Softtek® | keyland

Industry 5.0, the Smart Revolution

Index

Foreword

Industry 5.0 represents an evolutionary leap in industrial digitization and automation. This White Paper, the result of collaboration between **Keyland** and **Softtek**, combines Keyland's expertise in integrating 4.0 technologies and mobile robotics with Softtek's ability to align digital strategies with business needs. Together, these strengths provide a unique approach to driving industrial transformation and delivering tangible value to clients.

The future of industry is defined by the need to achieve climate neutrality and the ability to unlock the potential of smart technologies within a framework of growing social, business, and governmental awareness about the importance of creating a sustainable, environmental, social, and economic landscape.

To address these challenges, the **sector is committed to digital transformation, focusing on the impact of emerging technologies across the entire value chain.** In this context, it is essential to accelerate digital evolution with a people-centered, sustainable, and resilient approach, where innovative solutions not only drive the growth of organizations, markets, and countries but also contribute to building a responsible, creative, and sustainable future.

The new industrial paradigm is defined as resilient and digital. **We are witnessing an unprecedented shift driven by the need to transform industries, businesses, institutions, cities, and society.** Technological innovation is the catalyst for this transition toward smarter and more efficient models.

To lead this change, we identify the technical and technological challenges of the coming years to define a roadmap that incorporates strategies and digital tools to help organizations tackle these challenges.

This report highlights the technological advancements addressing these challenges. **These advancements are rooted in experimentation in fields such as artificial intelligence (AI), machine learning, virtual reality, digital twins, augmented reality, the Internet of Things (IoT), cloud computing, and advanced data analytics.** Understanding these innovations and their evolution will enable the development of highly competitive strategies to comply with regulations and seize new business opportunities.

With this research, we aim to provide a **comprehensive view of the technological trends** shaping the industrial sector and defining its evolution in the coming years. Staying ahead of the future will be key to defining the new business landscape.

01

From Industry 4.0 to 5.0

The transition from Industry 4.0 to Industry 5.0 represents a significant shift in how emerging **technologies are integrated into industrial processes. The Fourth Industrial Revolution has been characterized by the digitalization and automation of factories through the use of technologies such as IoT, artificial intelligence, advanced robotics, and big data analytics.**

These advancements have enabled greater efficiency, flexibility, and customization in production, as well as improved data-driven decision-making. **However, Industry 5.0 takes it a step further by focusing on human-machine collaboration, autonomous and intelligent processes powered by deep learning algorithms, and the fusion of the physical and virtual worlds.**

Industry 5.0 heralds a new era where the synergistic interaction between humans and machines promises to transform the industry, driving productivity and innovation to new heights while prioritizing worker well-being and environmental care.

This new phase builds upon and enhances the previous one, unlocking its full potential with the support of disruptive technologies and shortening the time between industrial revolutions, fueled by the rapid rise of Generative AI (GenAI).

It reflects a shift from an economic-centric focus to one centered on social value and well-being, placing worker welfare at the heart of the production process. It aims to deliver prosperity that extends beyond employment and growth. This new stage of industrialization **is built on three pillars: human-centricity, sustainability, and resilience.**

The human-centric approach integrates human and machine intelligence to create synergies and complement each other, fostering more efficient processes and personalized solutions while understanding market trends and the motivations of both customers and employees. This strategy is centered on maximizing digital transition, ensuring security, and enhancing talent capabilities while promoting social, environmental, and economic well-being. These holistic goals encompass the prosperity of all stakeholders and interest groups.

Sustainability, as defined in the Framework 30, Agenda 2030, and the European Green Deal, aims for efficiency and effectiveness in processes to achieve a 55% reduction in greenhouse gas emissions, a 32% increase in renewable energy use, and a 32.5% improvement in energy efficiency, all with the ultimate goal of attaining climate neutrality by 2050. To meet these ambitious objectives, technology emerges as a transformative solution capable of enhancing process efficiency, predicting demands, integrating renewable energies into production systems, and fostering circularity, while simultaneously providing an intelligence layer to all operations.

Resilience is another fundamental characteristic. With new technologies, organizations can predict market trends, develop real-time strategies to adapt to disruptions—whether resource-based or geopolitical—and anticipate new players entering the market, ensuring their value chains remain intact. The ability and flexibility to adapt to change are crucial in an environment where industries face constant dynamic shifts. These changes open windows of opportunity through technological innovation. Cybersecurity also becomes a key factor.

As technological evolution advances, so do risks; thus, an optimal strategy must include reducing digital vulnerabilities to prevent data breaches that could compromise organizational operations.

Industries are the engine of the economy and societal prosperity. **They must lead the human, digital, and green transitions** to unlock the full potential of the value they can offer. This global focus will define Industry 5.0, characterized by autonomous manufacturing, enhanced customer experiences, hyper-personalization, responsive supply chains, interactive products, social value, and cobots—just a few of the features already shaping this transition.

Industry 5.0 has emerged at this moment due to a convergence of critical factors: **resource and talent shortages, the urgent need to combat climate change, ongoing waves of global economic crises, and the rise of smart technologies.** Together, these factors enable the development of strategies that not only mitigate these challenges but also turn them into opportunities for improvement, focusing on the value chain with greater emphasis on environmental and social impact as outlined in ESG and CSR frameworks, alongside economic improvements for organizations, markets, and nations.

These efforts play a significant role in addressing pressing global issues.

Technology is undoubtedly **the sector's most solid bet for leading the shift toward more sustainable, efficient, and digital models.** This involves a mindset shift toward new strategies that achieve responsible economic, competitive, and productive growth aligned with social and environmental contexts. Digitalization serves as the catalyst for progress, innovation, and disruption in the industry.

02

Key Trends in Industry 5.0

2.1

Smart Industry

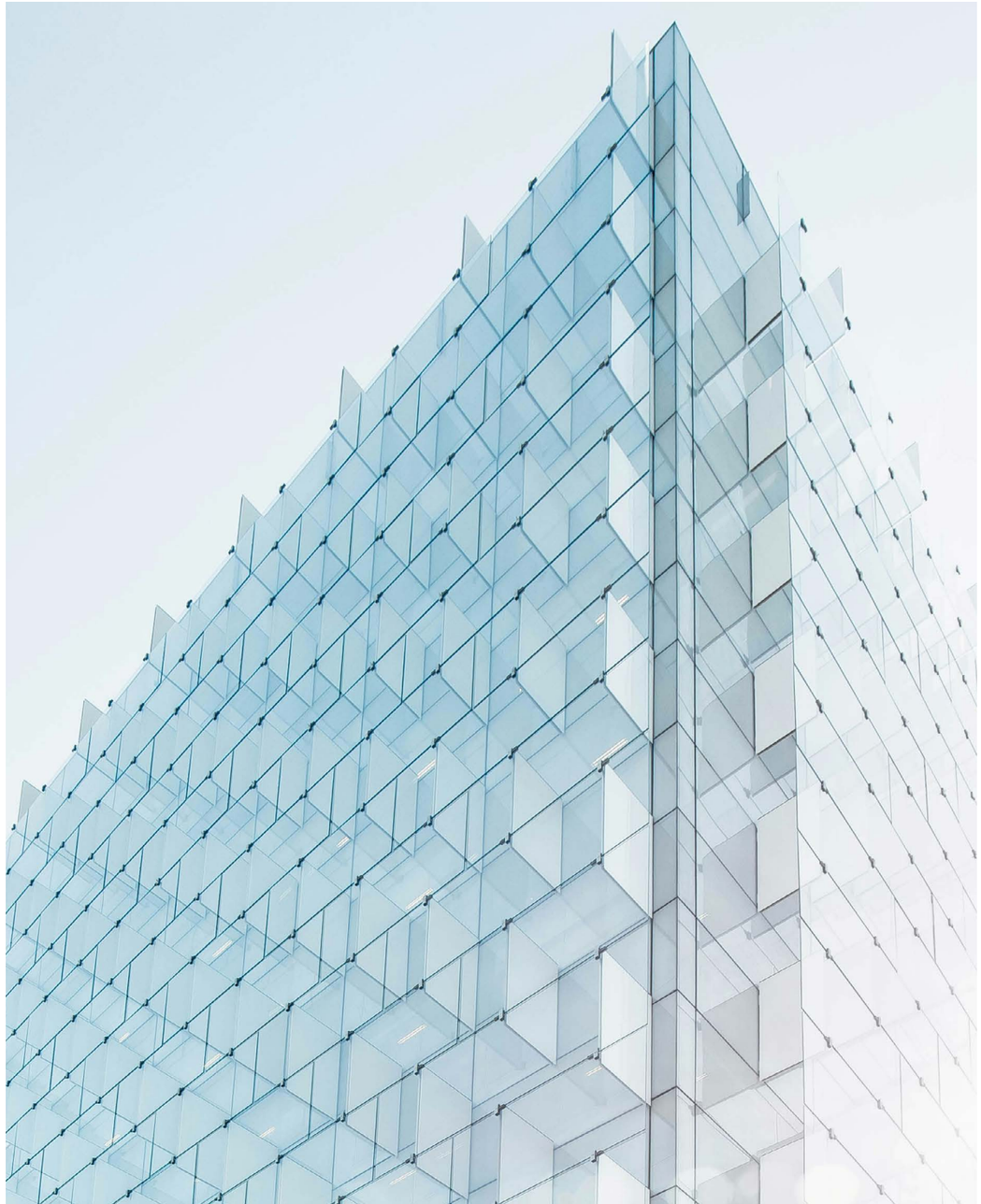
Smart Buildings

Generative Design in Smart Buildings

Generative design is an iterative exploration process that leverages artificial intelligence and generative algorithms to autonomously create a wide range of solutions based on the specifications, objectives, and constraints provided by the engineer. **These algorithms analyze input parameters to quickly and efficiently simulate multiple scenarios, exploring innovative solutions that optimize complex structures**—from space utilization to the selection of construction materials—**ultimately identifying the most suitable configuration**.This innovative approach, combined with technologies such as cloud computing and virtual simulation, accelerates the design process and allows for the evaluation of the behavior of multiple generated designs. In doing so, it ensures the selection of the optimal solution in terms of cost, time to market, performance, and sustainability.

Neurodesign Applied to Advanced Conceptualization

Neurodesign integrates advanced artificial intelligence and neuroscience technologies to create spaces and buildings capable of real-time adaptation to the needs of their occupants. Using emotion recognition algorithms, **intelligent systems can identify states such as happiness, focus, frustration, or distraction and autonomously suggest adjustments to the space or conditions, such as lighting, acoustics, ambiance, or breaks, to ensure an optimized experience.** Buildings designed under the principles of neurodesign **prioritize the physical and emotional well-being** of their occupants, promoting health, enhancing productivity, and strengthening emotional connection. This evolution marks a shift toward an era where technology not only responds to human actions but also understands and supports emotional states.



Biotechnology and Nanotechnology: Smart Materials

Nanotechnology enables the development of smart materials with adaptive and self-repairing capabilities, while biotechnology incorporates living materials for constructing smart buildings, enhancing their strength, durability, and energy efficiency.

The use of these dynamic materials, which respond in real-time to environmental conditions, **allows buildings to manage themselves autonomously**, anticipating situations and optimizing their response.

Among the most notable advancements are self-cleaning surfaces, essential for maximizing the efficiency of photovoltaic energy, and nanocomposites with adaptive properties that adjust their composition in response to extreme conditions such as earthquakes or temperature fluctuations.

Digital Twins for Smart Design

Digital twin technology facilitates the dynamic and adaptive management of spaces based on demand, enabling the creation of new layouts through simulations driven by predefined parameters and objectives to identify the best solution.

These virtual models **bring intelligence and agility to the design process by incorporating continuous learning and accumulated experiences.** The convergence of the virtual and physical worlds establishes a real-time connection, enabling constant simulations, testing, and analysis.

This allows industries to innovate in the configuration of their spaces, creating flexible and adaptable facilities that meet market demands or operational changes. This technology enhances building performance, reduces costs, and minimizes risks associated with adjustments or changes by accurately predicting how infrastructures, machinery, and people will behave under various conditions.

Energy Efficiency

Advanced Energy Management Systems

Energy management systems **utilize advanced algorithms and data analysis to optimize energy resources** in real time. They integrate various energy sources, including renewables, to efficiently manage distribution. EMS can predict consumption patterns and adjust energy demand, ensuring optimal resource usage and minimizing energy losses. The integration of intelligent automation provides **dynamic, adaptive, and intelligent control**, which is essential for environmental management. The data collected is processed by AI algorithms that automatically adjust energy systems, **maintaining optimal conditions with minimal energy consumption.**

Additionally, smart sensors **facilitate predictive and preventive maintenance of energy systems.** By detecting anomalies and early signs of equipment degradation before they escalate into critical failures, these sensors enable maintenance to be scheduled at the ideal time, reducing downtime and extending the lifespan of assets. This not only lowers costs but also ensures maximum efficiency of the systems.

Advanced Analytics to Enhance Performance

Advanced analytics enables industrial companies **to derive value from data through the combined use of cutting-edge processing technologies,** uncovering patterns and trends in energy usage to enhance efficiency. The implementation of machine learning algorithms and complex statistical models offers deep insights into the inner workings of machinery and operational processes. This supports continuous improvement and the early detection of faults or anomalies that could lead to excessive energy consumption.

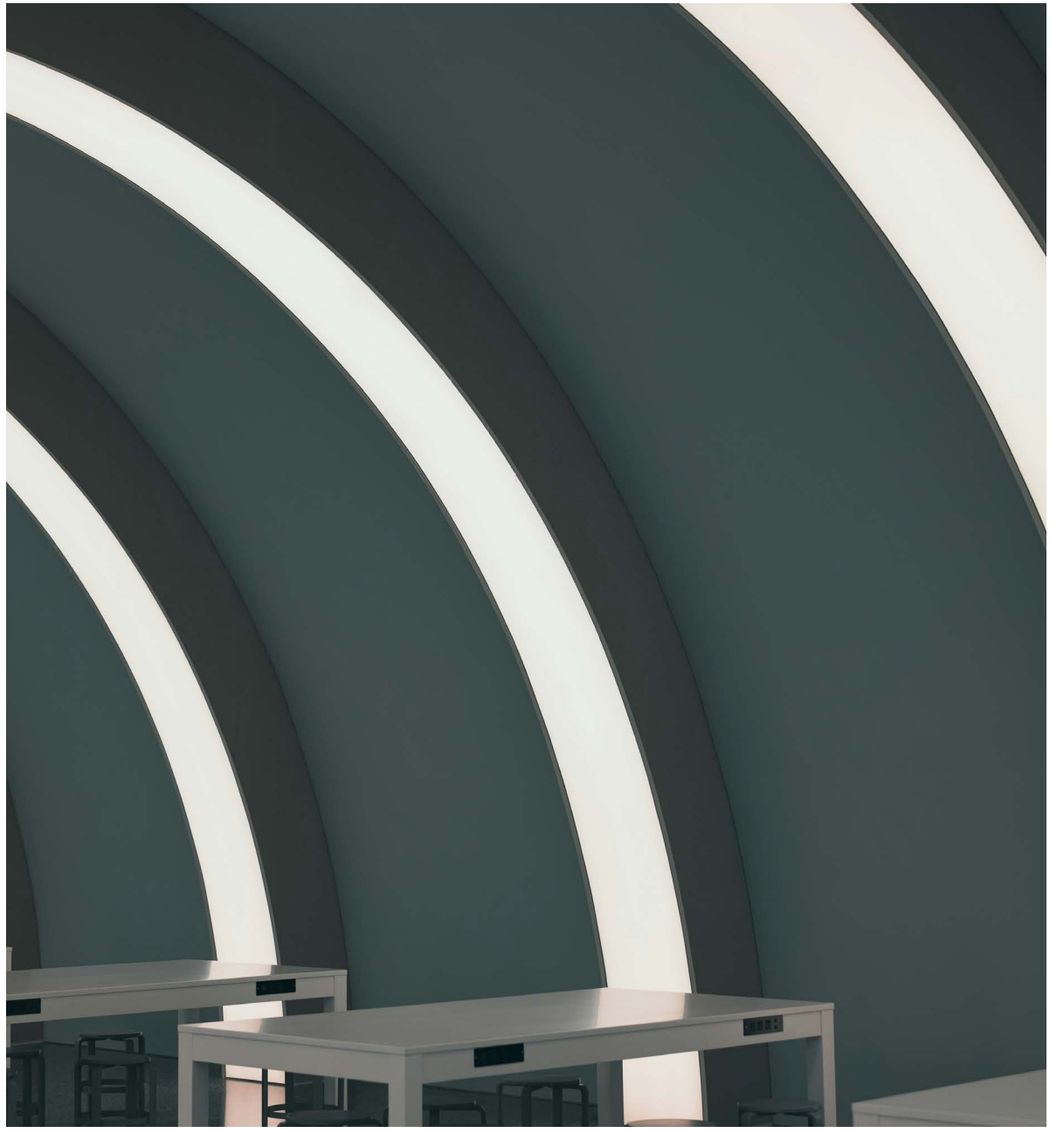
The ability to identify hidden patterns and previously undetectable correlations among variables helps reveal optimal performance levels, create simulations to achieve these goals, and plan for future scenarios.

Hypersensorization and Intelligent Automation

Factories 5.0 will manage energy consumption in real-time, automating decision-making to optimize usage and achieve climate neutrality. This will be made possible by IIoT sensor networks and RFID systems that enable hypersensorization, continuously monitoring all products, devices, machinery, and robots, both inside and outside the facilities. The data collected will be analyzed in real-time through AI and ML algorithms, which will identify **usage patterns and opportunities to improve efficiency.** Smart buildings will automatically adjust energy distribution according to demand, maximizing the use of renewable energy sources, minimizing waste, and providing proactive data-driven management that enhances both performance and sustainability. From the start, **new smart factories will integrate sensor networks, connected devices, domotic systems, and nanotechnology components,** allowing them to monitor key performance metrics and automate critical operational actions, driving efficiency and sustainability across all processes.

Integrated Systems and Cloud Observability

An integrated management system provides a single, unified design that streamlines all aspects of operations and processes, eliminating redundancies and data silos. This approach establishes an efficient, operational, and agile framework capable of meeting objectives and regulatory requirements effectively. **Cloud observability offers a comprehensive view of the system, enabling real-time monitoring and in-depth data analysis.** It gathers and examines information from multiple distributed sources, generating insights into performance and detecting anomalies before they become critical issues. With this capability, **it's possible to gain complete visibility into plant operations and strategically manage procedures and resources proactively, resiliently, and efficiently.** This ensures that expectations are met in an intelligent and innovative manner.



Operational Efficiency

Through modular infrastructures and mobile workstations equipped with intelligent management systems, **factories will be able to dynamically redesign workspaces**, adapting them to the operational and collaborative needs of each moment.

Advanced connectivity and edge computing provide the hyperconnectivity required to manage the large volumes of devices and data generated in smart industries. Thanks to its high speed and low latency, 5G **enables instant communication between devices, improving coordination and operational efficiency, particularly in dynamic and rapidly changing environments.** Real-time data processing optimizes production processes and increases operational efficiency by managing and analyzing information from smart sensors and IIoT devices.

Autonomous and Smart Plants

Autonomy will be the key driver of the coming decades. The next few years will be defined by a push for greater productivity and operational agility across the industrial sector. Achieving these goals **will rely heavily on the integration of autonomous technologies in all areas.** The unprecedented rise of artificial intelligence and autonomy will serve as the main catalyst for this transformation. **The evolution of intelligent autonomy is enabling industries to rethink their entire processes, empowering organizations with the ability to dynamically adopt predictive and resilient strategies.**

Intelligent autonomous systems give autonomous factories the insight needed to respond efficiently and optimally to changing conditions. These systems continuously **improve and optimize their processes and decision-making** through technologies such as artificial intelligence and deep learning.

AI Agents

In the realm of autonomy and intelligence, AI Agents powered by generative and self-evolving artificial intelligence will emerge. **These agents will possess cognitive capabilities and emotional analytics skills that enable them to interact not only with machines, but also with humans and the surrounding environment,** making autonomous decisions to achieve set objectives.

They will be able to adapt, learn, and evolve according to context and environmental changes, autonomously excelling in highly analytical tasks. This approach **will enhance agility, efficiency, and effectiveness by maximizing the potential of the underlying algorithms.**

Autonomous artificial intelligence is designed to address challenges in both business and industrial domains. Experts will leverage AI Agents as collaborators to enhance their creative and strategic capacity in tackling complex situations, ultimately enriching the outcomes achieved.

Cobots and Automation

Unlike AI Agents, which are designed to independently carry out specific missions, cobots (collaborative robots) are intelligent robots intended to assist with repetitive, highly precise, hazardous, or automatable tasks. This allows employees to focus on higher-value activities. **Cobots are easy to program, and thanks to technologies like IoT, AI, Big Data, 5G, and computer vision, they enable productive collaboration with any worker.** Their implementation improves operations and increases worker safety by reducing exposure to tasks that could cause injuries or accidents.For instance, cobots equipped with AI and computer vision can patrol facilities, operate in hazardous or hard-to-reach environments, and proactively identify anomalies, thereby enhancing both safety and machinery reliability.**Cobots are designed to support employees across various tasks and processes,** already fulfilling key roles and establishing themselves as essential tools in industrial programming workflows.

Physical and Cybersecurity

AR & VR for Training

The adoption of augmented reality (AR) and virtual reality (VR) technologies for training workers in their roles is transforming both the teaching and learning processes, optimizing the entire experience.

I**mmersive experiences are becoming the new standard for acquiring knowledge. They also serve as a risk prevention system that simulates processes within safe, controlled virtual environments.** This approach allows workers to acquire and practice critical skills without the risks associated with training in real facilities, ensuring they know how to handle dangerous situations before they occur in real life. In addition, these technologies enable **flexible training adjustments for workers as factory layouts**, processes, or collaborations with other areas or tools evolve. They can even integrate with digital twin models, combining AR and VR to create comprehensive, responsive learning systems.

Augmented Intelligence to Reduce Accidents

Augmented intelligence, using AI and machine learning, **can process and analyze massive amounts of operational and safety data, uncovering patterns, trends, and anomalies that would be difficult or impossible for a human operator to detect.** This innovation will lead to solutions that security teams can use to anticipate hazardous events, providing early warnings and data-driven recommendations to help prevent potential accidents.

It also enables the creation of simulations and predictive models that can anticipate unsafe conditions, allowing operators and managers to implement preventive measures and precise risk mitigation strategies.

Biometrics and AI to Ensure Operator Safety

Intelligent biometric systems enable full visibility into employees on the factory floor, including their distribution, location, behavior patterns, and workspace usage. This information is crucial for establishing a robust safety system and facilitating effective worker evacuation in case of an accident. The system can autonomously identify personnel outside designated areas and detect anomalous patterns among technicians, flagging behaviors or decisions that may pose an immediate risk.

Additionally, biometric technology, using unique physical traits such as fingerprints, facial recognition, or iris patterns, **offers a foolproof identification system for implementing a tiered access security strategy.** Modern factories will integrate advanced identification systems to enhance security levels, maintain rigorous control over personnel entering the facilities, and quickly identify any unusual behavior.

AI-Based Cybersecurity Protection

Artificial intelligence is a crucial ally for industries in safeguarding critical data and operations from increasingly sophisticated and ever-evolving cyber threats. The growing number of connected devices and sensors in modern factories significantly heightens exposure to systemic risks, compelling organizations to deploy intelligent cybersecurity centers that continuously monitor for suspicious activities, intrusions, or security breaches.

The combination of artificial intelligence, deep learning, and autonomous systems enables the development of predictive and preventive cybersecurity strategies that adapt and improve with every attempted attack. **These systems replicate the investigative and decision-making processes of security analysts, drawing on collected data and accumulated expertise.**

Algorithmic models enhance real-time processing power and accuracy, enabling the **analysis of vast datasets to detect anomalous behavior patterns and neutralize cyber incidents before they escalate into major threats.** Furthermore, autonomous security systems can update their code in real time to counter detected attacks. This dynamic approach ensures that strategies continually evolve with each interaction, optimizing defenses and minimizing risks.

Preventive and Predictive Maintenance

AI-Driven Maintenance

Predictive maintenance is set to undergo a significant transformation with the **integration of autonomous agents, advanced systems tied to the rise of generative AI, and deep learning** processes that operate fully independently.

Thanks to their adaptive reasoning and cognitive capabilities, **these agents efficiently, optimally, and in real-time manage** the tasks for which they are designed—such as predictive maintenance—establishing a new standard for the operation and management of key infrastructure. The cognitive process of these autonomous systems runs on a continuous loop, resetting after each iteration.

This allows them to detect in real-time any degradation in operations, infrastructure, or machinery, and immediately respond to close detected gaps. The cognitive layer automatically addresses incidents using deep learning algorithms and artificial intelligence technologies.

With the support of intelligent robots and IIoT systems, **industries can continuously monitor the condition of their resources, conduct preventive and predictive diagnostics, and initiate the necessary measures to optimize maintenance and proactively resolve any issues.**

Data Analytics for Maintenance Optimization

In a dynamic, ever-changing global environment, data-driven decision-making based on precise, timely insights is crucial for organizational success. **Intelligent sensor networks and IIoT systems generate vast amounts of real-time data, necessitating high-performance, agile infrastructures that can process both structured and unstructured data.** This enables the extraction of relevant information that facilitates intelligent and autonomous decisions throughout all organizational processes, thanks to the integration of artificial intelligence into the entire data science lifecycle.

Access to real-time information is critical for monitoring equipment and infrastructure, predicting failures, enhancing safety, optimizing processes, preventing manufacturing errors, and reducing repair costs. **AI analyzes collected data to identify patterns that indicate potential issues, such as wear, leaks, overheating, or systemic failures.** Continuous, detailed monitoring allows early detection of problems before they cause significant operational disruptions.

Autonomous Robots for Real-Time Repairs

Autonomous robots are a key solution for detecting and resolving incidents in facilities or performing maintenance tasks. Equipped with advanced sensors and AI systems, **they can operate in diverse environments, including hazardous or inaccessible areas for humans.** These robots proactively detect anomalies and address them using AI and learning systems, improving operational safety and reliability.

With specialized tools, **robots can carry out real-time repairs, such as adjusting parts, lubricating components, replacing worn elements, or performing welds.** This ability to act autonomously reduces risks, minimizes downtime, and extends equipment lifespan, allowing technicians to focus on more specialized and less automatable tasks.

Extended Reality for Contextual Machine Information

Extended reality and computer vision allow operators to view real-time, contextualized information about machinery, including usage data, performance indicators, maintenance processes, repair procedures, or alerts regarding its condition—such as defects, wear, or anomalies. This information is displayed directly in their field of view, providing instant, accurate diagnostics.

These data are processed through intelligent systems and advanced algorithms that generate a roadmap with recommendations on how to address detected issues, integrating this knowledge into standardized procedures to optimize the use of facilities and machinery. This enables **operators to identify and resolve issues more effectively, optimize processes, mitigate errors, make smarter decisions, and reduce downtime**, significantly boosting productivity.

2.2

Smart Processes

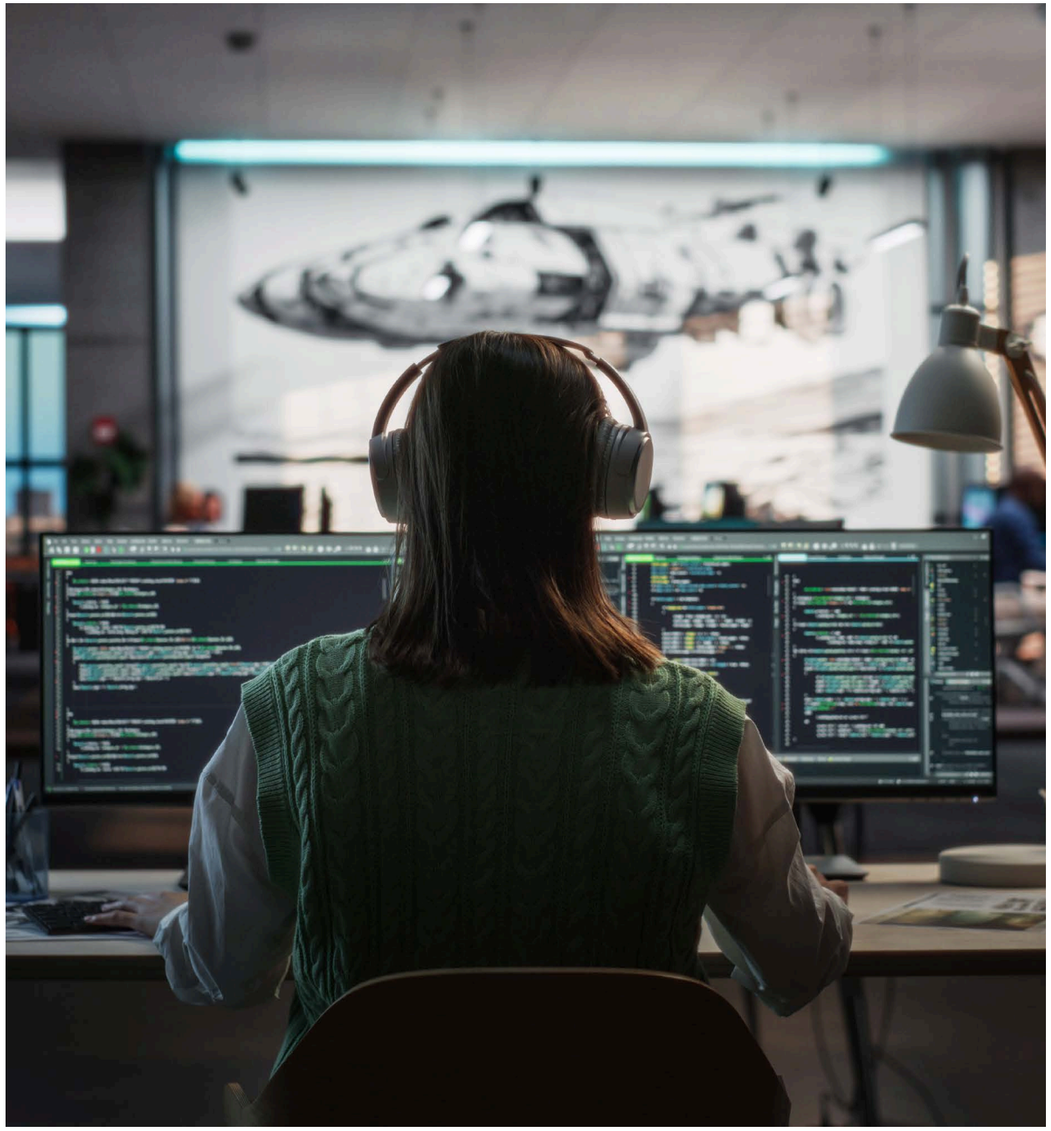
Innovation

1. Research and Development

Trend Detection and Innovation Powered by Artificial Intelligence

The future of product development extends beyond traditional boundaries by integrating artificial intelligence into the innovation process. **This revolutionary technology opens up new possibilities for designing, developing, and refining products, tailoring them more closely to customer needs and expectations.** It will drive greater personalization and adaptability, creating intelligent systems that optimize and streamline manufacturing.

Market data analysis, consumption trends, and behavioral patterns will identify innovation opportunities, enabling companies to **anticipate emerging needs and develop groundbreaking products.** Additionally, artificial intelligence will facilitate continuous design optimization throughout the product lifecycle by analyzing performance data and conducting advanced simulations, allowing for rapid adaptation. This technology also enhances market understanding by analyzing data, segmenting customers, and generating strategic insights for product design. As a result, **AI fosters creativity and produces solutions that not only meet customer demands but also stand out against the competition.**



Intelligent Generation of Concepts, Prototypes, and Hyper-Personalized Designs

In today's fast-paced market, product development is a race against time and the need for personalization. Success will favor those who embrace the transformative potential of generative AI. **These technologies allow engineers to explore uncharted territories without the constraints of production time or cost, leveraging digital twin and extended reality technologies to design and prototype.** With rapid prototyping, optimization, and concept generation, AI-powered tools are unlocking a new wave of innovation.

Artificial intelligence's ability to process large datasets and historical or trend-based information **provides software with the tools necessary to enhance creativity in concept generation and inspire designers with innovative ideas.**

Furthermore, AI excels in creating personalized experiences and products by analyzing user behavior and preferences. This approach **helps identify trends, stay ahead of competitors, and fully capitalize on opportunities,** while continuously refining business strategies.

2. Product Design and Hyper-Personalization

Generative Design: Continuous Design Optimization

Generative engineering, supported by computational simulation, **allows for the exploration, iteration, and refinement of a wide array of optimal designs. The system automatically evaluates multiple options, selects the best solution, and imbues them with innovative qualities.**

The ability to personalize products, combined with generative algorithm-driven design optimization, **ensures that products are not only efficient but also highly tailored to meet specific consumer needs.**

Generative design delivers numerous advantages, including increased creativity and innovation, enhanced efficiency, cost savings, sustainability, material optimization, and personalization. Machine learning techniques that identify patterns and optimize design parameters make this possible.

Additionally, generative design excels in topological optimization—refining the shape and arrangement of a design to meet specific performance objectives—and multi-objective optimization, which balances factors like costs and performance while applying Lean Manufacturing principles.

In a market where consumers demand ever-more personalized innovations and features, **companies must bring new designs to market quickly to meet the pressures of the global economy.** The only way to lead in such a dynamic, competitive environment is to adopt emerging technologies that enable design to be guided by consumer specifications, resulting in hyper-personalized next-generation designs.

Digital Twins and Extended Reality

Digital twins and extended reality enable engineers to visualize and analyze process performance, create product emulations with new features, or evaluate new production processes in simulated virtual environments to optimize manufacturing workflows.

These virtual models, exact replicas of physical installations and products, allow engineers and operators to iterate without the constraints of time and cost.

Implementing digital twins facilitates detailed simulation of installations, machinery, and products under various operational conditions and scenarios. **This tool is particularly valuable for assessing optimization levels, making virtual adjustments, and learning from experience through intelligent algorithms**, ensuring maximum process efficiency.

With the advent of quantum computing, this approach will become even more powerful, enabling innovation and design departments to push boundaries, providing a revolutionary approach to ideation, planning, and manufacturing, and driving innovation and competitiveness in the sector.

Production Planning

1. Resources, Supply, and Operations Management

Intelligent Automation of the Logistics Process

Intelligent automation incorporates three cognitive technologies: artificial intelligence, process management, and robotic process automation. Integrating these components creates transformative solutions that span production and logistical supply chain management. In warehousing, these technologies enable the implementation of advanced solutions and software that optimize goods flow, increasing productivity within storage facilities.

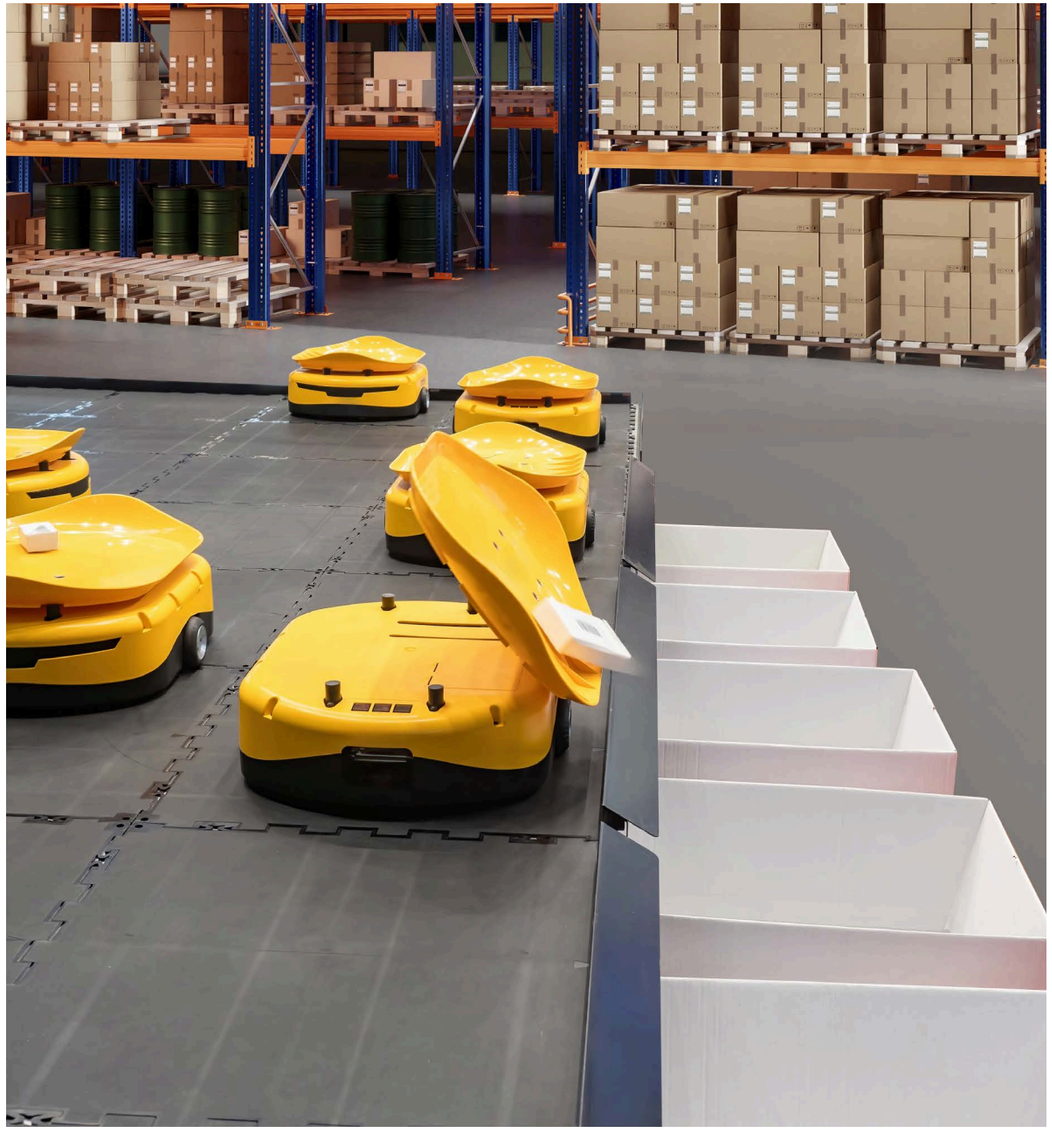
When applied to the supply chain, this combination simplifies logistical processes, promotes comprehensive warehouse management, and significantly reduces errors caused by manual handling of data or products. **Advanced robotics will further optimize manufacturing logistics processes, streamlining assembly, packaging, and material and product transportation both inside and outside facilities.**

Advanced robotics will also optimize manufacturing logistics processes, making assembly, packaging, and the transport of materials and products, both inside and outside facilities, more agile and straightforward. One major advantage of this innovation is that **logistics robots can operate 24/7**, helping to shorten manufacturing cycles. Furthermore, with connected sensors, collaborative robots can perform automated data analysis using AI, providing organizations with greater predictive capabilities and improved decision-making related to warehouse and distribution center operations.

Hyperconnectivity and Information Flows in Operations Management

Hyperconnectivity allows the industrial sector to gather all critical information and enable interaction between connected systems. Whether data originates from devices, sensors, machines, systems, historical records, or trends, **hyperconnectivity ensures their integration and alignment to enhance productivity and support continuous improvement tools, ultimately achieving full optimization across the value chain.**

Deep learning facilitates the modeling of high-level data abstractions through computational architectures that perform iterative, non-linear transformations. **The combination of hyperconnectivity and artificial intelligence enhances demand forecasting, production control, and agile adaptation to changes. This results in complete traceability and comprehensive control.**



2. Supply Chain and Distribution Planning

Predictive Analytics for Demand Management

Data analytics tools, powered by artificial intelligence and machine learning, **leverage a wide variety of information sources to estimate and forecast future demand based on identified patterns.**

Data scientists employ deep learning and machine learning algorithms, utilizing techniques such as neural networks or logistic models, to predict future events through statistical methods. Some modeling techniques use initial predictive learnings to generate valuable predictive insights.

Organizations use predictive analytics to manage inventories, balance warehouse supply levels, forecast future costs, set pricing strategies, and issue recommendations that enhance long-term performance.

Automation and Smart Robots for Warehouse Management

Artificial intelligence is transforming robotic warehouses, or smart warehouses, and their operations in two key areas: collaborative robots (cobots) and autonomous mobile robots (AMRs). **Intelligent robotics is now deployed throughout the entire logistical process, making storage and automated sorting, space management, transportation, order preparation, and fulfillment more efficient.** This results in significantly improved operational times and benefits.

Using AI and machine vision, cobots designed for intelligent picking can process orders quickly and accurately, identifying objects, determining the optimal grip points, and calculating space requirements to minimize waste.

AMRs, enhanced by advancements in AI and autonomy, can independently navigate their environments without the need for fixed guides. **They employ sophisticated sensor arrays, AI, machine learning, and computational systems to plan routes and adjust movements when encountering obstacles.** The advantages of AMRs for both workers and operations include exponential improvements in safety, efficiency, and productivity.

Production

1. Manufacturing

Assisted and Adaptive CAD/CAM Manufacturing

The integration of computer-aided design (CAD) systems and virtual simulation tools like computer-aided manufacturing (CAM) **will reduce prototyping times, minimize errors, and maximize resource utilization.**

In Industry 5.0, CAM will play an even more crucial role than it did during the Fourth Industrial Revolution, as it **integrates with technologies such as artificial intelligence, advanced robotics, and the Industrial Internet of Things (IIoT).**

This integration enables more adaptive manufacturing, where CAM systems automatically adjust production parameters in real-time **based on predictive analysis and AI models that process data from sensors.** Additionally, CAM systems facilitate adjustments to changing designs or production requirements, ensuring greater flexibility and responsiveness in dynamic industrial environments.

IT-OT Convergence in Manufacturing Supervision

Connecting IT (Information Technology) and OT (Operational Technology) is key to achieving true end-to-end digitalization in an industrial enterprise. **This ensures standardized, secure data flow and exchange among devices, machines, and systems always.**

The integration of data **spans the entire operation—from sourcing and production to shipping.** Systems provide intelligent, holistic monitoring and analysis of the entire process, enabling informed, real-time decision-making that helps prevent breakdowns, disruptions, or downtime. AI algorithms elevate this process to the highest level in smart plants, where digitalization and connectivity are fully integrated. **This provides greater agility to adapt to changes, complete traceability, and exhaustive monitoring throughout the entire chain.**

2. Quality Control

Machine Vision and AI for Visual Inspection

AI, deep learning, edge computing, and IoT are radically expanding the capabilities of machine vision. **By replacing classical algorithms with neural networks, these systems can compare incoming images or image streams against a neural network model**, recognizing subtle differences, nearly imperceptible discrepancies, and microscopic defects essential for optimal quality control.

AI is pushing machine vision further, **giving robots the ability to perceive in three dimensions, grip parts, perform inspections, and collaborate effectively with experts.** It also allows the use of natural language processing to read and interpret labels or signals.

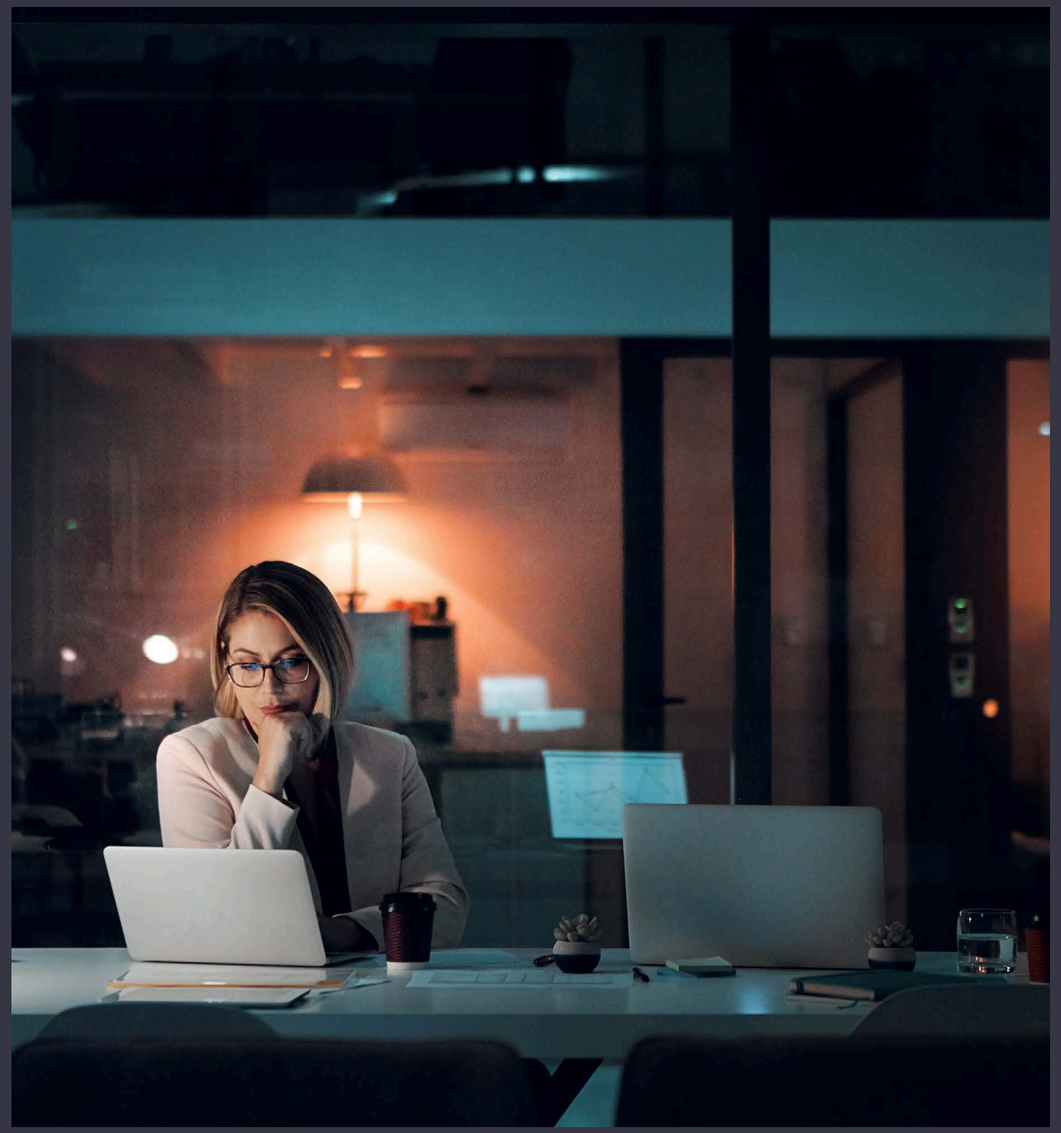
Robots and Automated Systems for Quality Control

By incorporating analytical capabilities and artificial intelligence, collaborative robots **can identify patterns, trends, and anomalies throughout production and distribution, anticipating potential issues.** They excel at precise quality control during testing, efficiently logging data to generate insights that ensure compliance with established standards.

Autonomous robots, meanwhile, can independently make decisions to **optimize components, understand shapes, calculate volumes, package, identify, classify, and track products.** This streamlines the entire process with superior levels of quality and precision, guaranteeing efficient and accurate distribution.

03

How does SAP S/4 HANA drive these key trends?



SAP S/4HANA Cloud is a next-generation enterprise solution, engineered with advanced technology to align with the Industry 4.0 paradigm. Its primary innovation is the integration of artificial intelligence, delivering greater agility, efficiency, and reliability through a unified data model. This approach enables businesses to anticipate decisions and respond to needs in real-time. **Its main functionalities are as follows:**

- **Industry Best Practices:** Ready-to-use, preconfigured processes based on proven industry standards.
- **Flexible Innovation:** The ability to drive independent advancements, transform business models, and redefine workflows.
- **Limitless Growth:** Expanding customers, markets, and products without adding complexity.
- **Confident Operations:** Backed by trusted guidance, ensuring speed and agility from the start.

Key Features:

- **Proven Best Practices:** Business processes that incorporate standard industry best practices.
- **Quick Time-to-Value:** Guided implementation, streamlined technical setup, and an intuitive role-based interface.
- **Continuous Automatic Updates:** Fully managed by SAP, eliminating the need for additional IT resources and avoiding business disruption.
- **Ongoing Innovation:** Integration of advanced technologies such as AI, machine learning, robotic process automation, and analytics to optimize business performance.
- **Security, Compliance, and Scalability**: Comprehensive technical operations including backups, disaster recovery, system maintenance, data protection, and high operational availability for peace of mind.
- **Open and Extensible:** Ready-to-use APIs, along with tools and documentation, enabling seamless partner integration and tailored solution development.

SAP S/4HANA Cloud offers innovative solutions that address the most critical needs of today's customers, helping them navigate and excel in a rapidly evolving business landscape.

Energy Efficiency

SAP Sustainability Control Tower

SAP Sustainability Control Tower offers a comprehensive solution designed to **address the evolving landscape of ESG (environmental, social, and governance) regulations.** It supports agile reporting with reliable, auditable data and the ability to convert ESG information into long-term value.

Built on HANA technology and pre-integrated, **it enables data extraction from SAP and other systems, centralizing all relevant information in one place.** With preconfigured content such as customizable metrics, emission calculators, and templates, it is designed to meet the increasing demands for sustainability. Additionally, it includes a reporting tool that integrates sustainability into business processes, enabling responsible decisions aligned with strategic objectives.

Its main features are:

Data Acquisitions: Import and enhance data from any source, integrating seamlessly with SAP data.

- **Access relevant ESG data** from environmental, social, and governance categories.
- **Harmonize and consolidate disconnected data from multiple sources.**
- **Ensure data reliability and audit security** through integrity checks, period-close workflows, and structured publishing processes for reporting and consumption.

Metric Management: SAP Sustainability Control Tower enhances data and performs GHG emissions calculations to create reliable sustainability metrics.

- **Deliver high-quality ESG metrics.**
- **Support key regulatory frameworks** such as TCFD, ISSB (IFRS S2), CSRD (ESRS, EU taxonomy), SEC, and more with predefined data models that can be tailored to customer needs.
- **Align metrics with the business structure** through advanced methods, aggregation, and disaggregation capabilities, ensuring efficient data allocation across finance, HR, real estate, and operations.
- **Calculate corporate carbon footprints** for all scopes and categories using both spend-based and activity-based methods.

Performance insights: SAP Sustainability Control Tower allows users to visualize and leverage ESG data to gain insights.

- **Data visualization according to standards**: Displays data in line with Best Practices (such as the GHG Protocol) or allows the creation of centralized dashboards.
- **Performance analysis:** Enables deeper exploration of performance to identify patterns.
- **Deriving insights from ESG data:** Utilizes data from all metrics to calculate intensities and scores, providing additional business context and insights.

Ready to Act: SAP Sustainability Control Tower enables companies to define and execute ESG goals, track sustainability actions, and streamline reporting processes.

- **Defining Clear Long-Term Goals:** Set detailed, granular targets to translate long-term expectations into actionable objectives.
- **Comparing Business Units and Performance:** Analyze and compare different business units and locations to drive specific, targeted actions.
- **Evaluating ESG Performance for Targeted Actions:** Assess current performance against defined objectives to identify and implement steps toward achieving ESG goals.

AI-Powered ESG Reporting: This functionality allows ESG reports to be automated with AI, reducing the effort involved in periodic reporting and embedding the sustainability strategy into program execution.

- **Customizable ESG Report Templates:** Use SAP-provided templates aligned with common ESG reporting standards, or create customized templates tailored to specific organizational needs.
- **Leveraging ESG Data:** Automatically generate draft reports for internal or external periodic reporting using the ESG data available within SAP Sustainability Control Tower.
- **Reducing Manual Efforts:** Significantly reduce the time and effort involved in sustainability report creation.

Preventive and Predictive Maintenance

SAP Asset Performance Management

SAP Asset Performance Management allows asset owners, plant managers, and plant engineers to optimize maintenance strategies, measure and improve asset performance, and meet sustainability goals.

With SAP Asset Performance Management, it's possible to minimize asset failure risk and make faster, more accurate maintenance decisions. It enables IoT sensor data and maintenance logs analysis, remote equipment behavior monitoring, and the extraction of strategic insights through Artificial Intelligence (AI):

- Cloud-based deployment.
- Native cloud solutions on SAP Business Technology Platform.
- Optimized maintenance strategy planning and monitoring.
- Strategic insights from sensor data and engineering simulations.

The main benefits of SAP Asset Performance Management include:

- **Reduced risk, cost, and maintenance:** Maximize value by balancing each asset's performance with the cost of that performance and the associated risk exposure.
- **Lower maintenance costs:** Reduce maintenance expenses by optimizing performance within fixed budgets, while minimizing risk and maximizing production.
- **Increased asset availability:** Enhance the ability of asset operators and service providers to minimize risks using strategic data insights, enabling failure prediction and corrective action.

The key features of **SAP Asset Performance Management** are as follows

1. Asset Risk Assessment: Prioritizes maintenance of critical equipment by assessing and segmenting assets based on risk.

- **Asset risk classification** by calculating risk and criticality scores based on standard formulas for various impact categories.
- **Derivation of maintenance actions and strategies** based on risk and criticality scores.
- **Use of templates** created by business users to standardize risk and criticality calculations.
- **Export and import of risk** and criticality assessments to Microsoft Excel spreadsheets to capture evaluations in offline environments.

2. Asset Accounting Engineering: Balances risks and costs by developing maintenance strategies based on standard reliability methodologies.

- **Implementation of seven-step Reliability-Centered Maintenance (RCM)** based on SAE JA1012 to define appropriate maintenance strategies for critical assets.
- Application of the **standard Failure Modes and Effects Analysis (FMEA) process to analyze failure modes.**
- Definition of **maintenance strategies** to mitigate asset failures at the class level using class strategy assessment.

3. Integrated IoT Technology:

- **Connection to any IoT data source**, including smart equipment and sensors, data historians, data lakes, and files.
- Full control over **device connectivity and management capabilities.**
- Use of **real-time IoT data** to optimize maintenance activities **with AI and rules.**

4. Asset Health Monitoring

- **Detection of equipment behavior anomalies** that could lead to potential failures using IoT sensor data and SAP Business AI capabilities.
- **User-created rule management** to monitor asset conditions using batch and streaming IoT data as well as measurement documents.
- **Automatic generation of maintenance notifications** with rule-based condition monitoring.

5. AI-Assisted Visual Inspection:

- Collection of **inspection images** using cameras and drones through standard APIs.
- **Analysis of images with AI** to determine asset conditions or use indicators like wear, condition, or failure modes.
- **Definition of rules** based on values derived from images to automatically create alerts and maintenance records.

Production Planning

SAP Integrated Business Planning

This cloud-based solution combines sales and operations planning (S&OP), forecasting and demand, response and supply, demand-driven replenishment, and inventory planning:

- **Automated, tightly coordinated supply chain planning processes.**
- **Advanced Machine Learning algorithms** and planning capabilities.
- **Native integration** with SAP Supply Chain Control Tower and other solutions.

The main benefits provided by SAP Integrated Business Planning are:

- **Demand forecasting through AI-powered algorithms:** Improves short- and long-term forecast accuracy using AI-powered algorithms, statistical modeling, demand sensing, and automated correction of outliers in historical sales data.
- **Increased planner capacity with multi-level supply planning:** Enables the creation of an effective supply plan for the entire network with modeling that spans all locations and multi-level bills of materials. Enhances agility with response management.
- **Fosters collaboration in a unified S&OP process:** Integrates financial and operational planning into a single S&OP process. Allows simulations of supply and demand changes to prepare for supply chain disruptions.

The fundamental features of **SAP Integrated Business Planning** are:

1. Sales and Operations Planning (S&OP): Enables sustainable, resilient planning by integrating financial and operational aspects, aligning inventory with service levels, and maximizing profitability:

- **Real-time planning:** Balances supply and demand, integrates financial and operational planning, and connects execution with medium- and long-term plans.
- **Scenario simulation and comparison:** Performs what-if analyses of supply or demand changes and allows scenario comparisons for quick, informed decisions that mitigate risk.
- **Collaboration:** Eliminates operational and planning silos, improving teamwork and efficiency in the planning process.
- **Performance monitoring:** Measures actual performance against the plan and includes monitoring capabilities to prevent future misalignment between operational and strategic plans.

2. Forecasting and demand management: Automated statistical projections and AI-driven insights can help better predict demand, optimize regulatory compliance, and reduce inventory to achieve a more sustainable, risk-resilient supply chain:

- **Demand planning:** Combines multiple demand signals with statistical forecasts and enables collaboration to ensure accurate demand plans.
- **Advanced demand sensing:** Provides greater accuracy in short-term forecasts to improve fulfillment and reduce inventory.
- **Robust statistical models:** Features sophisticated forecasting algorithms, combined with machine learning (ML) and pre- and post-processing algorithms.
- **Time-series analysis:** Classifies products based on historical patterns and selects algorithms according to that classification.

3. Inventory planning and optimization: Ensures customer service levels are maintained while meeting sustainability goals and maximizing benefits. This involves setting and meeting optimal inventory targets:

- **Multi-stage inventory optimization:** Uses less inventory to buffer against supply chain risk and uncertainty through multi-level inventory optimization.
- **Robust statistical models:** Offers significant improvements over textbook calculations using proven algorithms.
- **Forecast error management:** Prevents forecasting errors and other demand-related uncertainties, supporting a more efficient and accurate supply chain.
- **Integrated analytics:** Visualizes the supply chain network and quickly provides insights into inventory drivers.

4. Spare and Supply Planning: To minimize risk, viable supply plans are required to better meet demand with precise inventory targets and efficient capacity utilization.

- **Multi-level planning:** Performs modeling across locations and multi-level bills of materials to cover the entire supply chain network.
- **Supply planning:** Uses optimization techniques or constrained/unconstrained heuristics to develop a tactical supply plan.
- **Rough-cut planning:** Enables the development of a rough-cut capacity plan, simultaneously considering capacity and material constraints.
- **Response management:** Facilitates the creation of an order-based operational supply plan and the management of assignments with prioritization rules.

5. Supply Chain Visibility: If building a sustainable, risk-resilient supply chain, comprehensive visibility, alerts, and analysis are essential to measure performance, forecast the future, and anticipate disruptions.

- **Intelligent supply chain visibility:** Visualizes the supply chain as a network with exceptions that impact performance.
- **Simulation and comparison scenarios:** Executes simulations of demand or supply changes for what-if analysis and scenario comparisons to make quick, informed decisions.
- **Event-driven exception management:** Quickly identifies problems with customer alerts, providing context and prioritized information.
- **Collaboration across the supply network:** Enables working with suppliers and subcontractors for easier, faster planning.

Smart Production

SAP Product Lifecycle Management

Accelerates time-to-market by **digitizing product development with design-to-operate processes for discrete manufacturing and design-to-consume processes for process manufacturing.** This solution, previously known as SAP Enterprise Product Development, supports product development, value realization, and cost reduction:

- **Software-as-a-service (SaaS) solution** supporting the collaborative idea-to-market process.
- **Bidirectional synchronization of product data.**
- **A single source of truth for product data.**
- **Embedded collaboration and a 360-degree overview** for better analysis and decision-making.

The benefits of this solution include:

- **Faster innovation with new products:** Development of high-quality, connected products that meet standards and are sustainable using innovative development processes.
- **Actionable insights:** Enabling enterprise collaboration by leveraging all strategic information, relevant data, and stakeholders to accelerate product development.
- **Enterprise empowerment:** Creation of closed-loop business processes to synchronize the digital thread of design-to-operate and design-to-consume processes.

Its key features are:

1. Definition

- **Innovation management:** Identifying emerging trends ahead of the competition and conducting collective innovation campaigns to pinpoint new product development needs.
- **Requirements management:** Ensuring traceability and transparency by linking requirements to product and business data.
- **System modeling:** Allowing engineering teams to maintain a common reference point for all system models, thereby improving communication and collaboration.
- **Specification management:** Storing specifications in a central repository that serves as a single source of truth for product properties, raw materials, and packaging.

2. Development:

- **Configuration management:** Improving the consistency of product information across all life cycles to reduce errors, maintain quality, and accelerate change management.
- **Formulation:** Developing products and accelerating time-to-market by transforming recipes into formulas using flexible ingredients and AI functionalities.
- **Product data integration:** Seamless uploading, downloading, and transferring of product data between non-SAP authoring systems and SAP Integrated Product Development, enabling efficient collaboration.

3. Delivery:

- **Enterprise transfer management:** Transferring product models and transforming them into different views to extend and enhance the digital thread.
- **Visualization:** Enhancing productivity throughout the product lifecycle with next-generation visualization capabilities.

4. Management:

- **Collaboration:** Standardizing business processes with external and internal partners to reduce supply chain disruptions and boost productivity. The solution supports these efforts through effective collaboration and process visibility.
- **Testing management:** Coordinating and automating testing processes to quickly identify problems, ensure quality, and accelerate product launches.
- **Enterprise product structure:** Aligning components and product structures across teams to ensure consistency, speed development, and improve quality.
- **Strategic information:** Product lifecycle participants take the right actions based on aggregated information in dashboards, KPIs, and charts.

SAP Digital Manufacturing

SAP Digital Manufacturing is SAP's solution for **managing and controlling plant operations with out-of-the-box integration** with SAP ERP and SAP S/4HANA.

SAP Digital Manufacturing is a manufacturing execution system (MES) that **supports sustainable, risk-resilient, and resource-efficient production operations** through an Industry 4.0 approach.

Key features include:

- Cloud implementation.
- Visibility in both the office and the production plant.
- Powerful KPIs and analytics.
- Accurate execution of production processes.
- Enhanced operator productivity through machine learning for visual inspection.

The main advantages of SAP Digital Manufacturing are:

- **Performance monitoring and improvement:** Analysis of global and plant-level manufacturing performance, identifying associated causes through intuitive and preconfigured analytics.
- **Improved visibility and consistent reporting:** Data acquisition from automation systems and manufacturing operations management (MOM) systems, integrating multiple solutions and standards-based interfaces.
- **Faster and more consistent insights:** Accelerated root cause analysis with advanced algorithms and machine learning, supporting continuous business improvement.
- **Enhanced process visibility:** More transparent production management to quickly assess and address quality and productivity issues, reducing warranty and liability risks.

- **Customization adaptation:** Meeting market demands, handling extreme product variability, and improving customer satisfaction while maintaining productivity, margins, and quality levels.

- **Asset availability for more effective work:** Optimizing manufacturing resource usage, improving quality, and minimizing downtime by keeping MOM systems running smoothly.

The fundamental features of SAP Digital Manufacturing are as follows:

1. Meaningful and actionable data:

- Defining and leveraging your S88 or S95 production model.
- Mapping control systems and operational events.
- Using self-service analysis and reporting on real-time KPI and operational data.

2. Harmonized and reliable analytics:

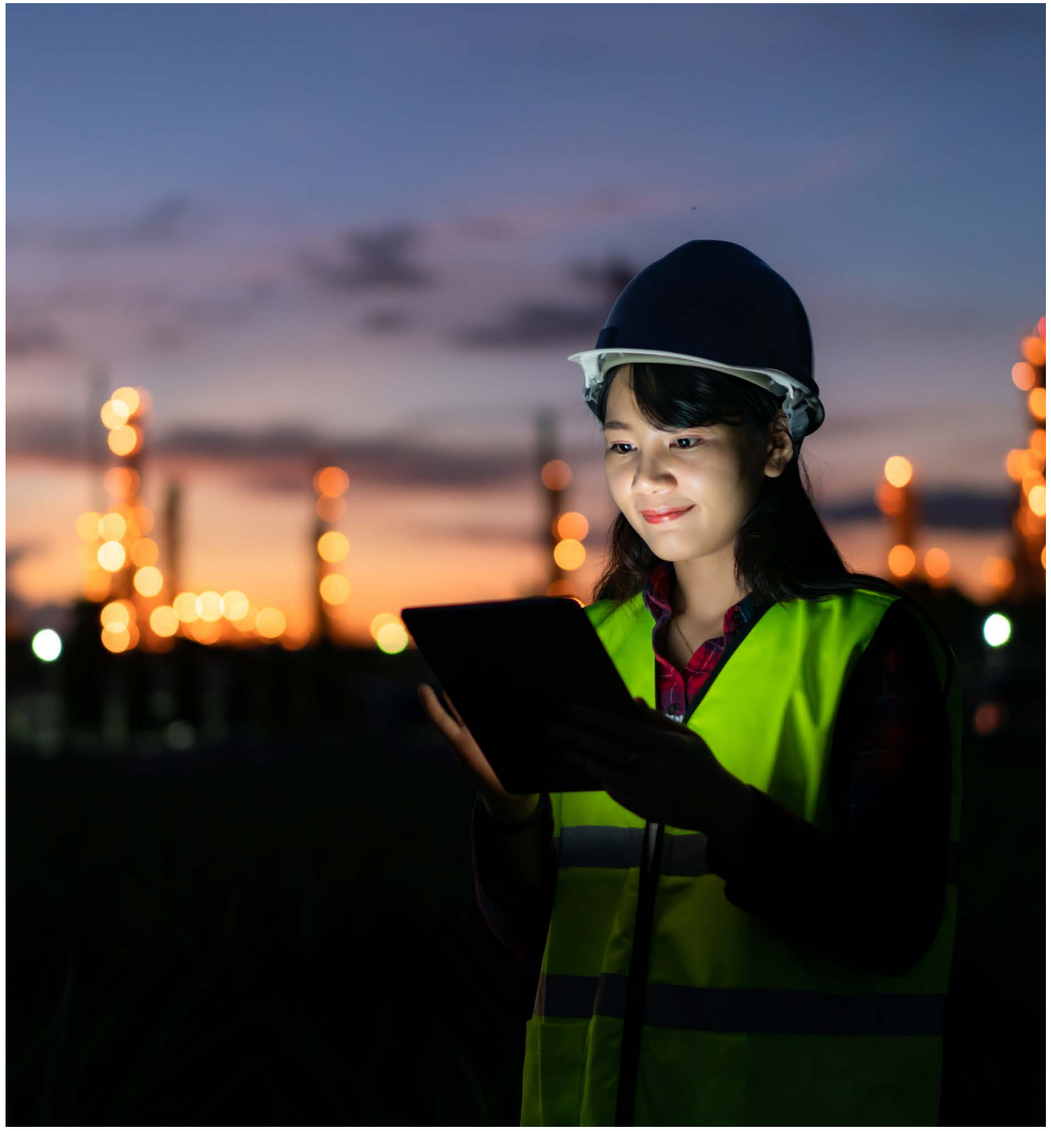
- Acquiring data from disparate manufacturing systems.
- Combining manufacturing data with SAP S/4HANA and SAP ERP.
- Integrating with MES systems, such as SAP Manufacturing Execution and SAP Manufacturing Integration and Intelligence.

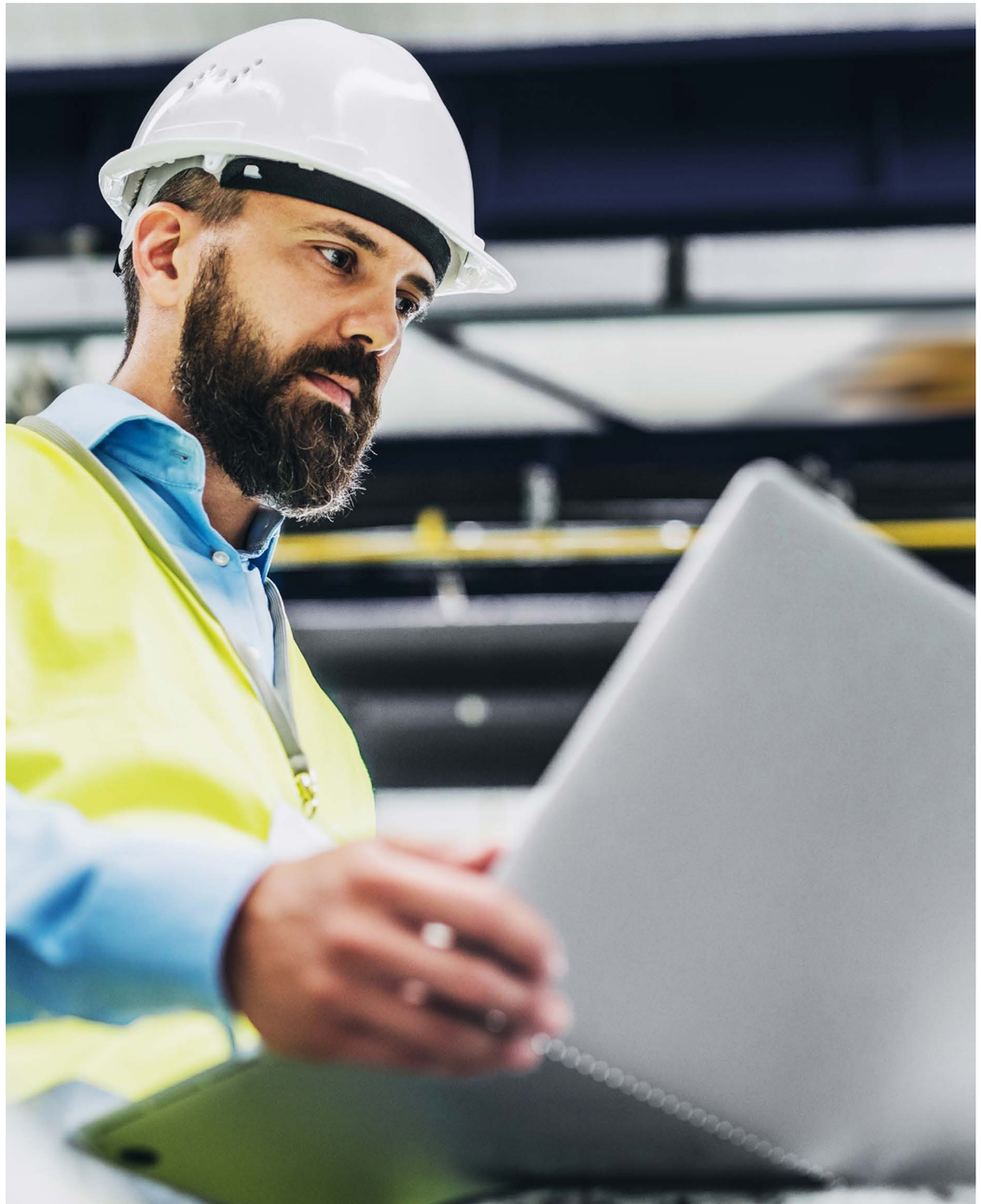
3. Unified manufacturing modeling:

- Building on industry standards.
- Defining KPIs using the modeling environment and harmonized data model.
- Applying existing and predefined integration standards.

4. Predefined industry standards:

- Using preconfigured industry-standard manufacturing KPIs.
- Creating KPIs based on company-specific and MOM system data.





SAP Extended Warehouse Management (SAP EWM)

SAP EWM is the **next-generation warehouse management software** in SAP S/4HANA Cloud. It is flexible, offers enhanced performance, is scalable, and provides expanded coverage. It extends capabilities beyond the traditional SAP WM. With SAP EWM, you can **manage high-volume warehouse operations and integrate complex supply chain logistics with storage and distribution processes, delivering high levels of visibility and control:**

- Comprehensive warehouse solution.
- Fully integrated quality, production, and traceability processes.
- Direct control of warehouse automation equipment.
- Intelligent slotting rules to optimize space utilization.

The main benefits are:

- **Reduced inventory and labor costs:** Anticipating fulfillment by optimizing resources and resolving issues before they impact operations.
- **Enhanced process and inventory transparency:** Identifying risks, avoiding disruptions, and conducting in-depth operational analysis with transparency into inventory, resources, and processes.
- **Improved space utilization:** Identifying available space and using it effectively to reduce costs, speed up fulfillment, and optimize inventory.

Key Features Include:

1. Warehouse Management:

- **Optimized supply chain execution:** Synchronizes warehouse operations with production as well as inbound and outbound transportation management.
- **Enhanced warehouse operations:** Enables the configuration of mixed and layered pallets, consolidation and completion of partial stock units, and the establishment of structures and standards that support advanced tracking.
- **Greater efficiency for retail processes:** Optimizes e-commerce revenue, supports flexible picking of multiple customer orders in a single route, and manages customer-initiated delivery changes or cancellations.

2. Storage and Fulfillment Lifecycle:

- **Inbound processing management:** Validates data from advanced shipping notices; processes receipts and optimizes operations with direct goods receipt from production.
- **Storage and internal process control:** Provides information on physical inventory, stock multiproperty, and cycle counting along with visibility into price inventory.
- **Streamlined outbound processes:** Schedules picking, packing, or phased shipping activities, and creates optimized work packages using augmented reality and voice picking.
- **Multifunctional capabilities:** Supports batch and serial number management, weight estimation, and scheduled dock shifts.

3. Support for simple and complex warehouse operations:

- **Basic warehouse management:** Offers transparency and control of stock, focusing on inventory management, inbound and outbound processing, goods movement, and reporting.
- **Advanced warehouse management:** Optimizes material flow control, price management, labor management, value-added services, kitting, and cross-docking.
- **Automated warehouse operations using robots:** Enables quick onboarding of multiple robotics providers, driving better decision-making and automating warehouse processes.

SAP Transportation Management

SAP Transportation Management integrates fleet and logistics management across your entire network, helping to reduce complexity, increase efficiency, and improve agility to achieve a more sustainable and risk-resilient supply chain.

With **SAP Transportation Management,** you can enhance how freight, fleet, and logistics are managed, driving sustainable goals and maximizing return on global transportation spending and domestic shipments across all transportation modes and industries:

- Transportation and demand planning
- Interactive freight tendering
- Freight agreements

Key benefits include:

- **Increased business productivity:** Automating processes and driving digital collaboration within the company's ecosystem to reduce idle capacity, avoid redundancies, and meet sustainability objectives.
- **Smarter decision-making:** Accelerating decisions, minimizing disruption risks, and improving on-time delivery rates using comprehensive views of logistical processes.
- **Resource utilization optimization:** Improving shipment transparency, expediting fulfillment, mitigating risks, and meeting customer satisfaction expectations, while optimizing resource usage.

Core features:

1. Strategic freight management:

- **Optimized quote-to-contract processes:** Evaluation and preparation of tenders with predictive rounds of bidding based on strategic insights.
- **Automated rate determination:** Efficient information exchange with logistics service providers.

2. Order management:

- **Real-time responsiveness:** Managing transportation demand changes through real-time order-to-cash and procure-to-pay processes.
- **Aligned sales and orders:** Synchronization of sales and order schedules to support customer delivery commitments.
- **Integrated intelligence:** Combining order and delivery data for seamless operations.

3. Transportation planning:

- **Optimized goods movement:** Flexible, rule-based pallet configurations.
- **Efficient delivery activity management:** Tracking and managing driver resources using default assignments within an interactive cockpit or Gantt chart.
- **Clear visibility:** Visualizing space planning and vehicle loading arrangements.

Project Management

SAP Enterprise Portfolio & Project Management

This solution **facilitates comprehensive project management across the company through a centralized repository.** It enables portfolio administration from projection and planning to accounting and closure, ensuring an efficient and organized approach at every stage. The main benefits are as follows:

- Enables comprehensive project management from initiation to closure.
- Allows early identification of project anomalies and risks.
- Integrates access to enterprise information.
- Provides precise cost reporting and analysis with Machine Learning.

Key Features:

1. Portfolio Management: Allows submission of project proposals, prioritizing them relative to existing projects, and tracking and reviewing their progress:

- **Portfolio alignment with business strategy:** Provides a complete view of capital expenditures, R&D performance, and capacity demands of professional and IT services.
- **Optimized project investment:** Evaluates project value, benefits, and risks using standardized scoring methodologies and questionnaires.
- **Cost tracking and schedule performance:** Offers direct insights into actual project costs and revenues and compares them with planned values and forecasts.

2. Project Management: Enables oversight of projects, tasks, and schedules, identifying critical paths, allocating resources, and tracking progress:

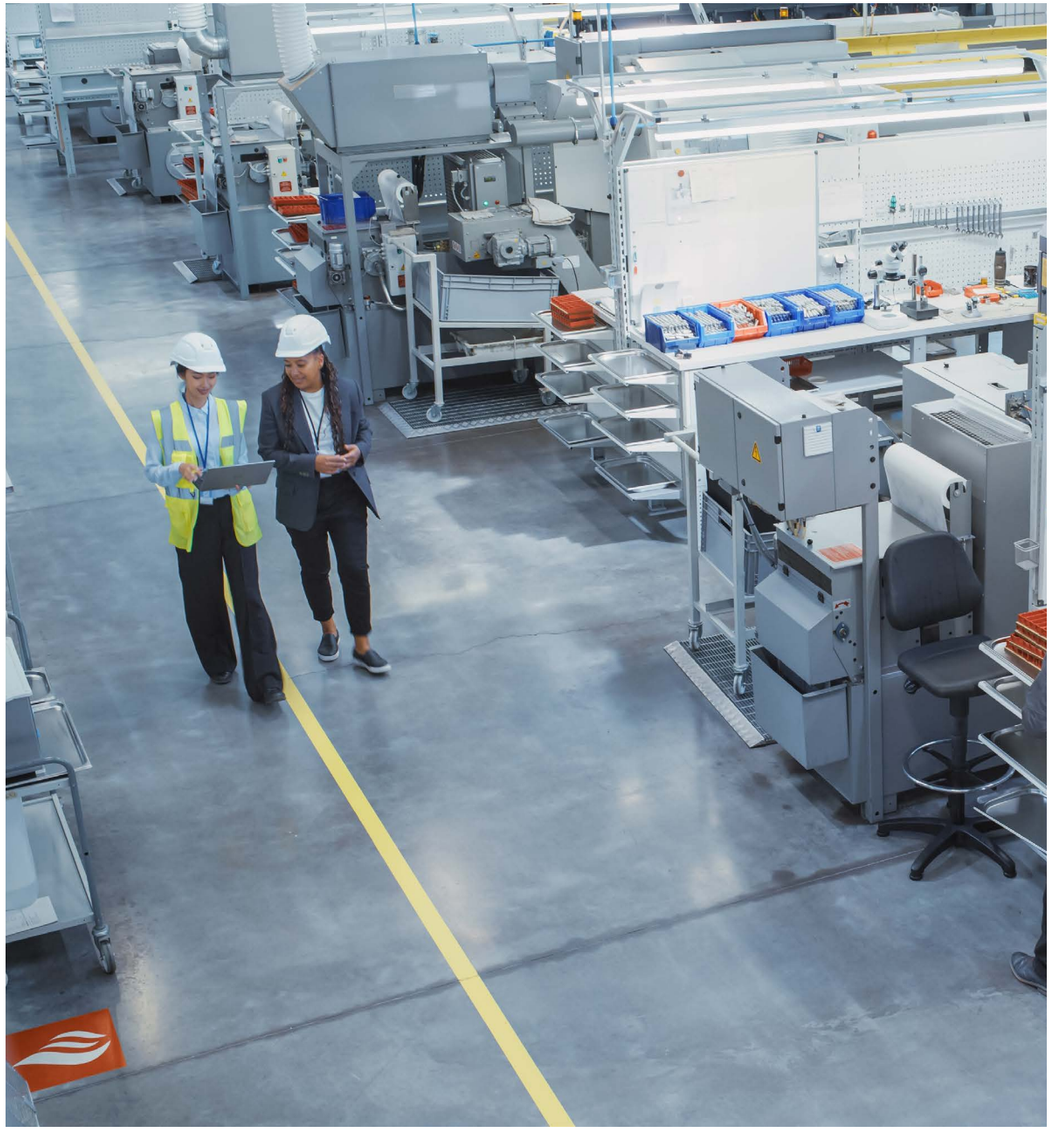
- **Company-wide project management operations:** Supports project phase management from structuring to visualization and provides for various implementation models and financial management.
- **Coordination among distributed teams:** Manages effort, duration, and task scheduling, assigning work to responsible individuals' dashboards.
- **Automated project controls:** Links project structures to Finance and Controlling Accounting to automate cost and revenue reporting within projects.

3. Resource Management: Identifies the right resources, monitors availability, optimizes utilization, and eliminates project bottlenecks:

- **Optimized resource utilization:** Allocates personnel, capital, and equipment based on project requirements, qualifications, availability, and future needs.

4. Commercial Project Management: Improves profitability and real-time transparency.

- **Project financial planning:** Enhances planning, monitoring, and control by creating cost and revenue plans and integrating them with accounting.
- **Issue and change management:** Establishes transparent processes for recording project issues and deviations and assessing financial impacts.
- **Risk management:** Documents and evaluates project risks using standardized assessment methods and plans and tracks risk mitigation activities.



SAP Solutions with AI

SAP Business AI for Procurement Processes

With SAP's AI, procurement processes can be **transformed with enhanced visibility and tools that automate key tasks.** Bottlenecks can be avoided with prescriptive strategic insights, risks can be mitigated across all procurement activities, and sourcing and purchasing can be optimized to boost efficiency.

- **Optimize processes and make better decisions faster** with on-screen recommendations.
- **Recommend quality suppliers** with guided sourcing based on past success and intelligent résumé analysis.
- **Guide workers with real-time strategic information** and relevant searches based on history.

SAP AI applied to each key Procurement process:

1. Sourcing and Contracts:

- **Optimizing and automating sourcing events:** Transforms the sourcing process with Joule's guidance, offering recommendations on relevant suppliers and suitable items. Improves efficiency by posting events up to 50% faster compared to manual templates.
- **Intuitive creation of sourcing events:** Generates supplier recommendations based on previous events. Facilitates asking appropriate questions of suppliers based on past activity. Allows the import of customized file formats to generate content for sourcing projects.
- **Category management driven by generative AI:** Automatically completes contextual information and offers recommendations within category tools. Frees up staff time and accelerates management processes. Empowers category managers to tailor and optimize category strategies.

2. Procurement:

- **Guided buying:** Provides users with a single procurement hub, ensuring compliance with rules, even without prior knowledge of them.
- **Delivery date projections:** Quickly adjusts delivery dates for order items in near real-time.

3. Solutions for payment and invoice management:

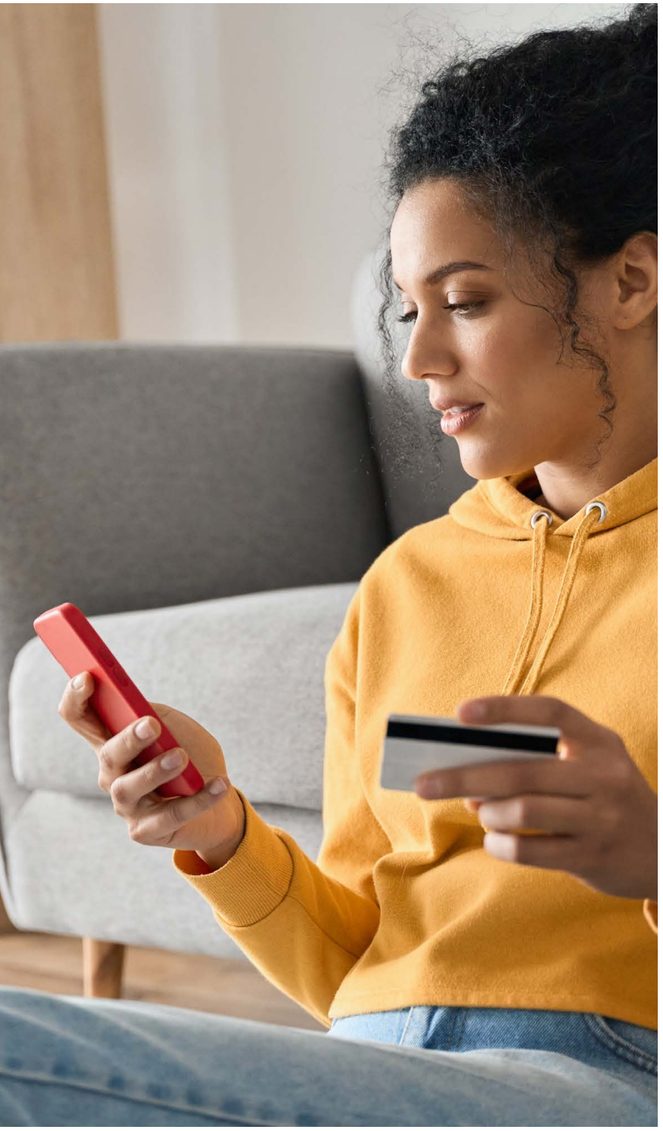
- **Automatic invoice classification:** Enables precise invoice classification through automated data enrichment services.

4. Supplier Management:

- **Improved supplier responses:** Facilitates timely supplier responses to RFIs, even for complex and detailed requests.
- **Generate attractive, detailed product summaries and descriptions:** Enhances buyer confidence and creates new business opportunities for suppliers with high-quality product listings in the network catalog marketplace.

5. External Services and Workforce:

- **Accelerate hiring with intelligent résumé analysis:** Evaluates résumés using ML and AI to compare potential suppliers side by side.
- **In-app job description translation:** Converts job postings into 21 languages, providing linguistic support across all regions.



SAP Business AI for Human Resources

With SAP's Artificial Intelligence, it's possible to cultivate a dynamic, inclusive, and future-ready workforce that is data-driven, connected, and people-centered.

- Encourages skill growth and career development through personalized recommendations.
- Optimizes workforce planning with intelligent personnel analysis.
- Identifies highly qualified talent and connects them with opportunities.
- Enhances employee experience with an AI co-pilot.

From inclusive hiring to personalized training and development, and through improved experiences, SAP's AI makes it possible to automate HR tasks and make more informed decisions.

- **Builds a future-ready workforce** by providing talent intelligence solutions that deliver valuable training and growth recommendations.
- **Improves agility and compliance** by leveraging automation and intelligence to support strategic decision-making.
- **Facilitates better collaboration** between HR and other departments using strategic insights and employee data across the organization.
- **Enhances the overall experience** of employees and candidates by optimizing and personalizing interactions.

SAP AI applied to each key HR process:

1. User Experience: **Boosts intelligent self-service capabilities for HR** by enabling faster, more efficient task completion with Joule. From approving and requesting leave to giving and soliciting feedback or obtaining document-based policy answers, Joule helps complete daily tasks more quickly and intelligently.

2. Selection: **Finds the best talent quickly and reliably** by creating inclusive job descriptions tailored to the business. Simplifies interview preparation with role-specific questions for candidates. Provides access to relevant information on company guidelines and policies.

3. Talent Intelligence: Offers **personalized development opportunities** by providing intelligent, individualized recommendations for training, roles, projects, dynamic teams, mentors, and peer connections. Supports various learning and development experiences, including peer connections, volunteering, training, project assignments, and temporary tasks.

SAP Business AI for Sales and Customer Service

With SAP's Artificial Intelligence, it's possible to **anticipate, automate, and personalize customer experiences.** The entire team can become the most knowledgeable and efficient collaborator, while AI capabilities are enhanced across the CRM, covering everything from sales to customer service and simultaneously ensuring data security:

- **Understand account and lead details** with AI-powered summaries.
- **Create compelling email drafts** using case and opportunity context.
- **Gain valuable strategic insights** from operational and customer data to add a personal touch.

SAP AI applied to each key sales and customer service process:

1. GenAI for Sales and Service:

- **Identify and proactively respond** to customer questions using reliable company data.
- **Generate responses, case summaries, and more** with suggestions designed for customer service teams.
- **Create discovery questions and emails,** and more, with suggestions designed for customer service teams.
- **Deliver better customer service** with a single layer of generative AI powered by data from all SAP products.

2. Guided Selling:

- **Personalized recommendations:** Uses historical data and Machine Learning to simplify the quoting process and offer personalized recommendations for the best products or configurations based on customer needs.
- **Simplified intelligent sales:** Forecasts opportunity moments and likelihood of success using past information and algorithms. Generates personalized insights that enhance sales teams' understanding of accounts and leads. Recommends next actions and drafts emails based on operational intelligence, strategic interaction insights, and account details.

3. Smart Projections: Enables precise forecasting of attainable sales volumes through intelligent performance projections. Improves projections with conversion probability analysis in the quote-to-order process.

4. Intelligent Customer Service: Facilitates faster service and better outcomes, while also supporting the handling of customer inquiries with the right information and recommended next steps. Through SAP's AI, tickets can be prioritized and categorized based on importance and customer needs, as well as cases resolved faster using recommended solutions and guided workflows powered by AI.

SAP Business AI for Marketing and e-Commerce

SAP's artificial intelligence **uses data to transform marketing and online sales initiatives, enhancing AI-driven strategies across all digital channels, from marketing to merchandising.**

- **Create, launch, and scale omnichannel interactions** with AI for marketing automation.
- Enrich product catalogs **with necessary data and high-quality content.**
- **Recommend products** based on customer interactions and business priorities.

SAP AI applied to each key marketing and e-Commerce process:

1. Digital Marketing:
Personalized experiences with innovative AI-based marketing automation:

- **Customer focus:** Based on their lifecycle stage, engagement propensity, or estimated spend.
- **Sophisticated campaign implementation:** Follow-up on abandoned browsing sessions, cross-sell post-purchase, and customer recovery using AI-based segments.
- **Generative AI in email marketing:** Adapts and personalizes the subject line and preview text.

2. Order Fulfillment:
Sales order automation and tax compliance:

- **Efficient creation of sales orders** based on unstructured data.
- **Simplification of tax management** through compliance detection and automation.

3. e-Commerce:

a. Always-relevant shopping experiences:

- **Relevant recommendations** based on customer behavior, purchase history, and browsing patterns.
- **Analysis of inventory levels**, sales trends, and order history to project demand and optimize inventory quantities.
- **Improved conversion rates** by enhancing catalog quality and product discovery.

b. Enhancing catalog quality and product discovery:

- **Enhancing and enriching product labels**, and generating new descriptions with just a few clicks.
- **Improving product discovery** by simplifying the process and delivering search results powered by AI image recognition.
- **Generating more strategic insights** with a single generative AI layer powered by data from all SAP products.

4. Recommendations and Returns:

a. Personalized recommendations:

Using historical data and Machine Learning to **simplify the quoting process and offer personalized recommendations** for the best products or configurations based on the customer's needs.

5. Customer Data:

a. Audience segmentation:

- **Creating target audience segments** up to 90% faster using Joule.
- **Using natural language and generative AI** to effortlessly create journeys, segments, and metrics.
- **Focusing on strategy and creativity**, leaving the technical aspects of segment creation to Joule.

b. Customer activity and action:

- **Improved security and protection** against account takeover, enabled by AI and customer identity verification and consent.
- **Forecasting, identifying, and responding to real-time interactions** that impact customer segments at high risk of churn.

Conclusions

In the coming years, we will witness a **rapid technological evolution in the industrial sector, creating a new paradigm for an innovative future.** Sustainability, resilience, and human-machine collaboration will be key in this transformation process, where the full integration of technology into work processes is essential. New technologies are redefining production processes, advancing toward more efficient and resilient models, as well as new consumption patterns.

The transition to digital and sustainability is a fundamental strategic commitment, supported by international policies and regulations, with the aim of generating a positive social, environmental, and economic impact. Investment in technology, talent, and digital knowledge will be decisive for the advancement of the sector and societies, serving as the engine of the economy and prosperity.

All social actors emphasize the urgent need to advance this transformation to face future challenges. **This transition is a critical opportunity to reshape the production model into one that is more resilient, conscious, and intelligent.**

Digital technologies play a transformative role at every level of the sector, from product conceptualization to production and distribution. **Factors such as hyper-personalization, customer experience, intelligent processes, the introduction of cobots or AI agents, greater efficiency, and talent empowerment will be key to the impact of Industry 5.0.**

The industrial sector is at a turning point, where the adoption of advanced technologies and **collaboration between technology and talent** are essential to overcome operational challenges, achieve sustainable goals, and mitigate negative consequences while unlocking opportunities for innovation, growth, and leadership in the market of the future.

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