THE INTELLIGENT ENTERPRISE FOR THE AUTOMOTIVE INDUSTRY

Delivering personalized car and mobility experiences at scale and as a service through a customer-centric ecosystem
Dear Customers,
Throughout boardrooms and industry leadership stakeholders, the automotive industry is grappling with a fundamental question: What business do we want to be in?
Why? Because advanced technologies are already mature enough to foster the vision of a fully autonomous, electrified, and connected vehicle, as well as to create a shared mobility environment that provides personalized experiences for each customer. While there is no limit to the impact the next-generation mobility business will have on society, it will continue to be built on a decades-long foundation – excellence in the design, manufacturing, and distribution of cars and components at scale. This is prompting some fundamental strategic questions.

As automotive manufacturers, suppliers, and distributors optimize their existing business, they must also ride the disruption that is reinventing the mobility industry. They face the challenge of sharpening their core competencies while increasing the pace of innovation, integrating with technology partners, and transforming their interaction with consumers through new business models to meet changing customer expectations. Simply providing or selling a world-class vehicle with leading-edge technology is no longer enough. It is the starting point for a unique customer experience positioned toward future mobility. Customers expect the automotive ecosystem to deliver engaging and trusted experiences. As a result, revenue is shifting from vehicle sales to data-enabled mobility services, increasing customer choice and convenience.

In response to new competition arising from the electrification market and ride-sharing platforms, to name two, automotive companies plan to reduce dependency on internal combustion engines, move to electric vehicles, and rebrand themselves as “mobility companies.” The transition can be fraught, particularly as the rate of consumer adoption of electric vehicles and new services is unpredictable and varies by region and geospatial setup. Nevertheless, the industry has unprecedented access to the tools, tactics, and technology that can pave the way. Industry 4.0 brings intelligence to manufacturing, enabling automotive companies to meet a new generation of customer expectations, including delivering customized solutions at the price of standard products. Industry 4.0 principles and technology such as the Internet of Things (IoT), cloud and edge computing, artificial intelligence (AI), and autonomous systems will drive automation, increasing adaptability and efficiency. And as autonomous vehicles become commonplace, the increase in asset use will drive changes in vehicle and component design.

For consumers, mobility services, including real-time monitoring of driver comfort and fitness to drive, as well as remote vehicle management, commerce, and data sharing with insurance and other services, will turn their vehicles into platforms for mobility services.

We see successful automotive companies focusing on five strategic priorities that simultaneously position them to run better today while transforming their businesses to capitalize on the opportunity of mobility. These strategic priorities are:

- Be customer centric
- Deliver mobility services
- Design connected cars
- Implement the digital supply chain and smart manufacturing
- Engage with a changing workforce

Following these strategic priorities and embracing Industry 4.0 and the intelligent technologies that collect, protect, and process experience and operational data, successful automotive organizations will develop the skill sets to fully use this data in real time to create outstanding experiences for customers, employees, and partners. These automotive organizations will be responsive to the challenges posed by shifting demographics and regional preferences. They will increase transparency and connectivity throughout the supply chain, encourage a new generation of workers that can bridge the worlds of software and engineering, and actively retrain their workforce as automation takes on more tasks.

This paper takes a deep dive into the trends shaping the automotive industry over the next five years and the path to innovation.

Our industry is at a tipping point. Competition from unexpected sources, increased consumer expectations, and a dramatic shift in the place cars hold in peoples’ lives are forcing the industry to confront some difficult decisions. Still, there has never been a greater opportunity to have an outsized impact on society. It is, indeed, a great time to be in the automobile business.

Sincerely,

Hagen Heubach
Director, Automotive Industry Business Unit
SAP SE
Global “megathemes” are affecting the automotive industry but also providing new opportunities for growth.

- The shift toward sustainable energy in combination with integrated mobility and the need for livable cities require convenient, fast, reliable, and cost-effective transportation. By 2050, two out of three people (68%) will live in urban areas that already struggle with congestion and pollution.\(^1\) Automotive companies will need to partner with technology providers, utilities, and municipalities to define and create solutions that satisfy the need for safe, sustainable, and convenient mobility while respecting citizens’ desire for an urban environment that is tailored to humans, not vehicles.

- Connected cars, new business models, vehicle networks, and technology-driven services will fundamentally shift the education and work requirements of the workers needed by automotive companies that will also be competing against technology companies for talent.

For example, for electric vehicles to be widely adopted in cities, charging infrastructures need to be in place, and the current patchwork of providers needs to become more customer friendly.
The automotive industry is being reshaped by major trends frequently referred to as CASE: connected, autonomous, shared, and electrified mobility.

- **Connected**: Modern cars are equipped with more than 100 sensors creating up to 25 GB of data per hour. As electronic components have a shorter lifecycle, this is driving the need for a more modular vehicle design. With already 100 million lines of software code in modern cars, competition for talent is fierce. According to one prediction, by 2023, approximately 76 million cars shipped will be connected.

- **Autonomous**: Up to 15% of passenger vehicles sold in 2030 could be fully autonomous, which is predicted to make roads safer due to fewer fatalities. The car will become a platform where transit time can be used for personal activities and services. With shared autonomous vehicles, mobility solutions become more cost-effective than owning a car.

- **Shared mobility/services**: As of 2017, in the United States, the majority of cars were used for trips of less than 6 miles. By 2030, 1 out of 10 cars sold could be a shared vehicle, potentially increasing the use of individual vehicles, impacting the relationship between the consumer and automotive brands, and increasing the need to deliver a great experience. Higher levels of use will require capabilities such as self-cleaning and self-healing interiors and modular designs, for example, to swap seats. Subscription models for cars are already being introduced by manufacturers such as Porsche, Volvo, and GM.

- **Electrified mobility**: The internal combustion engine (ICE) has always been the heart of a vehicle. The shift from an ICE powertrain to battery- and motor-driven technology has a huge impact on traditional OEMs, as it removes a significant element of their differentiating qualities – the engine. Electrification also drives big changes in the supply base, creating new challenges for warranty, after-market, and resale activities. Yet this trend is here to stay. By 2040, 54% of new-car sales will be electric, up from 4% in 2021. By 2040, the prediction is that 33% of the global car fleet will be electric. Profit pools will also shift from car sales to mobility services.

The move to mobility and the race for CASE is changing the playing field, allowing agile, new competitors into the marketplace. This is also disrupting established distribution models, with dealerships under threat as customers expect different buying experiences.

How well automotive companies address the global megathemes and the industry challenges will determine who will be among the winners in the next 10 years. In fact, there are indications that the best-performing companies are pulling away from the rest, widening the performance gap and creating a landscape where those leaders that embrace digital transformation, connectivity, and Big Data are the most profitable. By successfully adopting new technologies, they can deliver winning products, services, and experiences more efficiently.

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**Digital strategies are disruptive and changing the rules for automotive companies.**

Daimler AG, one of the largest global auto manufacturers, relied on an intricate automotive supply chain. The company faced daily challenges such as supply chain fragmentation, future system readiness, and massive volume growth. With SAP S/4HANA at its core, Daimler digitally transformed its global supply system to plan, source, and deliver the right materials at the right time. Today, it has a centralized system to plan and control global material flow.

As one of the world’s largest automotive suppliers, Magna International has 92 product development engineering and sales centers across 28 countries. Previously, the company used multiple ERP systems that created data silos, preventing management from acting on real-time business data. Magna implemented SAP S/4HANA Cloud to provide a centralized view of its business operations with accurate, real-time data and process simplification. As a result, the company reduced overhead costs by 25% and can act confidently knowing that it has data that reflects business realities.

Driven by automakers’ desire to make their vehicles safer, UNOMINDA, an automotive supplier, sought to integrate more sophisticated telematics and advanced driver assistance systems into its product portfolio. However, it needed to modernize its supply chain and improve its collaboration with suppliers to meet customer demand. After migrating to SAP S/4HANA, UNOMINDA dramatically sped up processing time and refined business processes. With access to actionable insights based on live data, the company is benefiting from smoother transactions with suppliers, shifting onto the fast track to meet growing demand for futuristic products.
By 2025, the mobility landscape will have dramatically changed for all participants.

For consumers, getting from point A to point B will be more convenient than ever. They will have more choices, such as carshare, rideshare, subscription, or traditional leasing and buying. Automotive companies will need to be part of fully integrated multimodal transportation solutions, especially in urban areas and cities to provide an experience beyond the vehicle.

Fleet operators will not only remain separate businesses but will be an emerging capability that will define the competitive advantage for companies with shared and autonomous operations. The organizations that can balance the optimization of utilization, maintenance spend, and customer service levels will be big winners.

Retailers and dealers roles will fundamentally shift as individual car ownership declines and consumers shift toward mobility-based models. They will, therefore, need to focus on building stronger customer relationships and experiences, with new levels of choice and flexibility to survive. Already some manufacturers are offering the ability to buy vehicles online so the model of large dealer networks per brand will have to evolve. Maintenance and services, including predictive services, will play a bigger role in defining the relationship – not only for individual owners but also for fleet operations.

OEMs will experience a fundamental change of their core business model. Either white-label manufacturing will shrink, or OEMs will use their strong brands to expand to become mobility providers. There will be significant consolidation among mobility and automotive providers. As ridesharing and carsharing grow, passenger vehicle sales volume will stabilize and maybe even shrink, especially in developed markets. However, the share of electric vehicles will continue to grow. OEMs will need to embrace digital technology to gather and analyze huge amounts of data across production lines and systems, using AI and machine learning (ML) to enable faster and more flexible and efficient processes. They will need to be part of new ecosystems to support and monetize customer relationships in innovative ways.

For suppliers, there will be increased consolidation, mergers, and acquisitions. New technology suppliers (electronics, sensors, or battery suppliers) will need to learn how to become automotive supply chain capable. Parts and interior components will need to be built for much higher vehicle use than today.

Commercial vehicles, fleet management, and logistics providers will see growth with the increase of ridesharing and autonomous vehicles. Concepts such as robotaxis, truck platoons, and autonomous operations will start to be commonplace.

Embracing opportunities from new technologies successfully and consequently implementing the right business initiatives will be the foundation of successful digitalization transformation and staying ahead of the innovation curve.
We have identified five strategic priorities necessary for automotive companies to transform their business.

**BE CUSTOMER CENTRIC**

**DELIVER MOBILITY SERVICES**

**DESIGN CONNECTED CARS**

**IMPLEMENT THE DIGITAL SUPPLY CHAIN AND SMART MANUFACTURING**

**ENGAGE WITH A CHANGING WORKFORCE**
Customer attitude about mobility is changing and having a profound impact on the automotive industry.

Digitally savvy customers today expect contextual access on multiple channels to products and services. It is imperative to understand customer expectations and learn how to deliver value and a great experience across a mobility ecosystem. Mobility services will be key, and in this fast-growing and profitable business segment, automotive companies must compete with technology companies for consumer experience and relationships, as these companies already have deep insight into consumer preferences. Automotive companies must strive for true customer centricity, understand their consumers and how their behaviors are changing, capture their feedback, and then make every business decision based on this insight.

The Vision
In 2025, market-leading automotive companies will have knowledge of every touch point with the customer, augmenting that with social, demographic, and external (situational or contextual) data to know their customers’ preferences. AI, chatbots, and augmented reality will be used to dramatically enhance customer interactions. Mobility services will drive customer experiences, using the car as a platform, and data privacy and ethics will be critical in earning a customer’s trust. Companies will interact with their customers constantly and seamlessly through multiple channels, including car connectivity. Dealerships will transform their business model from holding inventory and sales to delivering services across multiple brands.

The Journey
Dealers and OEMs will start toward this goal by leveraging data from connected vehicles. They will be developing a 360-degree view of their customer and a single view of all channel interactions, including chatbot activities. This means that customers can be served on all the channels they use to interact with your company. Ecosystem partners will exchange vehicle and customer data for mutual benefit and to provide customers the experience they want. Additional convenience and safety features will be provided, including predictive maintenance. To ensure that all customer needs are met, partnerships will extend across industry boundaries for collaboration with insurers, transportation providers, retailers, restaurants, fueling, advertisers, and others. Dealers will transform from sales-centric to service-centric operations, thanks to strong connections to customers and vehicles. Fleet operators, mobility service providers, carsharing and ridesharing agencies, and subscription providers will all require direct interaction with customers, as they attempt to optimize their revenue and profits (see Figure 1).

Figure 1: Customer-Centric Value Chain

By 2021, 60% of tier 1 suppliers will leverage real-time data across the value chain and will have increased their focus on new product collaboration with OEMs to reduce time to market by 35%.

BMW integrated different customer satisfaction reports into a single voice of the customer with Qualtrics® XM Platform and customer experience solutions. This process simplification enabled the company to appropriately escalate and act on customer feedback. As a result, 90% of all issues are resolved within five days, and the company saw a 23-point Net Promoter Score (NPS) increase in the first nine months. Now more than ever, BMW is better positioned to deliver a full-cycle luxury experience, from the dealership to the open road.
BE CUSTOMER CENTRIC
IMPROVED CUSTOMER BUYING EXPERIENCE

Understanding and putting the customer’s point of view and their feedback at the center of every decision are key prerequisites for success in the digital age.

It also means applying those insights not just in the sales department but also to determine which products are built, how customers are treated, and what services are offered. Enabling real-time, 360-degree insight into customers and vehicles – and the ability to adapt and automate the lead-to-cash process with a real-time integrated and automated multichannel system – is essential.

TRADITIONAL SCENARIO

- Leads have low visibility, combined with slow routing and categorization, resulting in time spent on the wrong opportunities.
- Discovery and evaluation processes have incomplete insight into customers and vehicles, which makes responding to customers difficult.
- Quote and order is a complex and time-consuming manual process.
- Decisions and communications are not tracked.
- Up-selling and cross-selling are limited.
- Compensation is misaligned to sales campaigns and is demotivating to the sales force.
- Billing and revenue systems are inflexible, making compliance and monetization difficult.

NEW-WORLD SCENARIO

- Immediate visibility of leads with a 360-degree view of customers and vehicles – resulting in faster time to hand off leads and closing.
- Discovery and evaluation process is integrated and collaborative.
- Consistent, accessible, and reliable insight – making it easier to respond quickly to customers.
- Simpler quote and order system with bundled offers.
- Constant monitoring of sales order status.
- Relevant insights and collaboration features for internal sales to maximize opportunities, anytime and anywhere.
- Feedback collected from employees in real time so it can be addressed, motivating employees.
- Clear visibility of compensation and alignment to sales campaigns.
- Ongoing personalized training and coaching.
- Consolidated invoicing for a complete view of consumption.
- Consolidated feedback of employee and customer experience that provides deeper insights into customer experience.

TOP VALUE DRIVERS

Higher customer satisfaction  Lower sales and service cost  Increased revenue growth
Recreational and luxury brands aside, customer loyalty will gradually move from brand and dealerships to integrated and convenience-driven services such as carsharing and ridesharing.

As long as a vehicle is clean and safe, it will not matter if the autonomous rideshare is a Ford or a Toyota vehicle. Who controls the customer relationship and interactions will be the company that can capitalize the most on customer insights and provide superior customer experiences.

The Vision
In 2025, vehicle and customer data will extend as well as enable existing or entirely new business models as companies use insights from the data that is collected. Services will be offered directly from the car and delivered through cross-industry partnerships.

Companies will seamlessly integrate operational and contextual feedback from vehicles, consumers, partners, and employees to continuously innovate and improve their customer, product, and brand experience.

The Journey
Automotive companies will leverage vehicle and customer insights, using partnerships and collaboration, to provide superior customer experiences. The car will be the platform for the mobility marketplace. Services such as parking availability, mapping, GPS data, and integrated billing will be offered as services, with other mobility and transportation services available through the marketplace (see Figure 2).

Because of increases in driver assistance and workload data sharing through cloud platforms, 20% of OEMs implementing data management and monetization strategies will increase their market share by 2023.18

Figure 2: Mobility Ecosystem

The connected vehicle allows established companies like ERGO Mobility Solutions to keep ahead of competitors by deploying new business models with the help of SAP S/4HANA. Enabled by SAP’s scalable and flexible platform, ERGO was able to introduce profitable on-demand and usage-based insurance products. The company saw efficiencies across the entire value chain, thereby providing the end user a near-seamless, high-quality experience.
Emerging business models focus on providing complimentary and alternative solutions to vehicle purchasing and leasing. These new business models are intended to attract new customers who value flexible and convenient choices for buying and leasing automobiles. Offerings need to be configured and priced based on new service business models and monetized based on value delivered to the customer. As automotive companies move from product-centric to customer- and service-centric offerings, they must implement these new business models. SAP® Customer Experience solutions and SAP S/4HANA provide capabilities that help companies pursue subscription or other new mobility-as-a-service opportunities.

**DELIVER MOBILITY SERVICES**

**SUBSCRIPTION AND MOBILITY-AS-A-SERVICE MODELS**

Consumers use online and offline tools to educate themselves and identify their target vehicles, usually visiting a dealership to complete the traditional purchase, financing, or leasing of a vehicle.

**TRADITIONAL SCENARIO**

- Attracting customers relies on traditional acquisition processes. Consumers educate themselves and then visit a dealership.
- There is a continual battle with consumers as industry trends move toward valuing flexibility.
- The offering to the customer remains product-centric.
- Challenges remain in customer retention as time between product sales can be years.
- Prices are based on the product, not on the value provided to the customer.

**NEW-WORLD SCENARIO**

One integrated solution, with support for the complete end-to-end process for subscription-based models online

- Insight into the needs of customers drives innovation.
- Business model design enables flexible creation of new digital offerings and products.
- Setup and maintenance of subscription-based customer contracts for vehicle use or other services are easier, including individual agreements.
- Use and performance data from connected vehicles is easily retrievable using IoT connectivity.
- Invoice generation is through usage data from connected cars.
- Automotive companies use real-time vehicle and customer insights to provide superior customer experience.

Capture customer experiences with subscription and mobility-as-a-service contracts. Compare experience data against contract profitability and customer retention. Then optimize processes and service offerings and billing for subscription and mobility-as-a-service contracts.

**TOP VALUE DRIVERs**

- **Flexible** model selection that enhances customer experience
- **Higher** customer satisfaction and retention
- **Lower** traditional ownership expenses
Vehicles must be able to meet the changing mobility landscape by becoming even more intelligent and connected.

Vehicles will become a platform for delivering applications and services. In addition, they will provide a constant feedback loop to the manufacturer. The value contribution resulting from the software and digital capabilities of vehicles will continue to grow significantly.

The Vision
In 2025, it will be commonplace for automotive companies to have the business strategies, work processes, and supporting software applications that help different organizations to work collaboratively on product development. Vehicles will be even more intelligent and connected. Telematics data will feed digital twin representations in real time. Real-time vehicle information will allow better vehicle fleet management as well as the management of critical components such as batteries, even initiating their own repairs. Design-to-manufacture processes will become sophisticated due to closed-loop lifecycle management based on continuous feedback from connected vehicles and connected assets. Product design and improvements will become even more agile, faster, and less costly with rapid prototyping using additive manufacturing (3D printing) and collaborative design, as it will become an imperative for automotive companies to develop and build vehicles, products, services, and experiences that their customers love.

The Journey
Automotive companies will start toward this goal with continued process optimization initiatives, including global harmonization and integration. They will further digitalize and connect their product lifecycle management systems with operational systems, suppliers, and smart products in the field. They will use Big Data and analytics to improve serviceability. Aligned with Industry 4.0 principles, machine learning and artificial intelligence will be used to further automate production, such as machine image recognition for quality inspections and augmented reality for complicated manufacturing or repair steps. Closed-loop product innovation will be enabled with connected vehicles, resulting in failure prediction through finite element analysis in the field, paired with machine learning algorithms and closed-loop design improvements. Automotive companies will be able to use real-time data and other capabilities to design and develop new business models (see Figure 3).

Figure 3: Connected-Car Digital Twin

By 2030, more than $100 billion in recurring revenue will be powered by data connectivity services, including apps, navigation, entertainment, remote services, and software upgrades.19

Smart, connected components in the mobility ecosystem allow organizations such as Exide Industries Ltd., one of India’s most innovative storage battery companies, to differentiate themselves in a crowded market. Enabled by SAP HANA® Enterprise Cloud, the company can detect and resolve issues for 20,000 connected batteries, with alerts that pinpoint faults. As a result, consumers now have a reliable power supply that they can depend on. Exide’s reliability earns customer loyalty and drives future usage-based development and profits.
As manufacturing and operations become more connected, having siloed, incomplete, and outdated information on assets is not an option. As companies recognize the strategic priority of industry 4.0 and digitalized processes, it becomes imperative for them to have a virtual, real-time representation of their assets and vehicles – a digital twin. This allows all partners to collaborate in real time and provides remote monitoring and diagnostic capabilities with access to benchmarking behavior. The result will be optimization of production and reduction of downtime.

**TRADITIONAL SCENARIO**

- OEM 1 ➔ Receive asset data ➔ Create master data ➔ Access master data
- OEM 2 ➔ Receive asset data ➔ Create master data ➔ Access master data
- OEM 3 ➔ Receive asset data ➔ Create master data ➔ Access master data

**NEW-WORLD SCENARIO**

1. Digital representation
   - Enrich and integrate with business context
   - Operate on digital twins and enable new business models

2. Business process support
   - Compose and integrate digital twins with data from design, engineering, production maintenance, and service

3. Business network collaboration
   - Collaborate across the business network – manufacturers, asset operators, and service providers

4. Network of digital representations

**TOP VALUE DRIVERS**

- **Reduction** in asset service and maintenance cost
- **Reduction** in asset master-data creation and maintenance effort
IMPLEMENT THE DIGITAL SUPPLY CHAIN AND SMART MANUFACTURING

Supply chains and manufacturing networks must be completely modular and flexible.

They must be able to execute seamlessly and respond directly to demand signals and customer orders. This will require increased automation on the shop floor, including the use of new technologies such as cobots, drones, augmented reality, and machine learning to increase efficiency even more.

The Vision
In 2025, automotive plants and machines will operate more reliably with higher degrees of automation and at lower cost. Supply chain agility will increase due to higher levels of automation and the visibility that automotive companies will have into their own operations as well as operations of their suppliers and logistics providers. There will be automated material handling and assembly, which will be tied together with predictive algorithms. There will be better and quicker decision-making when it comes to making changes in late-stage final assembly. This will enable companies to provide higher flexibility and more responsiveness to meet variable customer demand.

The Journey
Automotive companies will be operating digitally in real time. In concert with Industry 4.0 strategies, they will see a shift from transactional production execution to data-driven business processes and optimization with connected machines that provide instantaneous information, allowing for more flexible production schedules. Companies’ systems will also seamlessly connect and integrate with suppliers and logistics providers. Therefore, companies will analyze performance with higher granularity and use the insights to establish outcome-based contracts with suppliers. They will be able to reinvent their operational models by further enabling modular (cellular) production with machine learning–driven optimization, autonomous machines, and direct integration from e-commerce sites to shop-floor platforms (see Figure 4). Predictive maintenance and predictive quality will be commonplace, and companies will adopt equipment-as-a-service business models.

Figure 4: Five Levels of Connectedness for the Automotive Digital Supply Chain and Smart Factories

1. Shop floor to top floor
2. Machine to machine
3. E-commerce integration
4. Manufacturing and after-service collaboration
5. Vehicle network

60% of manufacturers will have empowered shop-floor workers with augmented reality and virtual reality, intelligent apps, and cobots by 2021, thus achieving productivity gains of up to 7% and more attractive work environments.56

Recognizing the potential of IoT technologies to revolutionize the automotive industry, JianXin Chassis, a Chinese auto parts manufacturer, resolved to turn its Ningbo plant into a smart factory. Now JianXin Chassis can multiply efficiencies and cost savings by integrating shop-floor production processes from end to end with materials management and quality management processes.
With growing model diversity and an increasing number of model variants, complexity is increasing, and the traditional linear production on assembly lines is reaching its limits.

Enabling modular manufacturing will be key to producing heterogeneous model mixes efficiently at scale, providing a quick and flexible reaction to changing customer demand. This splits the rigid assembly line into assembly modules so that autonomous mobile robots carrying work in progress can head to different assembly modules flexibly, making the assembly process much more dynamic and productive. Making this a reality requires a fully digitalized production site, with the IoT connecting devices and machine-to-machine communication, and with track-and-trace capabilities for staging materials and work in progress on the shop floor.

**IMPLEMENT DIGITAL SUPPLY CHAIN AND SMART MANUFACTURING**

**MODULAR MANUFACTURING**

**TRADITIONAL SCENARIO**

Workstations in assembly line – flow

- Fixed takt time that leads to inactivity on many sections of the line
- Limited ability to manage optional features (extras)
- Rigid sequential process – a jam at one station leads to a standstill for the entire line
- Difficulty in extending production line and capacity

**NEW-WORLD SCENARIO**

Workstations in modular assembly

- Dynamic takt time depending on complexity of vehicle configuration, allowing higher throughput and reduction of dead time
- Flexible reaction to customer demand and ability to realize customization at scale
- Breathing or modular assembly that allows easy extensibility of shop floor
- Production supply with automated guided vehicles that promotes just-in-time availability for needed components
- More detailed and granular production planning, resulting in better visibility of production plans, supply, and demand

**Benefits**

- **Increased** capacity utilization
- **Increased** number of variants per single flow assembly
ENGAGE WITH A CHANGING WORKFORCE

In the next 5 to 10 years, more than half of the workforce could be facing retirement: baby boomers will be gone, millennials will dominate the workforce, and Gen Zers will be entering the workforce.

This means an upcoming loss of critical trade skills and knowledge base for automotive companies. At a time when digitally talented people are in high demand, automotive companies will be competing with other industries, such as high tech, for talent, as software and platform development becomes more important.

The Vision
In 2025, there will be a higher degree of automation, driven in part by Industry 4.0 strategies. Automotive companies will use conversational user interfaces (UIs), augmented reality, and artificial intelligence to attract and retain their workforce and develop the skills of a younger workforce with different experience levels and expectations about technology. As the workforce becomes more opportunistic and transient – the gig economy – companies will develop more interactive, sustainable, and embedded methods of onboarding, training, reinforcing operational procedures, and improving collaborative knowledge sharing among generations and locations. They will need to be able to collect, interpret, and act on employee feedback to be able to offer exciting work environments and experiences for high-performing teams.

The Journey
Automotive companies will improve the hiring experience, screening job applications with machine learning and more rapidly attracting and onboarding new talent. They will make knowledge sharing, training, and enablement and feedback loops a natural part of the process by delivering embedded training and digital assistants for the less-experienced or less-capable members of the workforce. They will use conversational UI and augmented reality to improve worker productivity and job quality. They will create inspiring and flexible workspaces, enable autonomous teams, and continuously capture employee feedback and sentiment. To support a more fluid workforce, artificial intelligence will be augmented with temporary expertise for tasks. All employees will be able to drive their own self-learning with a closed-loop environment. And virtual design teams will collaborate using both virtual and augmented reality, driving higher levels of engagement.

According to recent BCG research, the biggest perceived technology challenge is not data security or the need to invest but a lack of qualified employees.21

Volkswagen Group Australia improved both customer experience and employee satisfaction at more than 100 dealerships across the country by implementing Experience Management solutions from SAP (Qualtrics). It was able to integrate customer experience data with employee satisfaction data to help management shape a unified strategy to deliver two wins with one platform. The company saw a reduction in employee churn and increased NPS scores (the highest ever) – some dealerships have improved their NPS by 20 points in less than 12 months.

Five Priorities for Success
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Candidates today can present themselves or are targeted through an unlimited number of sources and channels. Often, some of the best candidates are not even actively looking for job opportunities. Whether a “ready to switch” jobseeker or a targeted top prospect, today’s talent won’t tolerate a painful recruiting process. This new reality demands a focus on the candidate and thinking about new ways to attract and acquire the best talent. A holistic approach to the talent acquisition journey is needed – sourcing candidates across the globe, engaging and nurturing top candidates, and simplifying the hiring process with state-of-the-art tools. It also includes onboarding new hires before day one and connecting them to peers, content, and resources for better engagement, an improved employee experience, and faster time to productivity.

**TOP VALUE DRIVERS**
- Faster time to hire
- Lower cost to hire
- Faster time to contribution
KEY TECHNOLOGIES

The current pace of technological advancements has a profound impact on how automotive companies can transform themselves to respond to their customers’ needs and to market trends.

Intelligent technologies promise to bring great benefits such as productivity and efficiency gains, enabling innovative new business models and new revenue streams. The following intelligent technologies are instrumental in helping automotive companies respond to market trends.

**Artificial Intelligence and Machine Learning**

Machine learning enables algorithms to “learn” from existing data and achieve the best possible outcomes without being explicitly programmed. Once the algorithm is trained, it can then predict future outcomes based on new data. Automotive companies are using this technology not only in their autonomous cars but also in their business operations where they can use these capabilities to eliminate repetitive manual tasks such as service ticket classifications, routing, and responses; resume matching; and line-item matching for cash application.

**The Internet of Things and Industry 4.0**

Advances in ubiquitous connectivity and edge computing are driving a step change in cars as well as business productivity. This connectivity, coupled with artificial intelligence and machine learning, can analyze petabytes of data and effect real business outcomes. Connected cars as part of vehicle networks can access a marketplace for apps and services such as fueling at gas stations and reserving parking spots. Remote monitoring of cars provides real-time data used to predict maintenance needs or safety issues.

Manufacturers have been using the IoT during operations for some time. Now, the entire value chain can be connected – from design to production to supply chain – enabling faster, more flexible and efficient processes to produce higher-quality individualized vehicles at reduced costs. Data-driven insights of customer preferences and usage data can drive better design, lower material costs, reduce risk, and identify potential quality problems in manufacturing processes before they occur. This transformation will improve resource productivity and efficiency, drive agility and responsiveness, increase speed to market, and enable customization to meet customer needs. Additionally, assets can be jointly managed as digital twins by manufacturers, customers, and partners, thereby improving asset data and modeling.
Data Platform to Manage Experiences
Reducing the cycle time to sense, analyze, and respond is a big competitive differentiator. Leaders are interlocking the operational performance data from companies’ business systems (what is happening) with the experience data coming from customers and employees (why it is happening). The business outcome of such a system improves customer satisfaction and informs the next generation of products and services.

Advanced Analytics
The integration of advanced analytics capabilities, including situational awareness, into applications enables business users to analyze data on the fly and drives better decision-making both for the business and in the car. Thanks to embedded analytics, empowered users can get real-time visibility into their changing environment, see the use of fleets, simulate the impact of business decisions, mitigate risk, and achieve better customer outcomes.

Conversational AI
Advances in machine learning are enabling algorithms to become highly accurate in natural-language understanding and in image and speech recognition. Voice will be the go-to interface for the next generation of applications and in the car. Within the business, a digital assistant will allow for greater simplicity, mobility, and efficiency while increasing worker productivity and reducing the need for training – especially useful in after-service and call-center activities.

Blockchain
A relatively recent breakthrough technology, blockchain is revolutionizing the movement and storage of value by creating a chain of unaltered transactional data. The blockchain model of trust, through massively distributed digital consensus, could reshape supply chains and commerce across the entire digital economy, for example, digitalizing the bill-of-lading document as part of the international ocean shipping process.

Augmented Reality
Virtual reality, the use of digital technology to create immersive simulations, was once the stuff of science fiction. So was augmented reality, which lets users interact with digital content that’s overlaid on the real world. Already in use to help workers with difficult or infrequent maintenance activities, this will become even more critical to attract and retain millennials in the workforce.

Robotic Process Automation
Robotic process automation streamlines repetitive, rule-based processes and tasks in an enterprise. It can reduce costs through the use of software robots by replicating specific tasks or keystrokes.

Additive Manufacturing – 3D Printing
Both repair and aftermarket customization will be revolutionized through the availability of high-quality, manufacturing-on-demand processes. Not only will repair parts be created when and where they are needed, but there will be disruption across the aftermarket accessories segment. The barrier for entry will be lowered for new suppliers.

Key Technologies
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Companies will become intelligent enterprises on three distinct tracks as they evolve their strategic priorities to match their company’s vision. They will:

- **Optimize** what they already do by implementing a stable and scalable digital core to make processes more transparent and integrated.
- **Extend** their current processes by connecting them to the real world using IoT technologies.
- **Transform** their business using a constant stream of data, enabling new service-driven business models (see Figure 5).

**Figure 5: Strategic Priorities Across the Maturity Framework**

Optimize

- Unify the customer experience across all touch points.
- Monitor the data and condition of vehicles and assets remotely.
- Incorporate software-based features for connectivity and flexibility.
- Optimize supply chain transparency and enterprise connectivity.
- Automate hiring processes with machine learning.

Extend

- Provide additional convenience and flexibility beyond the vehicle.
- Offer new digital mobility services based on insights and data.
- Enhance traditional product design processes with stakeholder integration.
- Increase machine-to-machine connectivity and collaboration.
- Use intelligent knowledge capturing and machine learning-guided learning.

Transform

- Move from being sales-centric to being service-centric.
- Enable fully subscription-based sales and service interaction.
- Enable intelligent and consistent product innovation based on actual usage data.
- Enable a truly modular production process.
- Collaborate using both virtual and augmented reality.

Technology enables globally connected supply networks, efficient manufacturing, smart mobility, and customer experiences.

- Seamless omni-channel interactions
- Ecosystem that extends the customer experience and increases total value
- Interactions through car connectivity
- Services based on value and data
- Partnerships and collaboration that provide value
- Vehicle as a platform for services
- Vehicle as fully connected digital twin
- Self-awareness, intelligent data exchange
- Continuous closed-loop feedback
- Modular supply chain and manufacturing
- Direct connection to demand signals
- Automated shop floor: cobots, drones
- Rapid screening and onboarding
- Ongoing knowledge sharing and training
- Fluid workforce complemented by AI
How do you achieve these strategic priorities?

Start with reimagining your business together with your customers. Then build a path for even more optimization and intelligent automation to simplify your business and free up resources to invest in more digital transformation programs and find new business models and revenue streams.

According to a July 2018 study by Forrester Consulting that was commissioned by SAP, innovative companies focus on digital priorities to help them achieve digital transformation more than other manufacturing companies (see Figure 6).

**Figure 6: Innovators Focus More on Digital Priorities Than Others**

<table>
<thead>
<tr>
<th>Priority</th>
<th>Innovators</th>
<th>Others</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart factories</td>
<td>97%</td>
<td>63%</td>
<td>34%</td>
</tr>
<tr>
<td>New business models and networks</td>
<td>97%</td>
<td>76%</td>
<td>21%</td>
</tr>
<tr>
<td>Digital supply networks</td>
<td>96%</td>
<td>70%</td>
<td>26%</td>
</tr>
<tr>
<td>Connected products</td>
<td>95%</td>
<td>67%</td>
<td>28%</td>
</tr>
<tr>
<td>Customer experience</td>
<td>92%</td>
<td>70%</td>
<td>22%</td>
</tr>
</tbody>
</table>
Most organizations understand what is happening in their business but may not always know why. They know what’s happening because they have systems that capture operational data (O-data) – about their customer transactions, supply chain, manufacturing, spending, and the activities of their workforce. They can see that data through reports and dashboards. They can see trends and predict what will happen next.

But to influence what happens next, companies need data about the interactions that people have with their products and their business. Experience data (X-data) captures beliefs, emotions, opinions, and perceptions – the “why” something is happening. And when companies know why something is happening, they can make an informed decision about the best way to respond.

Intelligent enterprises connect experiences with operations. They use both X-data and O-data to guide their business decisions. Intelligent enterprises collect insights from customers, employees, products, and brands at every touch point. They use powerful technologies to automate and integrate their data, processes, and applications, enabling them to sense risks, trends, and opportunities. And they act on this intelligence across every part of their business. (See Figure 7.)

Only SAP has the strategy, expertise, and solutions to deliver on this vision, enabling intelligent enterprises to turn insight into action.
HOW TO PLAN YOUR PATH TO THE INTELLIGENT ENTERPRISE

In the digital economy, intelligent technologies and integrated business processes are now driving digital transformation.

To do this effectively requires an end-to-end plan for becoming an intelligent enterprise. This includes creating an intelligent enterprise road map and implementation plan with proven best practices and deployment options that optimize for continuous innovation with a focus on intelligent outcomes.

The End-to-End Journey to Becoming an Intelligent Enterprise

Plan
well to manage expectations

Simplify and innovate
▪ Reimagined business models, business processes, and work
▪ SAP Intelligent Enterprise Framework methodology as a guide for digital transformation
▪ Value-based innovation road maps

Build and launch
with proven best practices

Standardize and innovate
▪ Model-company approach to accelerate adoption with model industry solutions
▪ Design thinking and rapid, tangible prototypes
▪ Co-engineered industry innovations delivered with agility

Run
all deployment models

Run with one global support
▪ One global, consistent experience
▪ End-to-end support – on premise, in the cloud, or with a hybrid approach

Optimize for continuous innovation

Optimize to realize value
Continuously captured and realized benefits of digital transformation

To move forward with speed and agility, it helps to focus on live digital data and combine solution know-how and industry-specific process expertise with data analytics so that the right digital reference architecture is defined and delivered. In that context, a model-company approach is aimed at simplifying and increasing the speed of the digital transformation journey. Model companies represent the ideal form of standardization for a specific line of business or industry. They are built on preconfigured SAP solutions based on best practices supported by SAP, along with the business content that encompasses our experience and expertise relevant for the industry. They provide a comprehensive baseline and come with the accelerators to jump-start digital transformation projects.
Our comprehensive ecosystem for the automotive industry offers:

- The Intelligent Enterprise as the overarching strategy to meet future requirements, providing:
  - SAP S/4HANA co-development programs for customers and partners
  - Industry co-innovation programs for industry-specific use cases
  - Delivery of enterprise-to-enterprise industry clouds
  - Thought leadership, evangelism, and enablement by industry through events, councils, and regular customer exchange
- Integration into a wide range of business services (OEMs, suppliers, key vendors, and more)
- Open architecture, with a choice of hardware and software specifically designed to meet requirements
- Complementary and innovative third-party solutions to provide leading-edge and state-of-the-art technology

In addition, SAP is a founding member of the Open Industry 4.0 Alliance, which aims to overcome proprietary isolated solutions with a common reference architecture to accelerate the implementation of Industry 4.0 solutions and services.

Our partner ecosystem includes, among others:
SAP supports automotive companies in becoming intelligent enterprises – providing integrated business applications that use intelligent technologies and can be extended on SAP Cloud Platform to deliver breakthrough business value.

10-Year Innovation Vision
SAP delivers fully intelligent business solutions and networks that span across company boundaries and promote purpose-driven businesses. These solutions will be the most empathic symbiosis between machine intelligence and human ingenuity.

- Self-running enterprise systems
- Self-organizing business ecosystems
- New markets and business models

Comprehensive Industry Coverage
SAP enables comprehensive coverage of the complete automotive value chain across the enterprise. With its clear industry road map, SAP is the partner of choice for the automotive industry.

- More than 7,100 automotive companies in 106 countries innovating with SAP solutions
- 15 of the 15 car manufacturers with the highest production in the world run SAP solutions
- Support for all lines of business on a single platform

Proven Services Offering
By bringing together world-class innovators, industry and emerging technology expertise, proven use cases, and design thinking, we help automotive companies develop innovations that deliver impact at scale.

- Proven methodologies to drive innovation, from reimagining customer experiences to enhancing operations
- Innovation that is fuelled through a managed innovation ecosystem from SAP
- Ability to build your own innovation capability and culture

Learn more
- SAP.com for Automotive
- SAP Services and Support
Outlined below is external research that was used as supporting material for this paper.


Note: All sources cited as “SAP” or “SAP Performance Benchmarking” are based on our research with customers through our benchmarking program and other direct interactions with customers.