scrum Master and Agile Practitioner.

Amit Pawar

Senior Director

Package Implementation
SAP

Amit heads SAP delivery for the energy vertical, bringing over 20 years of experience across SAP-led transformations. He oversees critical engagements and leads strategic initiatives that drive business value and operational efficiency. Amit is known for his ability to deliver complex SAP implementations across industries, with a strong focus on client satisfaction and account growth. His leadership style combines a deep understanding of SAP ecosystems with a collaborative approach to ensure seamless execution and sustained impact.

Key Contributors

Senthil Kumar P

Soham Rudrapurkar

LTIMindtree is a global technology consulting and digital solutions company that enables enterprises across industries to reimagine business models, accelerate innovation, and maximize growth by harnessing digital technologies. As a digital transformation partner to more than 700 clients, LTIMindtree brings extensive domain and technology expertise to help drive superior competitive differentiation, customer experiences, and business outcomes in a converging world. Powered by 84,000+ talented and entrepreneurial professionals across more than 40 countries, LTIMindtree — a Larsen & Toubro Group company — solves the most complex business challenges and delivers transformation at scale. For more information, please visit **https://www.ltimindtree.com/**