DIGITAL INDUSTRIES

How automotive manufacturing is shifting gears

Embracing flexibility, continuous optimization, and sustainability in automotive manufacturing

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New vehicle features and technologies require adaption within manufacturing.

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The automotive industry is witnessing a significant transformation driven by electric vehicles, autonomous technology, and sustainability. This shift challenges manufacturers to adapt and innovate, requiring a reevaluation of traditional manufacturing methods to meet evolving demands effectively.

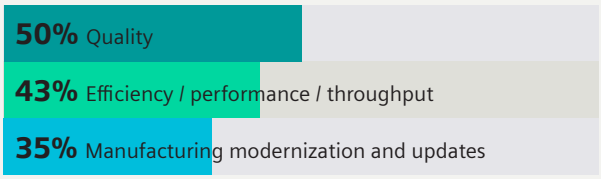
This means modernizing plants, training employees for new skills, and dealing with a complex supply chain. At the same time, they must meet the growing demand for diverse vehicle models and adhere to strict sustainability regulations. This means they need to increase flexibility in production and at the same time reduce downtime to a minimum.

In tandem with these challenges, there's a significant move towards glocalization and product personalization, underpinned by a strategy of local production. This shift demands not just advanced supply chain management but also the development of robust reserve strategies to ensure resilience and responsiveness.

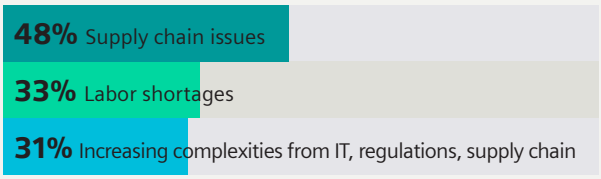
Additionally, companies must accelerate product development, ensure traceability, and reduce emissions without sacrificing quality or increasing costs. They also need to balance this with the production and maintenance of traditional vehicles, merging innovation with the economic need to safeguard profits and satisfy consumer expectations.

Key findings of State of the Market Report for Smart Manufacturing in the Automotive Industry

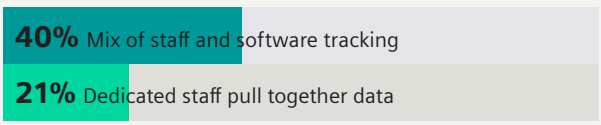
Top business priorities



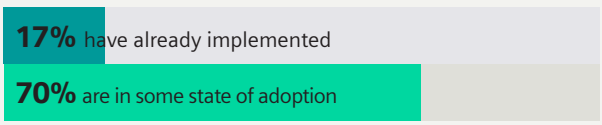
Top challenges



Manufacturing lifecycle management is mostly manual



Adoption of a Smart Manufacturing approach

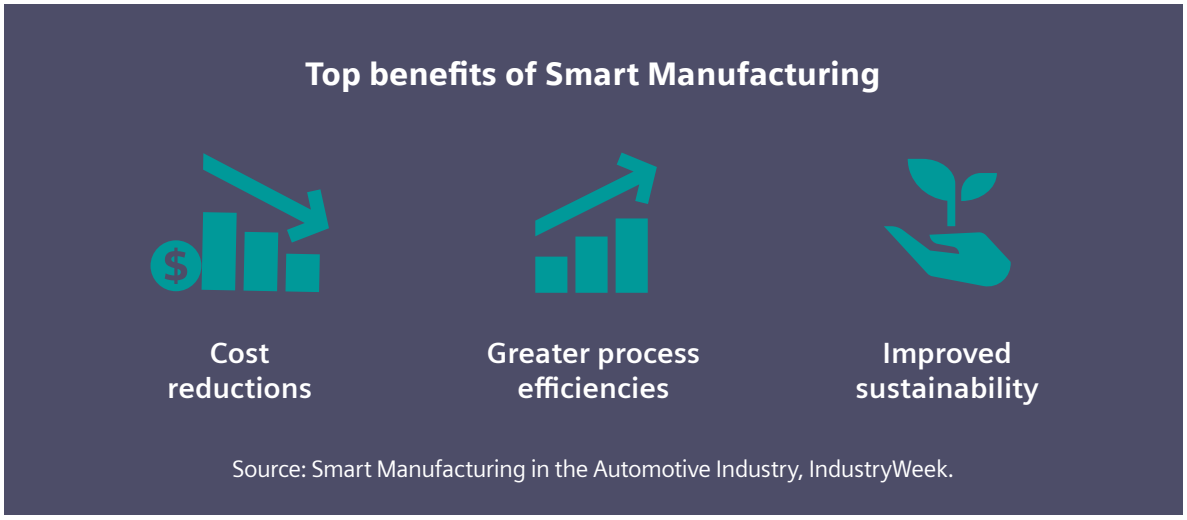


Source: IndustryWeek, 2022

To stay competitive, manufacturers should adopt a strategic approach to navigate these challenges. Achieving higher production flexibility, efficiency, quality, and sustainability is essential. With Siemens' operation and optimization solutions for automotive manufacturing, manufacturers can:

- **Rapidly modernize plants:** Embrace new technologies to keep your production facilities at the cutting edge
- **Compress development timelines:** Speed up the introduction of new products to market, shortening the path from concept to consumer
- **Adapt quickly to production shifts:** Enhance your ability to respond to market demands, ensuring your production lines are both flexible and efficient

This strategic pathway not only addresses the immediate challenges but also sets the stage for sustained innovation and growth in automotive manufacturing.



- Maximize flexibility with next-level automation
- Achieve excellent productivity
- Meet your sustainability goals

Case study:

"To drive innovation within the automotive industry, it is essential to have the right technology in place. We feel that Siemens' best-in-class solutions can empower automakers and the vehicle electrification supply chain to reduce development time and deliver high-quality solutions, with the ability to adapt to changes easily at every stage of the process."

Jason Buxton, former Chief Information Officer, VinFast

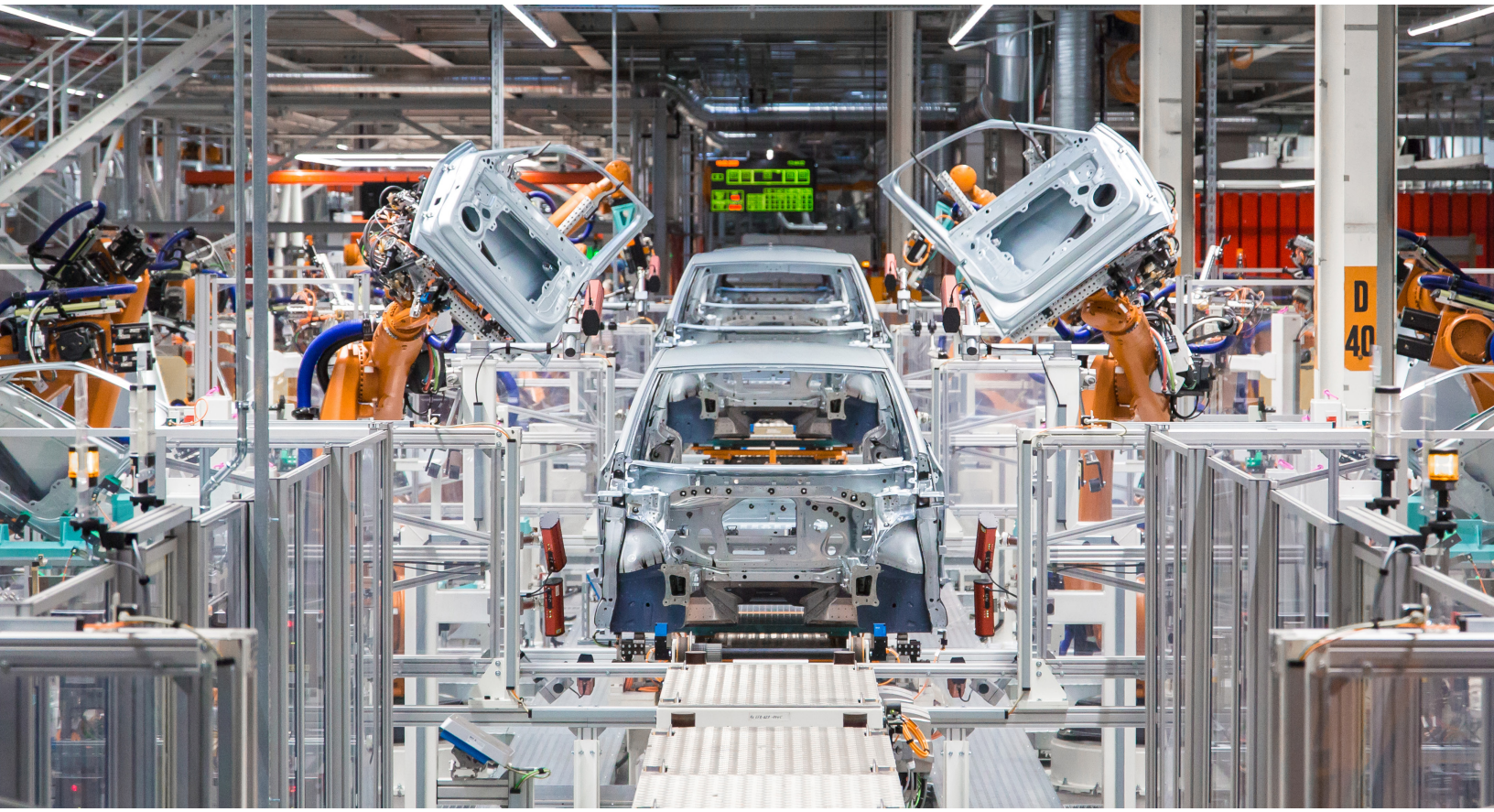
Next level automation

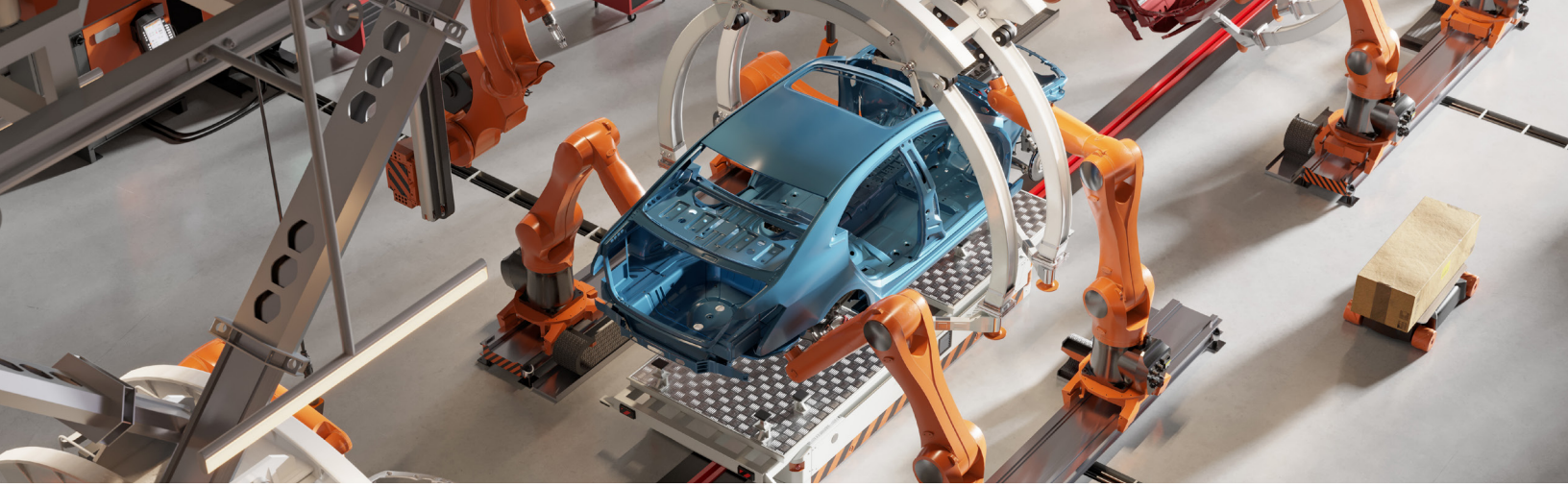
The increasing demand for electric vehicles as well as for customized and technologically advanced vehicles has significantly complicated production processes in today's dynamic automotive manufacturing landscape. This development highlights the urgent need for manufacturers to make their production lines more adaptable, flexible, and scalable.

The adoption of advanced automation technologies becomes critical in this context, serving as a key to boosting efficiency and ensuring the flexibility required to keep pace with rapid market changes. Advancing with such innovations represents a significant leap, enabling manufacturers to meet evolving demands with unprecedented agility and precision.

A new level of automation is required:

- **Embracing disruptive technologies:** digital twin, software-defined control, AI, auto code generation for standardization
- **Focusing on standardization:** standardized processes, scalability, and reusability to meet customer demands





Typical use cases

Performance analytics in body shop and final assembly

In the realm of automotive manufacturing, the transition toward next-level automation processes marks a significant leap toward achieving higher efficiency, flexibility, and speed. Automation, as opposed to manual operation, is crucial in meeting the stringent demands of the industry, such as the expected target cycle time where a car is produced every 60 seconds. Failing to meet this target prompts immediate investigation into the causes and solutions for any delays, underscoring the need for a more creative, better, and faster production process.

A market survey conducted by IndustryWeek and Siemens in July and August 2022, gathering 1,500 responses from senior executives and managers in the automotive manufacturing industry, reveals significant insights into operational challenges. According to the survey, 47% of the respondents reported that detecting and recovering from a production line shutdown can take up to five days, while 18% indicated it could take an entire week. The absence of a comprehensive overview of operations across all production stations makes the rapid diagnosis even harder. In addition, manufacturers risk the production of incorrect or poor-quality parts before or during a production line shutdown. All of these issues can lead to missing revenue targets.

A pivotal solution to these challenges from Siemens lies in the seamless integration of data across diverse platforms—ranging from machine parks and both legacy and new IT systems to non-Siemens products. This integration is adeptly handled by edge devices and applications engineered for efficient data collection and storage. A standout feature of this solution is its integrated data buffering, enabling in-depth historical analysis to pinpoint production inefficiencies.

The scalability of this system is a key advantage, facilitating the smooth inclusion of more machines and production lines under a centralized management system. This centralization streamlines the addition of new components and ensures the consistent application of firmware and security updates. Furthermore, a dedicated performance monitoring app provides granular analysis of cycle times across different machine stations, offering invaluable insights into the nuances of production efficiency. Through these advanced technological solutions, automotive manufacturers can enhance their production workflows, making them more automated, creative, and ultimately more successful in meeting the ever-evolving demands of the industry.

Enhanced production line output (an increase of 20 cars, reaching 4000 per day)

Efficiency in maintenance (faster route cause analysis)

Virtualization of automation in the body shop

In the body shop, the drive towards software-driven automation and comprehensive data integration is transforming how operations are conducted. The current landscape, characterized by various platforms and isolated systems, presents significant challenges in achieving seamless control and integration. The solution lies in harmonizing these elements into a unified software platform, creating a single data backbone that consolidates control functionalities and disciplines. This approach not only streamlines operations but also unlocks the value of data through enhanced connectivity and accessibility.

Addressing the need for modernized network and data center infrastructure requires a strategic blend of integrating Information Technology (IT) and Operational Technology (OT). By differentiating the cross-plant network infrastructure from the fieldbus level, it's possible to meet the demands for real-time capability and determinism essential for both shop floor operations and cloud-based environments. Central to this strategy is the deployment of virtual controllers for critical real-time applications by leveraging AI and data analytics. This not only boosts system resilience through redundancy and high availability but also ensures the flexibility needed to adapt to changing demands.

The integration of simulation and automation on a unified platform exemplifies a streamlined approach to managing body shop operations. Simplifying the update process through standard IT protocols further enhances system maintenance, ensuring that automation performance and configuration can robustly scale. By drawing on the expertise of OT and manufacturing IT specialists, this strategy fosters a seamless, efficient environment that supports the dynamic needs of modern automotive manufacturing, ensuring operations in the body shop are not just maintained but significantly improved.

- **Accelerated innovation cycles with the deployment of new functionalities, encompassing:**
  - **Centralized device management**
  - **Software management**
  - **Security management**
- **Enhanced scalability and flexibility across the production line's lifetime**
- **Adoption of comprehensive IT/ Software application capabilities to support all operational aspects**

Automation standardization

Streamlining operations in automotive manufacturing involves tackling the complexity brought on by a diverse array of hardware, software, and tools. The goal is to move towards a more automated, less manually intensive operation, enhancing efficiency across the board. Simplifying both operation and maintenance through a unified user interface and consistent diagnostic approaches can significantly reduce the manual workload. Moreover, leveraging existing systems rather than replacing them outright offers a cost-effective path to improvement.

The challenge lies in the lack of standardized procedures, which can lead to increased costs and inefficiencies. The journey towards digitalization further complicates matters with its myriad of connectivity issues, from differing interfaces and protocols to complex data structures. Standardization is key to overcoming these hurdles, yet it demands significant investment.

The SICAR modular toolbox is a solution crafted to meet these standardization challenges head-on. SICAR provides a range of flexible components, blueprints, and solutions designed to improve shop floor management and create a cohesive, efficient operational environment. With access to SICAR's proven resources, companies can tailor their standardization efforts to their specific needs, streamlining operations and cutting down on inefficiencies. This approach not only optimizes shop floor operations but also paves the way for a smoother digital transformation.

- **Up to 50% reduction in storage expenses**
- **Engineering software expenses reduced by up to 50%**
- **Operating expenses cut by up to 10%**
- **With SICAR, customers can significantly lower the costs related to establishing and maintaining their automation standards, achieving savings of up to 90%**

Assembly lines OEE (Overall Equipment Effectiveness) increase by robotics

Automotive production lines are becoming increasingly complex, driving the need for higher levels of automation. To stay competitive, the automotive industry must raise productivity through automation, aiming for up to a 20% increase in output to meet market demands and maintain competitiveness.

To address the complex challenges in automotive production lines, several innovative solutions are proposed. A crucial step is leveraging robot libraries with proven and pretested software modules, ensuring reliable and efficient operations. Integrating intuitive robot hardware via the TIA engineering portal facilitates smooth automation, using a standardized robot command interface and unified, vendor-independent operator screens. Additionally, task-specific robots are introduced to handle complex operations, enhancing productivity and efficiency. To further streamline production, Siemens experts offer support in implementing LEAN production principles, promoting a more efficient and cost-effective approach to automotive manufacturing.

- **Higher Output: The integration of robots into the automation process leads to a significant increase in production capacity, resulting in higher output and efficiency.**
- **Optimized Up-Time and OEE: By incorporating automation, production lines experience reduced downtime and improved Overall Equipment Effectiveness (OEE), ensuring smoother operations.**
- **Leverage Data for Transparency: Using digital technologies, production data is harnessed to provide greater transparency, allowing for continuous process optimization and enhanced decision-making.**

Software-defined automation workstation

Automotive production lines are becoming increasingly complex due to the diversity of components and isolated disciplines on the shop floor. This complexity results in high engineering efforts and requires continuous maintenance tasks for software and security updates across a distributed automation system. Additionally, there's a lack of flexible connectivity solutions to gain insights into plant operational data. The absence of a common user interface and uniformity across IT and OT integration complicates operations, leading to inefficiencies and increased costs.

To address these challenges, a scalable, all-in-one application platform with an INDUSTRIAL OS is proposed. This platform combines OT disciplines, such as control, HMI, and safety, with IT disciplines, including device management, data mining, and analytics, into a single automation solution. The integration of these disciplines creates a cohesive environment, simplifying engineering efforts and providing flexible connectivity for enhanced plant insights. This unified approach streamlines software and security updates, promotes operational uniformity, and facilitates a seamless user and deployment management experience across the shopfloor.

- **Ensure Efficient Maintenance with centrally orchestrated software and security updates through the Industrial Edge Management system, reducing downtime and simplifying system management.**
- **Facilitate IT/OT Convergence by unifying the engineering process for PLC, HMI, and Safety on a common platform, creating a seamless workflow between information technology and operational technology.**
- **Gain the advantage of Real-time Decisions in machine and line operations, allowing for immediate responses to operational issues and improved overall efficiency.**
- **Achieve Reduced Variances on the shopfloor by minimizing the number of components, leading to a more streamlined and efficient production environment.**

Efficient green production

In the rapidly evolving landscape of automotive manufacturing, the shift towards e-mobility underscores the critical importance of green production practices. As regulations become stricter and sustainable targets more ambitious, the industry faces a complex set of requirements that challenge traditional manufacturing paradigms. Embracing green production is not merely about adhering to environmental regulations; it's about embedding sustainability as a core element of operations and supply chains, ensuring that every aspect of manufacturing vehicles contributes positively to environmental goals. This approach necessitates innovative solutions that enhance sustainability without sacrificing quality or cost-efficiency.

- **Integrate** advanced energy management to identify energy saving potentials
- **Implement** smart technologies to save unnecessary energy consumption and reduce CO_2 impact
- **Utilize** data across the entire supply chain to gain transparency on carbon footprint and mitigate risks

Typical use cases:

Energy consumption and transparency in the body shop and the paint shop

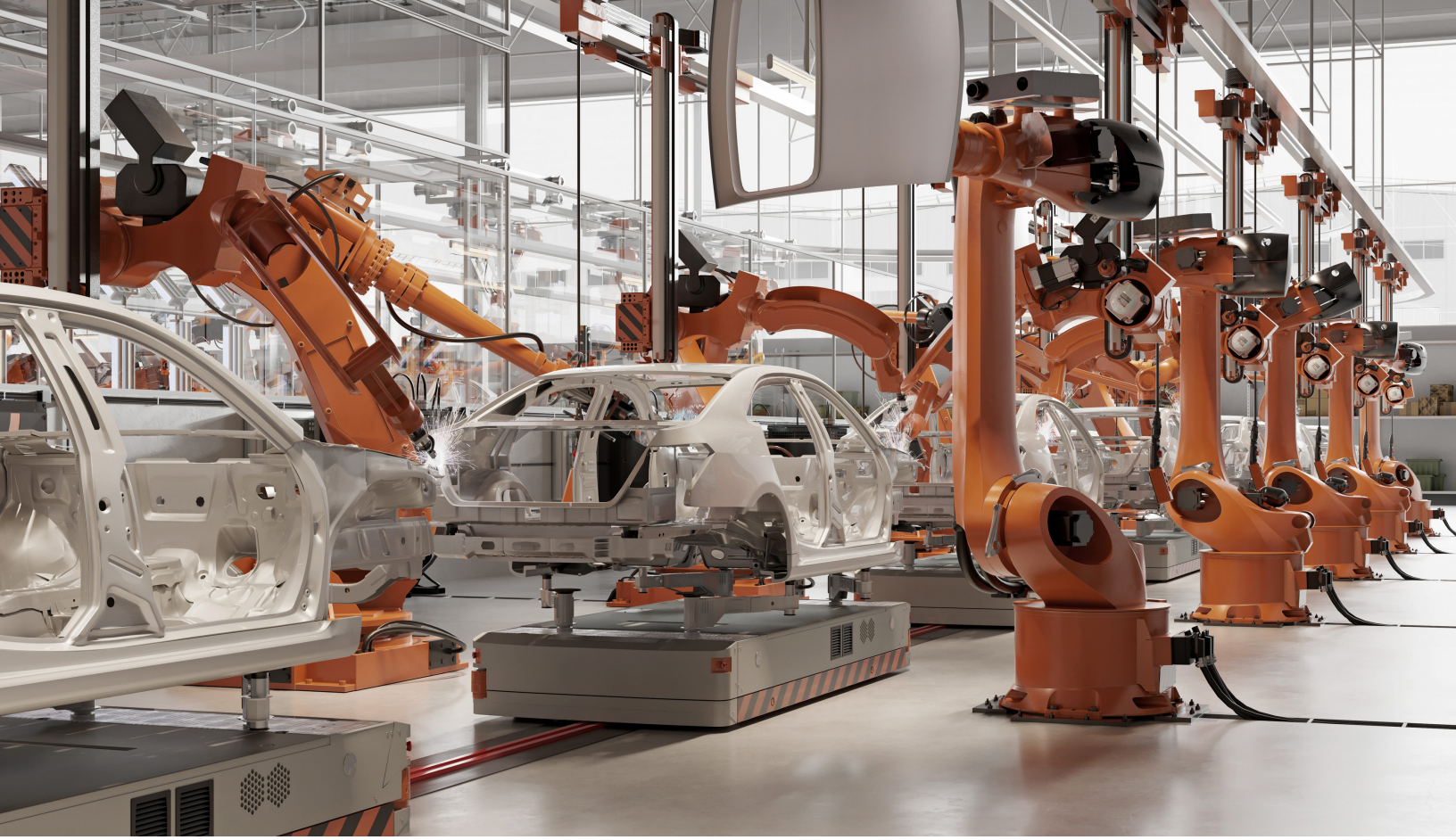
In the automotive manufacturing industry, managing energy consumption effectively presents significant challenges, notably due to insufficient transparency regarding energy use and purchasing practices. Among the various stages of car production, the paint shop stands out as the most energy-intensive, accounting for over 60% of total energy usage. Following closely is the body shop, where the energy demand is primarily driven by the extensive welding required, involving thousands of welding points per vehicle.

This energy consumption landscape is complicated by a lack of detailed and consistent data transparency on the energy usage of machinery, making it challenging to benchmark and enhance efficiency across different production facilities. Furthermore, the absence of automated solutions for calculating the carbon dioxide emissions attributable to each vehicle exacerbates the difficulty of minimizing energy wastage and environmental impact. As the industry increasingly aims to reduce its carbon footprint, overcoming these obstacles becomes crucial for not only improving energy efficiency but also for advancing towards more sustainable manufacturing practices.

- **Decrease energy expenses and enhance energy efficiency by up to 50%**
- **Enhanced consistency, scalability, and benchmarking possibilities with an integrated automation solution**

Facing the complex energy management challenges in the car manufacturing industry, it's essential to adopt a clear and effective strategy. The key is to implement energy measurement devices across shop floors, suitable for both Brownfield and Greenfield facilities, to accurately monitor energy consumption. This step enables precise control and understanding of energy use.

Additionally, evaluating machine efficiency through a standardized approach allows for comprehensive energy analysis at both the individual plant and broader company level. The strategy is rounded off with the deployment of dashboards for the detailed analysis and visualization of energy data, aiding in the identification of opportunities for energy conservation and efficiency improvements. Such a structured approach not only supports informed decision-making, including effective load management but also significantly boosts energy savings, aligning with the industry's push towards sustainability and reduced environmental impact.



Standby of robotics in robot cells in body shop

In the realm of manufacturing, a notable challenge emerges with the energy consumption of robots during production downtime. The practice of manually powering down these robots for breaks, weekends, or idle periods is fraught with impracticalities, primarily because of the extended time required to reboot and the looming risk of complications or failed restarts upon attempting a full shutdown. This situation not only contributes to unnecessary energy consumption but also poses a barrier to achieving greater environmental sustainability within the automotive industry.

The "PROFienergy" protocol presents a compelling solution from Siemens to address this issue. Designed to integrate seamlessly with the PROFINET network, PROFienergy enables a targeted approach to managing the energy use of robots and machines, especially in the body shop where the demand for energy is particularly high. This protocol allows for the activation of energy-saving modes without the need to purchase additional equipment, representing a cost-effective and efficient method to reduce energy consumption.

The advantages of adopting PROFienergy extend beyond mere energy savings. By facilitating targeted standby modes, it significantly lowers CO_2 emissions, aligning with broader sustainable goals. Moreover, this protocol ensures machines remain in a state of readiness, equipped for quick restarts without undergoing a complete shutdown. This aspect is particularly beneficial, as it avoids the challenges associated with long reboot times and the risk of restart failures.

Thus, PROFienergy stands as a testament to the power of innovative technology in addressing the operational challenges of the manufacturing industry. It offers a path to not only enhance energy efficiency but also to foster sustainability without compromising the availability or performance of essential production machinery.

- **100% plant availability with energy saving**
- **Energy-efficient manufacturing and reduced CO_2 impact**
- **95% reduction in Energy Consumption by implementing sleep mode operations**

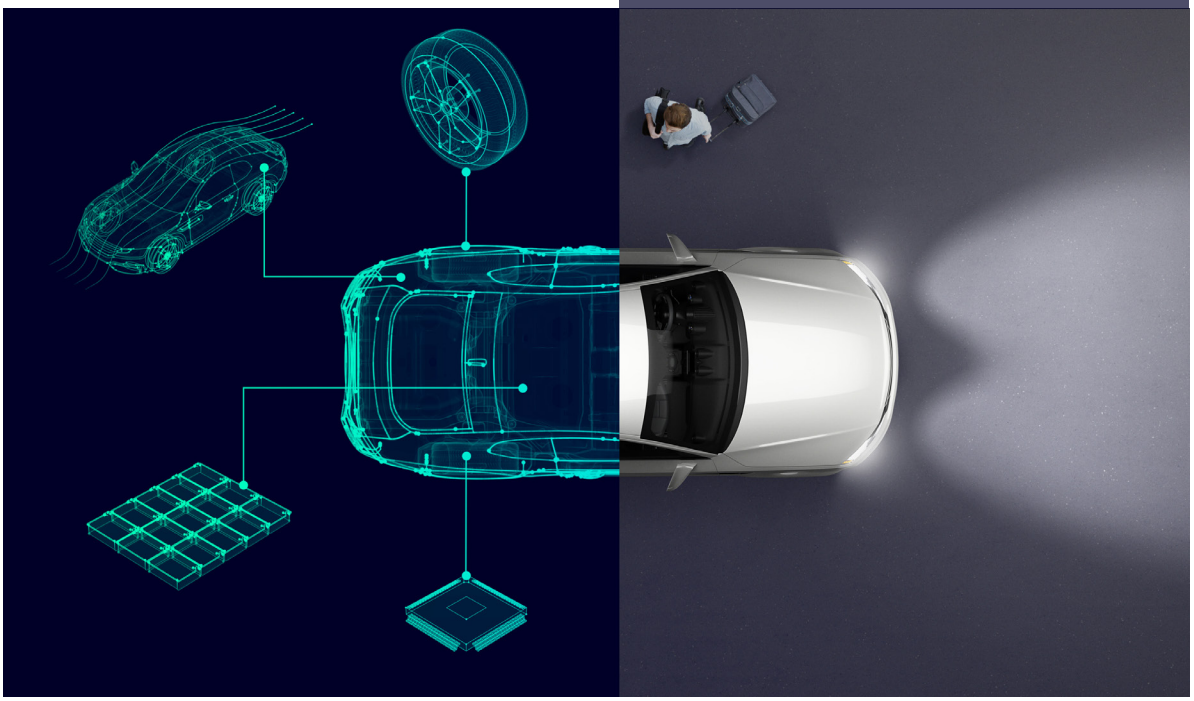
Track and manage carbon footprint data within your supply chain

Addressing the challenge of exchanging reliable Product Carbon Footprint (PCF) data across the entire value chain involves overcoming significant hurdles. These include the difficulty of comparing data due to varying standards and formats, as well as the need to aggregate carbon footprint information in compliance with diverse standards and regulations. These challenges highlight the complexity of managing PCF data within a fragmented landscape of information and regulatory requirements.

Navigating the complexities of sharing accurate Product Carbon Footprint (PCF) data across the value chain calls for a dynamic PCF management approach. Catena-X represents the first collaborative, open, and decentrally organized data ecosystem for the automotive industry, featuring uniform standards and shared principles. The supply chain contributes significantly to product-related emissions. To measure and reduce these emissions, cooperation across often complex, cross-industry supply chains is essential. With this objective, Siemens has initiated the Estainium network to facilitate the exchange of Product Carbon Footprints among manufacturers, suppliers, customers, and partners.

This method relies on efficient communication for regular updates, ensuring the system is both agile and adaptable. Aggregating PCF data at every step of the supply chain provides a complete carbon footprint picture, pinpointing areas for improvement. Collecting data directly where emissions occur guarantees precision. Moreover, facilitating data movement across the supply chain not only validates PCF claims but also encourages ongoing enhancements in environmental performance. Designed to comply with multiple standards (e.g., Catena-X, Estainium), this strategy streamlines PCF management, addressing comparability issues and bolstering sustainability efforts in a concise, effective manner.

- **Supply Chain Transparency:** With 90% of industrial CO2 emissions happening within supply chains, enhancing transparency is crucial for identifying and addressing emissions sources.
- **Dynamic PCF Management:** A dynamic PCF approach converts data into a pivotal tool, enabling data-driven decisions that facilitate effective emission reductions and drive product decarbonization efforts.



Siemens Battery Passport

The battery production sector, especially for electric vehicles (EVs), confronts critical issues such as unethical labor practices, environmental damage, poor recycling processes, and safety risks. A major hurdle is the lack of transparency across the supply chain, making it hard to track and report the myriad of attributes each battery possesses, a necessity for meeting strict regulatory standards.

Siemens introduces a game-changing solution: the Siemens Battery Passport. This solution not only guarantees compliance with regulations but also enhances the integration of diverse data models. It's a pivotal step towards a greener EV production line by offering precise monitoring and improvement of the carbon footprint tied to battery production, aiming for a zero-environmental impact.

Moreover, the Battery Passport extends its utility by aiding in the prediction of EV battery lifespans, crucial for those in the business of repurposing batteries. It equally benefits recyclers by making the mineral recycling process more efficient, thus supporting the cycle of resource use.

For those upstream in the supply chain, such as miners and materials suppliers, aligning with the Battery Passport's data standards means gaining a significant edge. It showcases a commitment to upholding ethical and sustainable practices within the industry. In essence, the Siemens Battery Passport stands as a lighthouse for ethical, sustainable, and safer battery production, steering the industry towards better environmental and social governance.

- **Adhere to EU Battery Pass and Catena-X requirements:** Ensuring compliance with these guidelines guarantees content meets the highest regulatory and industry standards
- **Compatibility with Siemens Xcelerator[1]:** Leverage open APIs, such as those for Battery Carbon Footprint, to ensure smooth integration and interoperability within the Siemens ecosystem
- **Seamless Supply Chain Integration:** With native support for Catena-X, integration into existing supply chains becomes effortless, enhancing collaboration and data sharing
- **Open DPP4.0 Architecture Utilization:** This approach opens the door to third-party business opportunities, fostering innovation and expansion by embracing a flexible and accessible architecture

1. Siemens Xcelerator is a digital business platform for accelerating digital transformation, integrating hardware and software solutions and IoT services to enhance innovation and efficiency across industries.

Digital enabled workforce

- **Facilitate** a digital workforce through new training methods
- **Implement** digitalized training based on a "learning by doing" methodology
- **Address** added complexity through innovative training approaches

Typical use cases:

Virtual maintenance training

One of the fundamental issues impacting automotive manufacturing is the notable shortage of highly skilled operators and technicians. This shortage is causing significant operational inefficiencies, leading to increased downtime and extended troubleshooting times. To tackle these challenges, there's an urgent requirement for a strategic emphasis on comprehensive training and development programs. These programs are essential for upskilling and reskilling the capabilities of the existing workforce, equipping them with advanced competencies and knowledge to efficiently navigate complexities of the current challenges while preparing for upcoming technological advancements.

To address these workforce challenges in automotive manufacturing, a streamlined training approach is essential. Begin by using 3D data for creating engaging training materials that mirror real-world scenarios, making learning more relevant and effective. Enhance these materials with expert input or authoring tools for tailored content that meets specific training needs.

Adopt a hands-on learning approach to boost retention, using practical exercises rooted in standardized concepts. This method ensures trainees not only understand but can also apply their knowledge effectively.

Incorporate interactive, role-specific training, monitored through learning management systems, to keep training focused and enhance safety and motivation. Finally, utilize cloud-based platforms to deliver consistent training across all locations, ensuring every technician and operator meets the same skill standards.

This streamlined training strategy is crucial for overcoming the current deficiencies in skill levels and safety standards, ultimately leading to improved efficiency and reduced downtimes in automotive shops.

- **Up to 40% decrease in manual errors, improving quality**
- **50% reduction in training time, enhancing productivity and knowledge retention**
- **Cost savings by reducing pre-production prototypes and damaged parts, promoting sustainability**
- **Improved health and safety through secure virtual training environments, boosting employee well-being and motivation**

Remote Assistance for operations and maintenance

In the automotive industry, maintaining high availability of production lines is crucial. Quick access to expert services for immediate failure resolution and fast reaction times are key to minimizing unplanned downtime. Furthermore, efficiently tackling complex operation and maintenance tasks requires connecting with experts who have the necessary competencies.

To address these needs, Siemens provides location-independent, system-specific remote services tailored to customer assets. This approach enables swift, secure troubleshooting, system diagnosis, and access to expert services. Our Remote Assistance service bridges the gap between people and technology through "Connecting People" (human-to-human interactions) and "Connected Devices" (interactions between humans/machines and machines). It features comprehensive tools for collaboration, including audio/video communication, desktop sharing and control, and direct access to devices like PLCs, Edge, and IPCs, ensuring effective and efficient problem resolution.

- **Increases service efficiency by up to 20%**
- **Ensures enterprise security**
- **Boosts uptime with quick failure identification**

Data-driven quality systems

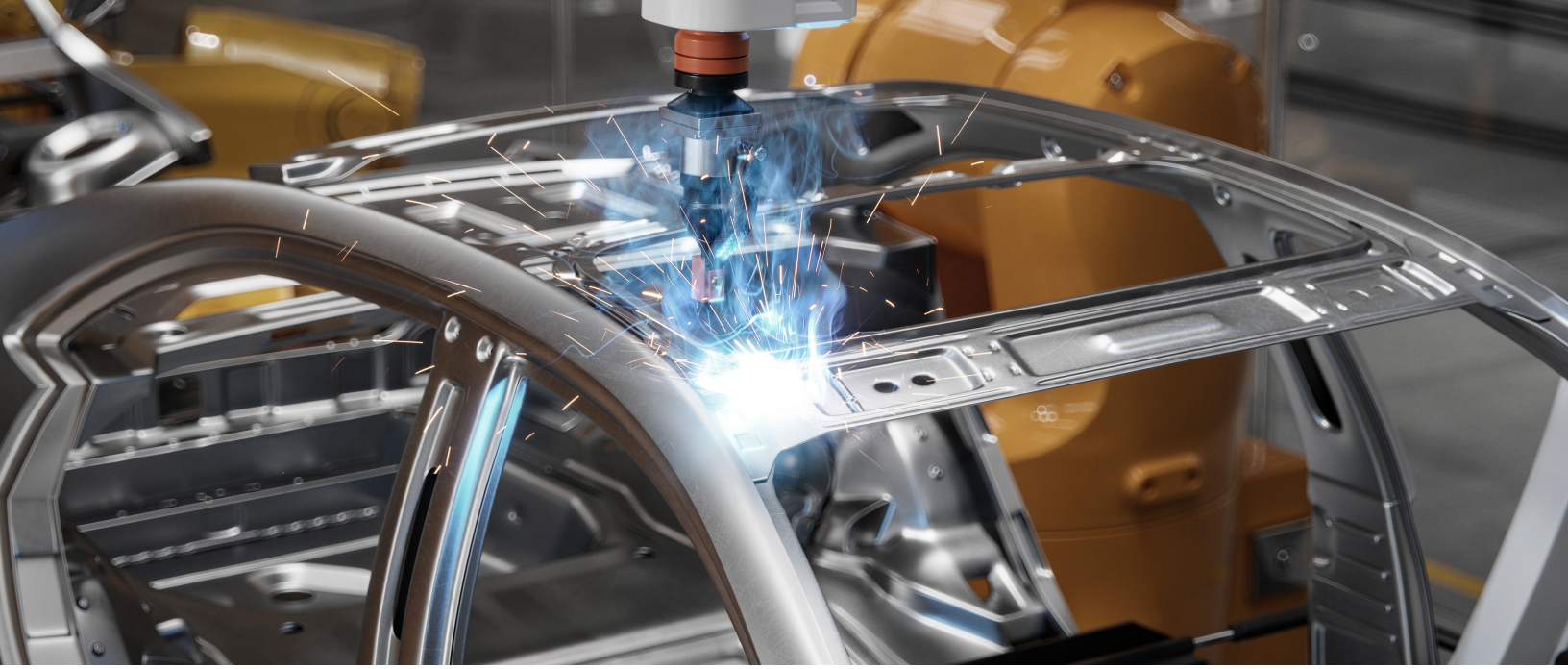
- **Capture** production quality data in real-time
- **Prevent** quality issues through automated adjustments
- **Decrease** manual inspections through process monitoring
- **Use** performance analytics and detect anomalies

Typical use case:
Visual defect detection in the press shop

The challenge in press line operations is the rapid production of parts, occurring every 3-6 seconds, which are subject to manual sample inspections. However, this method fails to detect approximately 60% of defects. The complexity of metal stamping—owing to the variety in shapes, potential defects, and the need for fast cycle times—compounds the difficulty of ensuring quality.

To address these issues, the solution involves setting up a high-speed image acquisition system that captures images of the stamped parts in less than 4 seconds. This system is complemented by the implementation of computer vision and machine learning algorithms designed for efficient defect detection. Additionally, a user-friendly interface is developed for executing AI models directly on the shop floor, making it accessible for immediate analysis. The entire solution is deployed through automation that integrates industrial edge AI capabilities on the shop floor, streamlining the process and significantly reducing the rate of undetected defects.

- **Reduction in manual classification efforts by up to 80%, achieving a 100% inspection rate**
- **Minimized security risks associated with undetected defects**
- **Lower labor costs as a result of deploying automated visual inspection solutions**
- **Implementation of a model retraining framework to ensure continuous improvement and adaptability**



Predictive maintenance

- **Implement** monitoring of quality and equipment performance
- **Apply** AI technologies to analyze production data
- **Guide** maintenance staff to solve issues proactively

Typical use cases:

AI-based data analysis in the welding process

The challenge in maintenance practices stems from reliance on fixed intervals, which does not optimize clamp life-cycle utilization. The process of identifying clamp anomalies is inefficient and time-consuming, particularly when the root cause is ambiguous. This inefficiency is compounded by the need to dispatch experts without clear problem identification, leading to significant delays and complexities in finding and deploying the right expert for maintenance tasks.

To address these issues, the AI-based system "Clamp-io" revolutionizes maintenance by accurately distinguishing between normal and abnormal clamp operations. It pinpoints specific failure areas—such as the cylinder, mechanical components, or valve—allowing for precise and targeted maintenance efforts. This enables a shift towards predictive maintenance, significantly enhancing availability, performance, and overall equipment effectiveness (OEE). Furthermore, "Clamp-io" proactively triggers timely interventions for any detected anomalies in clamp behavior, effectively reducing unplanned downtimes and streamlining the maintenance process.

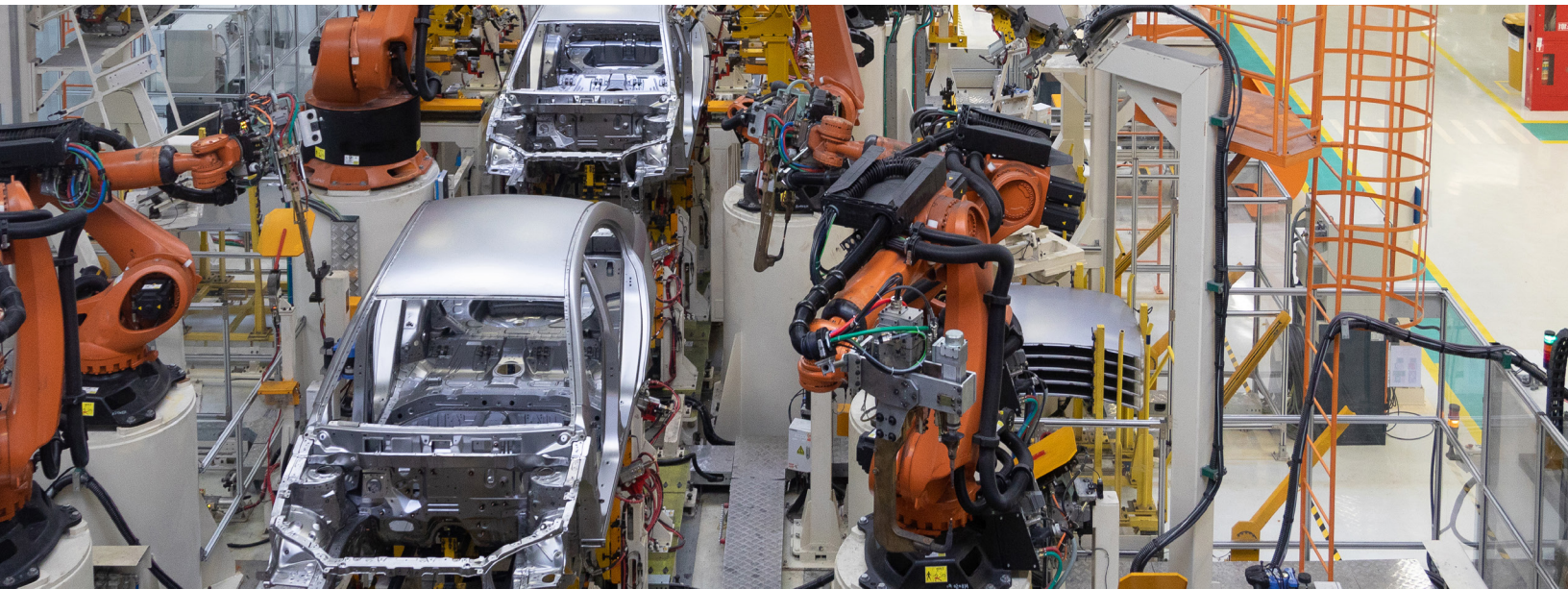
- **Implementing predictive maintenance across thousands of clamps in body shops**
- **Enhancing Overall Equipment Effectiveness (OEE) in body shops**
- **Achieving 80% accuracy in predicting faults**
- **Ensuring 100% automation in detecting anomalies**

Predictive maintenance in conveyor systems

In automotive manufacturing, the unexpected downtime of a single EMS (Electrified Monorail System) carrier can halt the entire production line. Due to the lack of transparency and sophisticated detection capabilities, identifying complex fault patterns and pinpointing potential weaknesses in extensive production lines are significant challenges.

To tackle these issues, the Industrial Edge EMS application for Condition Monitoring and Predictive Maintenance offers a comprehensive solution. It includes continuous monitoring of key parameters like motor current and temperature, as well as the quality of code readers. Advanced analytics automate the detection of anomalies and trace cycle times, facilitating early identification of potential weak spots in complex production systems. The application provides prepared dashboards, heatmaps, top X analyses, and automatic event logging to enhance visibility and comprehension of the production process. Furthermore, it enables comprehensive tracking and monitoring of each EMS carrier, ensuring a holistic overview of the entire conveyor line's performance. This integrated approach significantly reduces the risk of production shutdowns due to single carrier failures and improves overall line management for increased efficiency and minimized downtime.

- **Enhanced Fault Detection and System Availability:**
  - Increase system availability through early detection of faults
  - Improve machine availability by 100%, significantly reducing the likelihood of unplanned downtimes
  - Cost Efficiency and Downtime Reduction
- **Save on operational costs by minimizing unplanned downtimes**
  - Decrease time to repair by 50%, and reduce the time to resolve downtimes by 15%, ensuring a swift return to full operational capacity
- **Operational Efficiency and Process Improvement:**
  - Detect hidden bottlenecks and accurately identify root causes of faults to streamline production processes
  - Shorten commissioning and ramp-up times, accelerating the transition from setup to full-scale production



Flexible shopfloor orchestration and operation

- **Orchestrate** flexibly diverse assets like robots, AGVs, machines, and conveyors
- **Centralize** updates for security and operating systems managed through Common Device Manager and Fleet Manager

Typical use cases:

Common device orchestration

Managing a diverse device landscape presents two major challenges: the significant effort required to perform firmware, configuration, and security updates, and the need for ongoing training to develop the skill sets necessary for managing varied workforces, including operators and maintenance personnel.

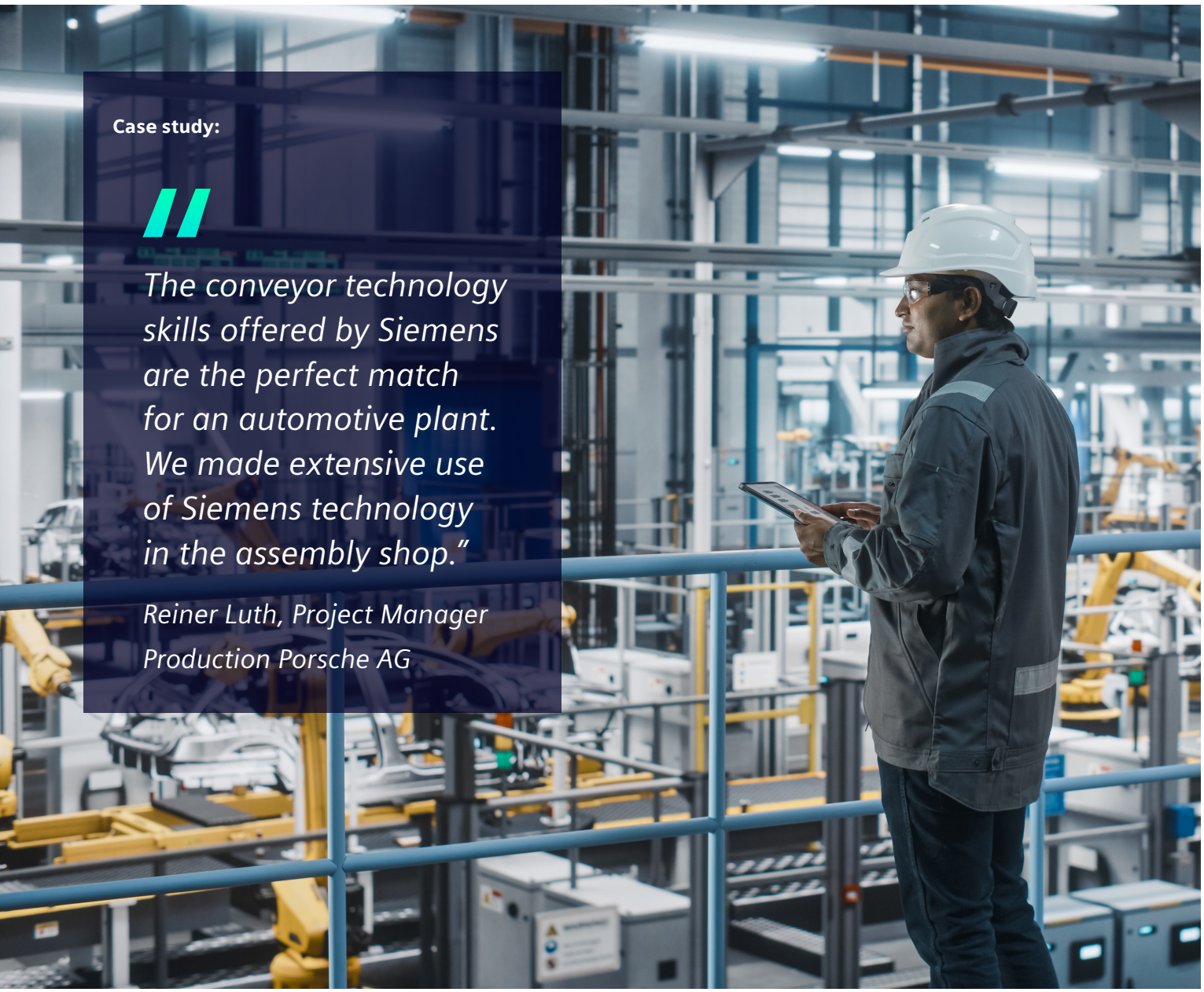
To address these challenges, implementing an open and agnostic device management system that seamlessly integrates with the customer's existing corporate asset management system is proposed. This solution will include the integration of standardized IT protocols and services, ensuring a unified approach to device management. By applying a common device management strategy across all shops, especially in the body shop with its wide array of devices such as PLCs, HMIs, switches, distributed IO, drives, sensorics, and IoT devices, operations can be streamlined, the burden of updates and training reduced, and overall efficiency enhanced.

- **30% Effort Reduction:** Vendor-independent asset management streamlines operations
- **Non-stop Production:** Enables OT shopfloor configuration while maintaining continuous operation
- **OEE Increase & Cost Reduction:** Boosts equipment effectiveness and lowers operational costs

Flexible production logistics

To streamline logistics on the automotive shop floor, adopting intelligent fleet management for Automated Guided Vehicles (AGVs) and Autonomous Mobile Robots (AMR) is key. This approach ensures efficiency by integrating fleet simulation with real-time operations, allowing for ongoing adjustments and improvements.

- **Maximize** production efficiency by up to 30%
- **Reduce** commissioning time
- **Reduce** downtime



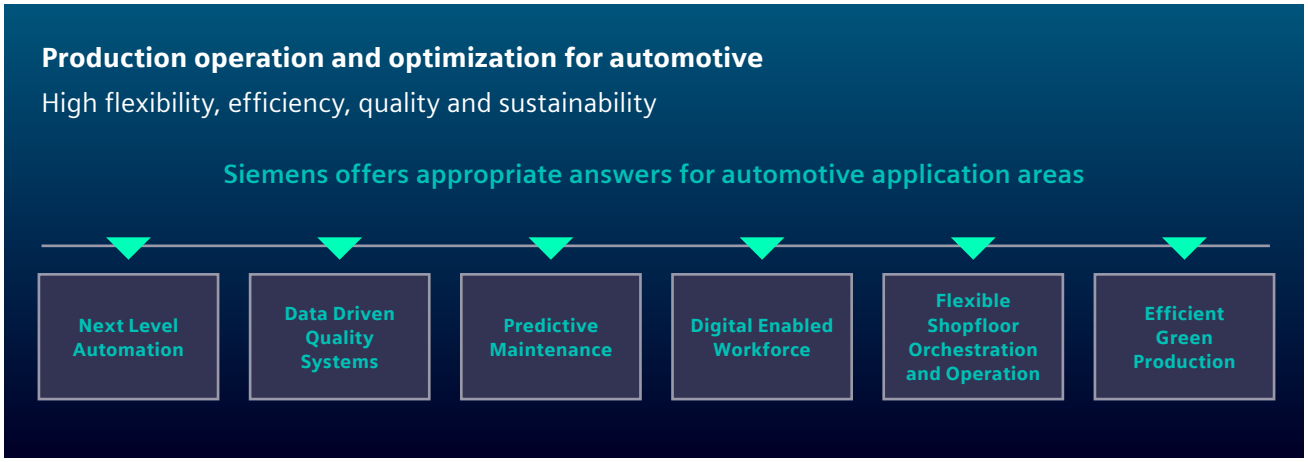
Case study:

"The conveyor technology skills offered by Siemens are the perfect match for an automotive plant. We made extensive use of Siemens technology in the assembly shop."

Reiner Luth, Project Manager Production Porsche AG

Conclusion

Siemens' Production Operation and Optimization solutions for the automotive industry deliver unparalleled flexibility, efficiency, quality, and sustainability, setting a new standard in manufacturing excellence.



We want to increase the degree of automation in our production processes while simultaneously reducing complexity. We've chosen to work with Siemens, because they have the necessary application expertise in this area."

Thomas Zembok, former Head of Manufacturing Automation and Digital Production, Volkswagen AG

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About Siemens Digital Industries:

Siemens Digital Industries (DI) is a leading innovator in automation and digitalization, empowering organizations of all sizes to transform their operations and create sustainable products for the future. Through its Digital Enterprise portfolio, DI offers a comprehensive suite of software, hardware, and services that facilitate the seamless integration and digitization of the entire value chain, customized to meet the unique needs of each industry. Siemens Xcelerator business platform provides a unified environment for organizations to leverage the full potential of DI's solutions, including its robust digital twin technology. DI assists organizations of all sizes in their digital transformation journey, utilizing software, hardware, and services from the Siemens Xcelerator business platform. In partnership with its customers, DI accelerates transformation, helping them achieve greater productivity, flexibility, and sustainability. For more information on Siemens Smart Manufacturing for Automotive, visit siemens.com/automotive-smart-manufacturing or follow us on LinkedIn and X.

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