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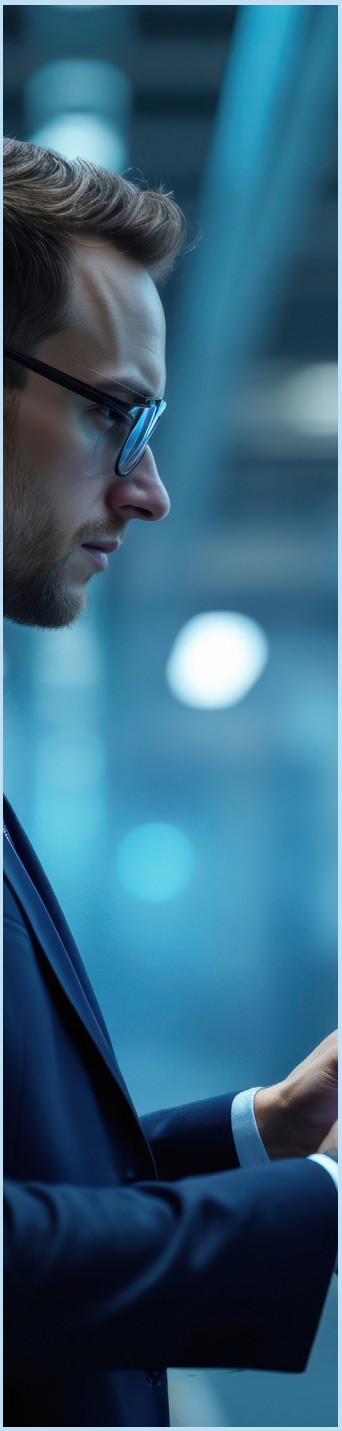

HOW AI TRANSFORMS SERVICE PARTS MANAGEMENT IN MANUFACTURING

Abstract

AI-led service parts management is no longer an operational upgrade—it is a strategic lever for profitability, resilience, and servitization in manufacturing. By embedding AI across forecasting, inventory, and service operations, manufacturers can reduce downtime, optimize working capital, and unlock higher-margin, outcome-based service models.

Service parts management is a strategic function in manufacturing enterprises that operate complex product lines and extensive service networks. An AI-enabled digital ecosystem augments inventory management, forecasting, demand planning, and service operations. We propose a technology-based capability mapping approach to boost the effectiveness and efficiency of service parts management.

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Service parts management in manufacturing enterprises

Service parts management is a critical function in industrial production. Efficient distribution and inventory management of service parts and components is imperative for seamless maintenance and repair in plant and service operations. A strategic approach to service parts management ensures that the right parts are readily available at the right time and location. This boosts profitability, reduces equipment downtime, rationalizes repair costs, minimizes unplanned procurement, and mitigates safety risks.

The global service parts market is valued at US$ 46073.41 million, growing at a CAGR of 3.52%[i]. Further, the global remanufactured automotive parts market is poised to record a CAGR of 3.93% between 2022-27[ii]. The cradle-to-cradle principle of the circular economy and stringent standards for carbon emission control mandate efficient operations. This demands that service parts be restored and reused promptly after malfunction due to wear and tear, damage or corrosion. It is estimated that the cost of remanufactured automotive parts is 20-50% less than new parts[iii]. Across 30 industries, aftermarket services deliver an average EBIT margin of ~25%, compared with ~10% for new equipment, according to a McKinsey report[iv].

Challenges in service parts management

Manufacturers generate 40-50% profits from aftermarket services[v] Service parts management is a cornerstone of efficient after-sales operations. However, predicting inventory position across the network is a challenge for almost 72% of supply chain leaders[vi]. The proliferation of SKUs and unpredictable demand patterns are among the primary operational challenges (Figure 1). Moreover, the complexity of global supply chains hampers effective service parts management (Figure 2). The issue is compounded by a dynamic business landscape and data fragmentation.

Figure 1: Operational challenges

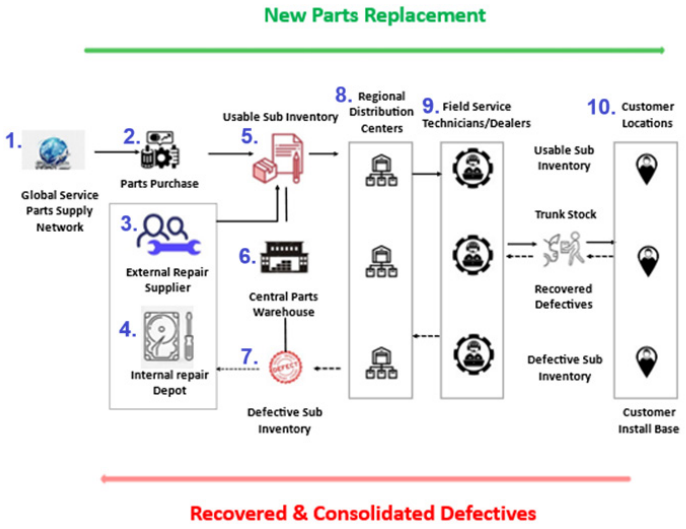
High SKU count
A majority of manufacturers manage 50,000–100,000 SKUs.

Competitor analysis
60–80% of OEM parts are nonmonopolistic and each OEM part typically has 2-50 service parts.

Pricing
A majority of enterprises use simple pricing algorithms for cost-plus pricing of strategic service parts.

Market size estimation
A majority of enterprises use simple pricing algorithms for cost-plus pricing of strategic service parts.

Figure 2: Global service parts supply network



Industrial manufacturing units bleed ~US$ 50 billion annually due to unplanned downtime, 42% of which is caused by equipment failure.[vii] Notably, in 2022, the automotive industry incurred a loss of US$ 2 million per hour due to downtime.[viii]

Digital transformation of service parts management

Conventional methods for service parts management adopt a 'fail and fix' approach. It is characterized by manual forecasting processes, siloed data, and cost-intensive methods to manage physical inventory. A strategic, data-driven approach empowers enterprises to pivot to a 'predict and prevent' system. It can be achieved by implementing a bouquet of digital technologies (Figure 3).

Figure 3: Digital solutions

Cloud First Approach	Seamless integration of structured and unstructured data ensures better visibility into the extended service parts supply chain. Further, a scalable infrastructure supports synchronized contingency planning.
Internet of Things (IoT)	IoT sensors create a digital thread that enables predictive maintenance of equipment. The ability to replace parts before it fails reduces production downtime and related costs.
AI and predictive analytics	AI improves forecasting accuracy. Data-driven predictions and real-time insights from diverse data streams enable smart decision-making.
Blockchain	Smart contracts enable automated tracking and tracing of service parts. Blockchain combines decentralized information sharing with immutable accessibility.
Digital inventories & 3D printing	3D printing creates a 'digital inventory', where a part exists as a file, not a physical object. Service parts can be printed on-demand, onsite, thereby minimizing lead times as well as warehousing costs.

Deep learning and convolutional / recurrent neural networks boost demand forecasting, time series analysis, and data mining. Deep convolutional neural networks are useful for estimating the lifespan of service parts and hybrid maintenance approaches for asset management. Moreover, ML-powered entity resolution platforms and cloud solutions integrate structured and unstructured data to provide a comprehensive view of a global service parts supply chain network. Further, digital twins simulate parts degradation and test scenarios to improve performance.

Digital platforms enable manufacturing enterprises to improve efficiency and streamline end-to-end processes. In addition, it helps track key performance indicators (KPIs) (Figure 4).

Figure 4: KPIs for service parts management

Asset uptime	Part fill rate	First-time fix rate	Profit margin
Although the demand for 90% service parts is intermittent, timely availability can improve capital assets utilization by at least 2-5%.	A fill rate of 95-99% often increases customer retention rate.	The ability to complete a field job on the first visit improves technician productivity and the customer experience.	A profit margin of 10-20% for each part sale is ideal.

Digital strategies enable industrial manufacturers, including automotive OEMs, to achieve business outcomes. For instance, high SKU counts can be efficiently managed with advanced inventory systems, robust demand forecasting, and data analytics. Competitors can be identified via an analysis of service part offerings, pricing strategies, and market share. Similarly, analysis of the 'installed base information' can lead to significant cost savings and stock reduction. Further, cost-plus methods can be replaced with dynamic, value-based pricing strategies to grow revenue.

Advanced solutions simplify day-to-day operations. Figure 5 articulates how digital solutions address specific challenges for two 'illustrative' user personas.

Figure 5: Role-based solutions (Illustrations)

Persona 1 – Inventory manager
Name: Jonathan Patterson
Age: 33
Experience: 6 years
Location: New York City

PERSONA TAKEAWAY

AI-enabled inventory intelligence enables inventory managers to shift from reactive stock balancing to proactive capital optimization—reducing excess and obsolete inventory while ensuring high service levels across an increasingly complex, multi-SKU service network.

CHALLENGES:

- Boosting legacy processes with new technology
- Streamlining operations in a digitized ecosystem
- Accurate forecasting of parts, and aligning maintenance and order schedules
- Reducing inventory costs across channels

SOLUTIONS:

- Implement a digital inventory management system that integrates end-to-end processes and provides centralized visibility and control.
- Utilize AI-powered analytics to analyze historical data, market trends, and other relevant factors for accurate demand forecasting.
- Leverage real-time tracking solutions to enhance visibility into inventory across locations and mitigate the risk of over- and under-stocking.
- Undertake cost-benefit analyses to evaluate the impact of inventory management strategies for maximizing efficiency and profits.
- Collaborate with O&M teams via a centralized platform to communicate parts availability, lead times, and procurement updates.

Persona 2 – Operations and maintenance manager
Name: Mariana Napolitani
Age: 40
Experience: 17 years
Location: Melbourne

PERSONA TAKEAWAY

Predictive, AI-driven service parts availability empowers operations and maintenance leaders to maximize asset uptime, improve first-time fix rates, and move from break-fix firefighting to planned, outcome-driven maintenance execution.

CHALLENGES:

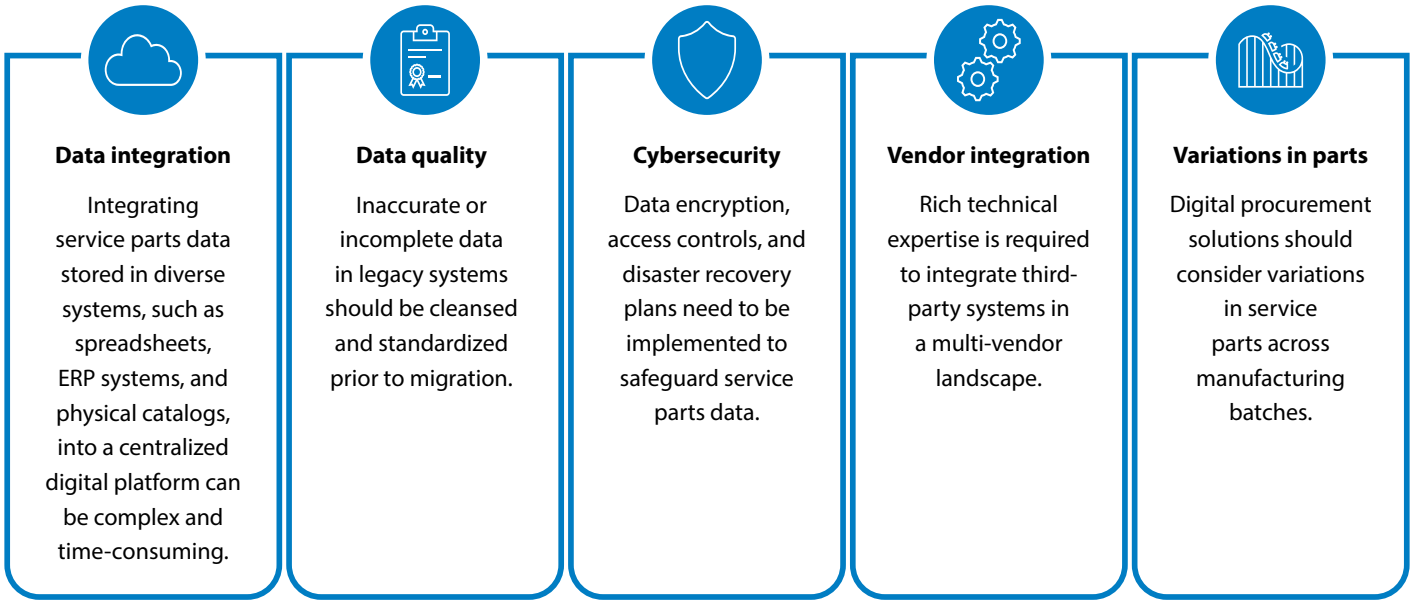
- Ensuring data availability in a disconnected environment
- Keeping maintenance and parts data up to date
- Identifying tasks that reduce productivity
- Lack of standardized data classification
- Maximizing parts availability to avoid service downtime

SOLUTIONS:

- Consolidate maintenance and parts data management systems to ensure a single 'source of truth.'
- Adopt a mobile-enabled maintenance management system to share real-time information on parts availability, schedules and procedures with maintenance teams.
- Track performance of maintenance processes, identify bottlenecks, and refine strategies for optimization and improvement.
- Benchmark procedures against industry best practices to improve first-time fix rates and asset uptime.
- Implement predictive maintenance strategies to prevent equipment failure, and align maintenance schedules with parts availability.

Smart service inventory planning reduces obsolete stock by 5-20%[ix], while ML-based automated service parts planning reduces workload of planners by 50-90%[x]. However, IT teams need to address operational challenges to ensure successful implementation of digital solutions (Figure 6).

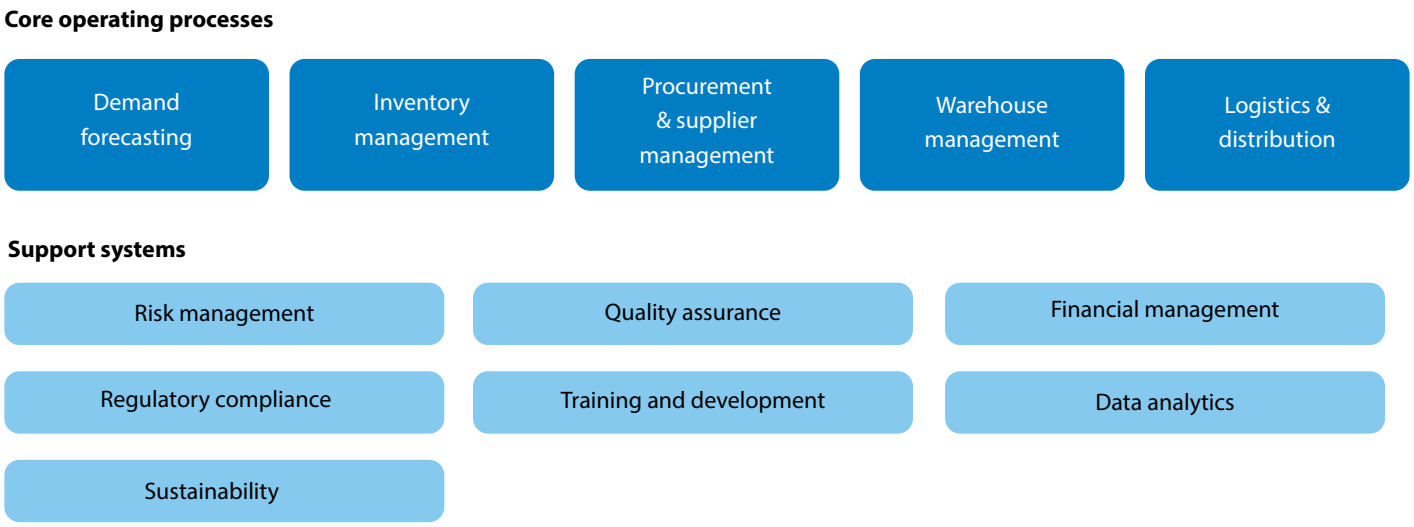
Figure 6: Challenges in implementation



Value chain analysis

Manufacturing enterprises need to pivot from conceptual, logical value chain models to to Business Process Model and Notation (BPMN)–based process models models supported by value chain analysis to maximize the value of digital transformation in service parts management. Infosys proposes a process classification framework for service parts management (Figure 7).

Figure 7: Process classification framework



Process classification allows enterprises to benchmark and optimize processes vis-à-vis industry best practices. Notably, it helps develop outcome and relationship-based business models to drive service excellence, cost optimization, and new revenue streams.

Capability mapping

Capability mapping enables a SWOT analysis, which helps align the IT strategy with business goals. Figure 8 is an illustration of a typical business architecture for capability mapping at a manufacturing enterprise. Figure 9 dives into capability mapping of parts management.

Figure 8: Business architecture

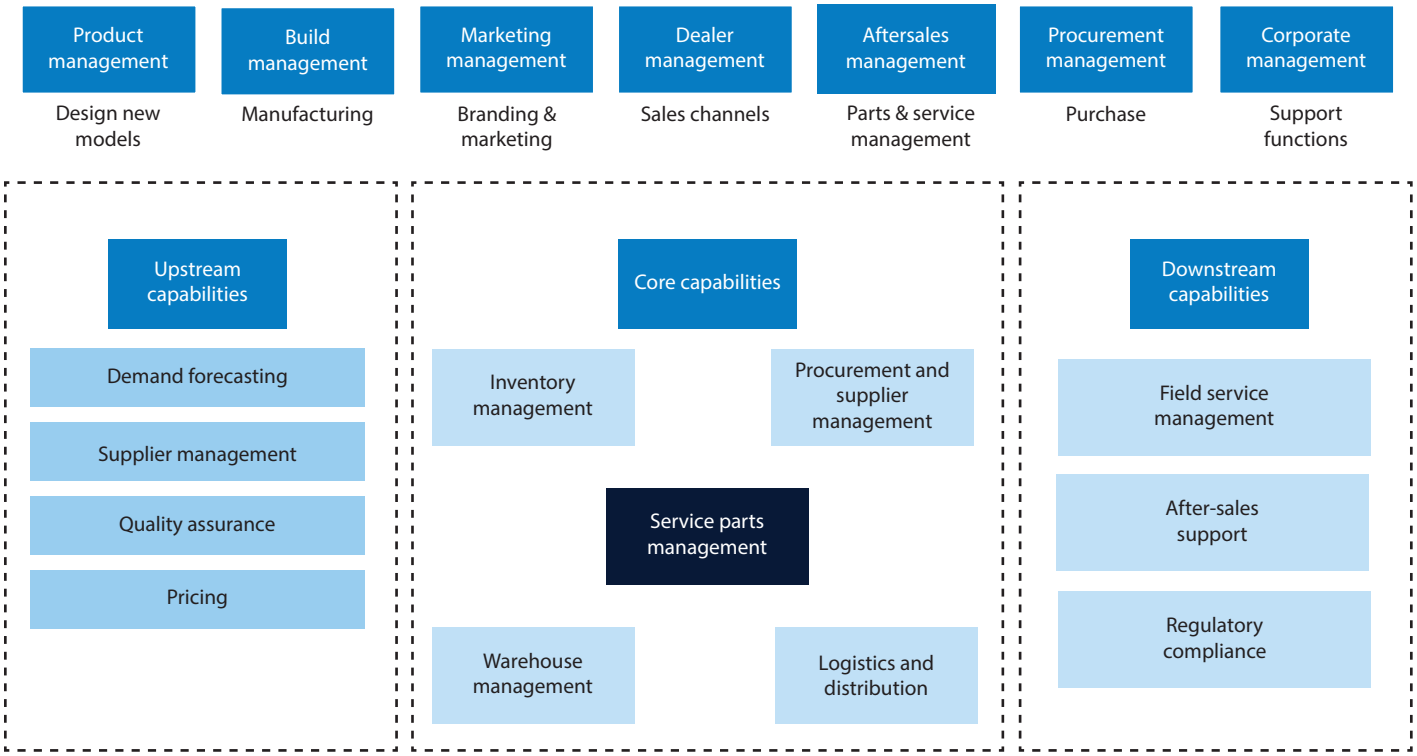
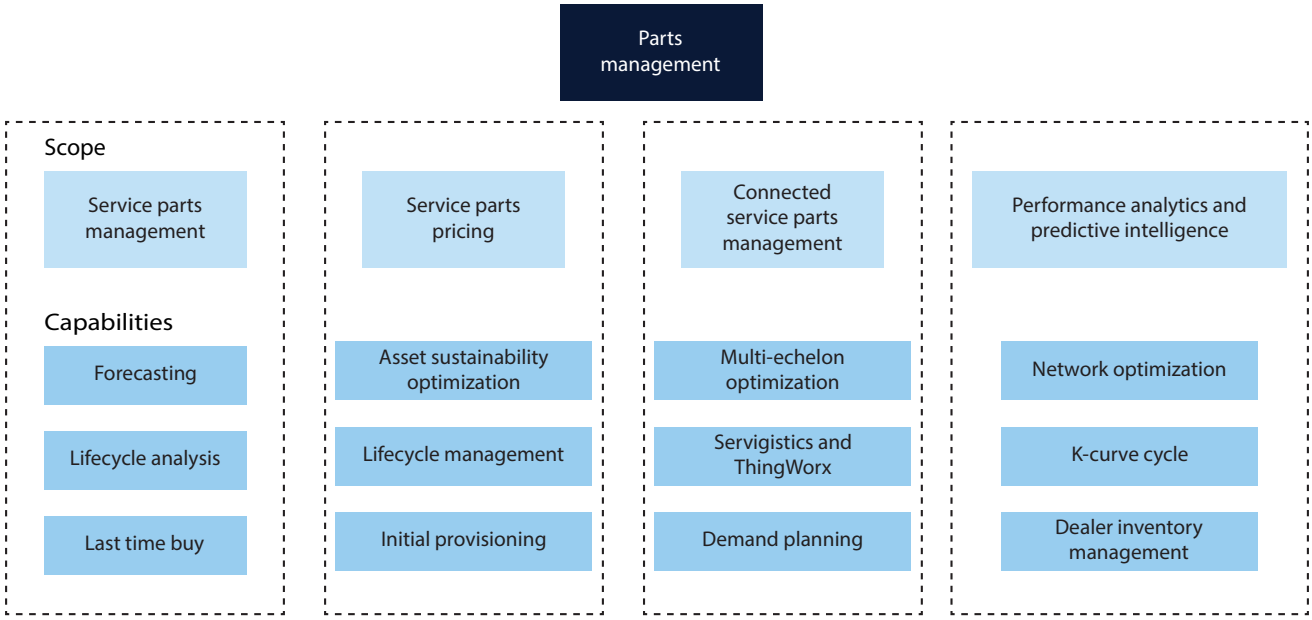
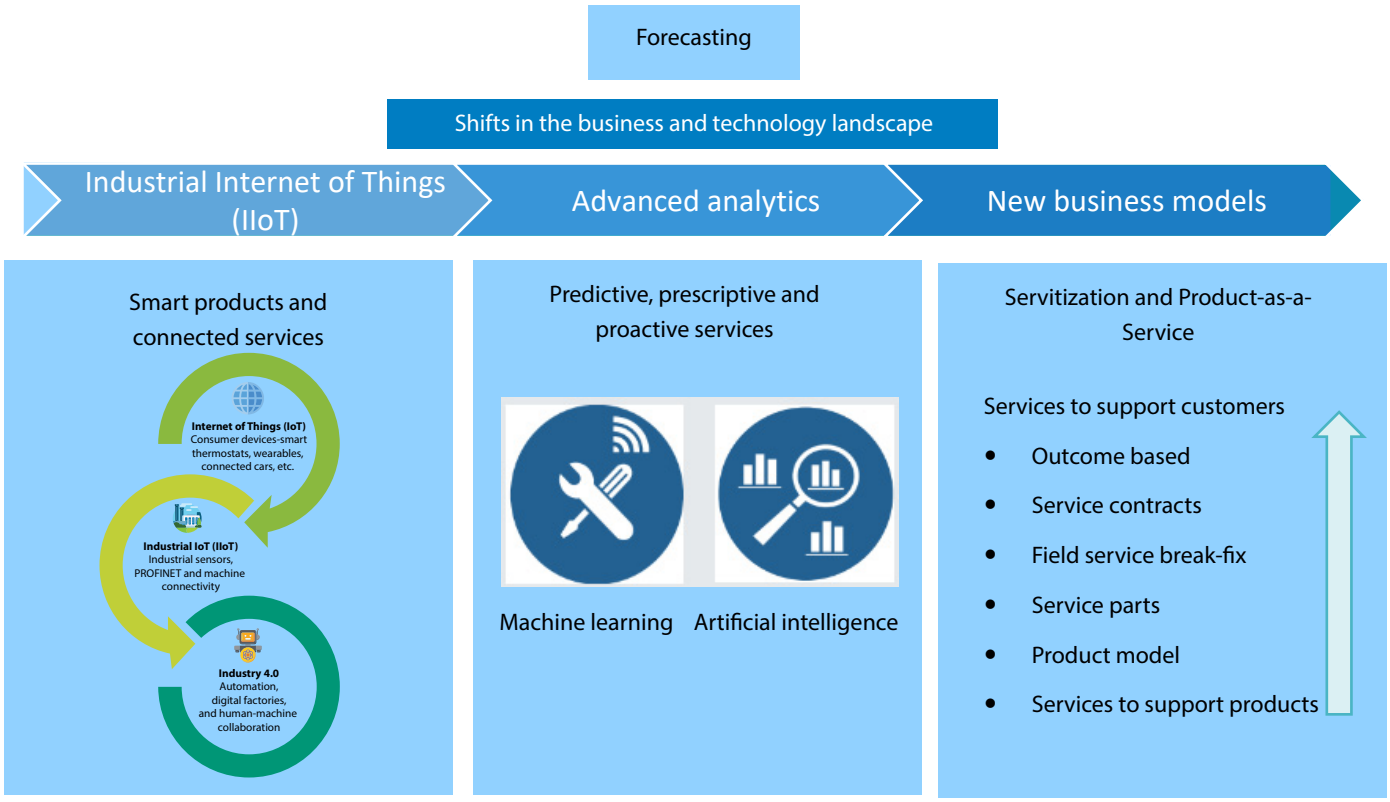


Figure 9: Parts management



The integration of IIoT, AI and ML improves the performance of forecasting tools (Figure 10). The ability to anticipate trends and detect anomalies enhances forecasting precision and responsiveness. In fact, AI-powered tools reduce forecasting errors by up to 50% and minimize lost sales due to inventory stockouts by up to 65%[xi]. Further, predictive services and operational synergy boost efficiency and support new business models.

Figure 10: Smart forecasting



Manufacturers can embed AI into demand planning to reduce downtime and streamline inventory across connected service parts networks (Figure 11). AI-driven demand planning enhances accuracy in fulfilling service parts requirements and enables proactive inventory management. Notably, it drives cost efficiency, improves first-time fix rates, and minimizes service disruptions in distributed service ecosystems.

Figure 11: AI-powered demand planning

Demand planning

Smart transformation of service parts management	
Workflow automation and data consolidation	Robotic process automation (RPA): Automates repetitive tasks and consolidates data from various sources. Data integration: Tools such as Apache NiFi and Qlik Talend enable seamless data consolidation.
Automated ordering	Predictive analytics: Uses historical data to forecast demand. Inventory management: Solutions such as SAP Integrated Business Planning (IBP) and Oracle Demantra automate workflows.
Supplier predictability	Predictive modeling: Techniques such as regression analysis predict supplier lead times. Supply chain analytics: Tools such as LLamasoft (now part of Coupa) and Kinaxis provide real-time supply chain visibility.
Products with historical sales data	Time series analysis: Autoregressive Integrated Moving Average (ARIMA) and other methods facilitate demand forecasting. Demand planning: Blue Yonder (formerly JDA Software), Anaplan and other AI-powered software support integrated planning.
Inventory optimization	Machine learning: Techniques such as Random Forest and Gradient Boosting enable accurate demand prediction. AI algorithms: Tools such as E2open and ToolsGroup optimize inventory.

Use case in service parts management

Business challenge: Fragmented dealer systems, manual workflows, poor ETA predictability, and high service inventory costs across markets

Solution: AI-ready dealer parts management platform integrating forecasting, automated replenishment, and real-time visibility

Business impact: ~25% operational efficiency improvement, ~13% reduction in inventory holding cost, and ~20% reduction in lost sales

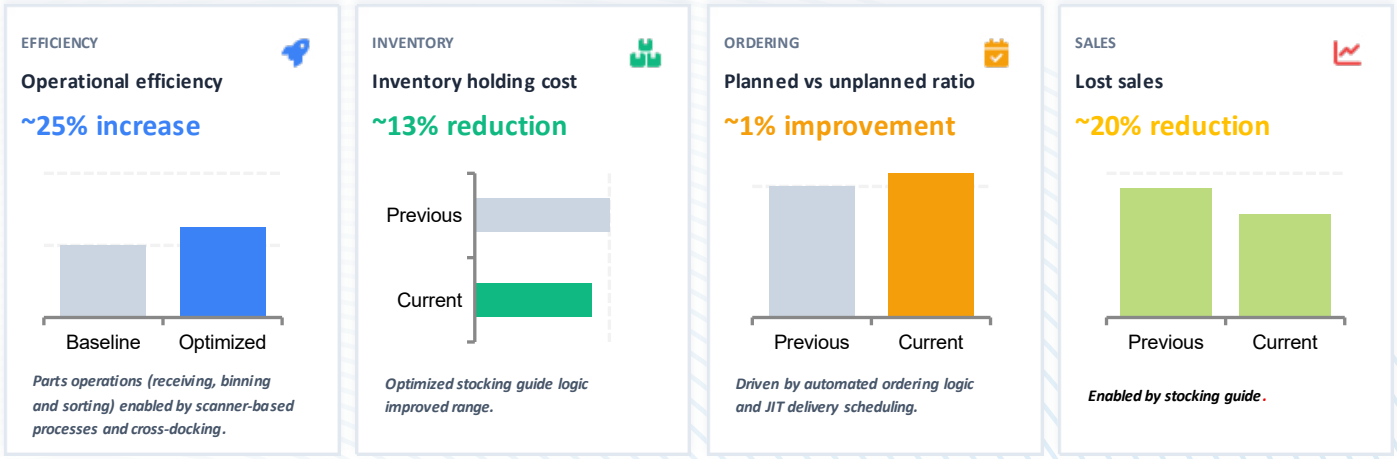
An automotive OEM faced operational bottlenecks in parts management across dealers and markets due to fragmented systems, manual workflows, and the lack of real-time visibility. Non-standardized processes led to incorrect ETA predictions, frequent urgent orders, and high inventory costs. In addition, the absence of forecasting tools and integrated workflows resulted in reactive decision making and sub-par customer experience. The OEM sought a unified, automated, and data-driven solution to streamline operations and enhance service delivery.

Infosys simplifies operations

Infosys implemented a Dealer Parts Management Module (DPMM), an integrated digital platform to transform dealer operations spanning the parts lifecycle – from appointment booking to returns and claims management. The DPMM solution integrated Dealer Management Systems, OEM platforms and master data, enabling real-time ETA visibility, ETA alerts, and appointment-linked ordering. Infosys automated daily stock replenishment, implemented dynamic stocking guides, and created intuitive interfaces for parts managers and service advisors. We standardized processes across thousands of dealers and leveraged a system-driven approach to facilitate proactive planning.

Intelligent automation, seamless integration, and data-driven processes streamlined service operations and parts management. Further, the DPMM solution enabled end-to-end traceability as well as real-time visibility and control of parts availability. It empowered dealers to deliver faster, smarter and richer service experiences to customers, while ensuring cost effectiveness. Significantly, the DPMM solution enabled operational excellence at the automotive OEM (Figure 12).

Figure 12: Business outcomes



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