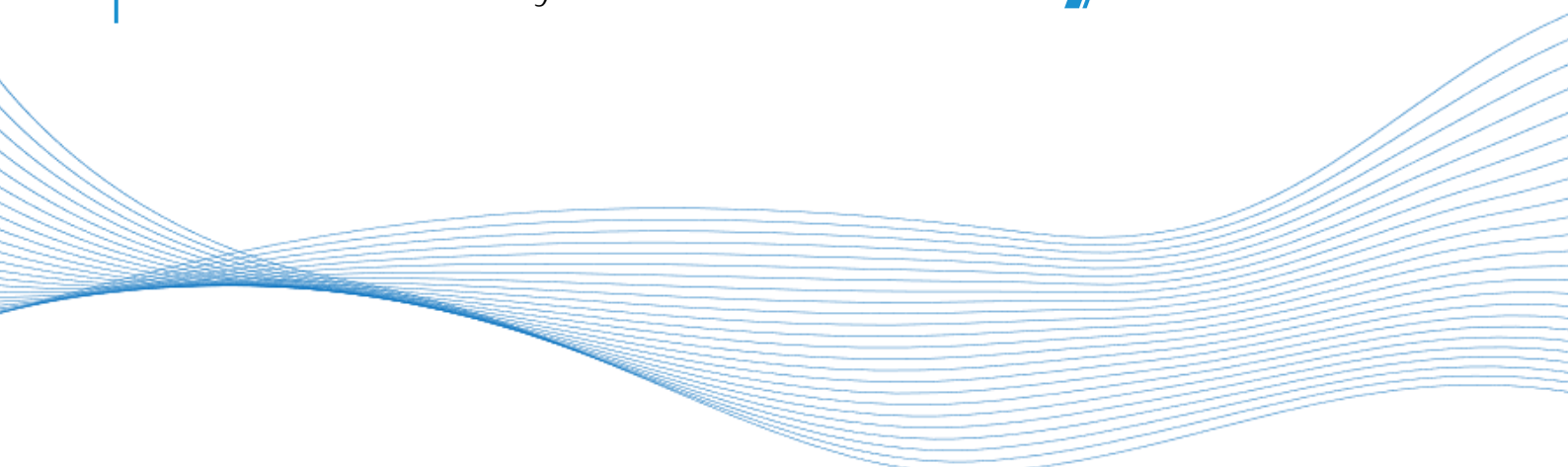




Manufacturing AI Trends Radar 2025

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The Role of AI Technologies in Transforming the Manufacturing Ecosystem



Rajesh Sundaram
Executive Vice President,
Chief Business Officer-Manufacturing

Manufacturing is undergoing a profound transformation where AI no longer just supports decisions but actively drives them. At the forefront of this shift is Agentic AI and Generative AI, reshaping how factories operate, learn, and evolve.

Agentic AI systems bring autonomy to the shop floor. They go beyond traditional automation, capable of making real-time decisions, learning from feedback, and optimizing complex workflows without human direction. Meanwhile, Generative AI introduces creative intelligence into the ecosystem—redefining how we approach design, documentation, and decision-making. From automating technical manuals to streamlining engineering rework, it frees up time and resources for innovation.

Together these technologies are embedding intelligence in every layer of the value chain, from design to delivery, powering smarter, faster, and more responsive manufacturing.

Key shifts already underway include:

- Self-optimizing workflows: Equipment adjusts in real-time using embedded agentic logic.
- Intelligent material handling: Autonomous vehicles interact with inventory systems to move and allocate materials independently.
- Generative design for additive manufacturing: AI-generated 3D models optimize for material use, strength, and efficiency.
- AI-led process planning: Gen AI tools recommend manufacturing process sequences, machine settings based on part components, and toolpaths.
- Synthetic data generation: Simulated datasets enable better AI training for predictive maintenance and defect detection.
- Conversational AI assistants: Copilots on the shop floor offer real-time guidance, flag anomalies, and suggest improvements.

What comes next is even more ambitious: integrated, autonomous ecosystems where Agentic AI collaborates across systems, and Generative AI accelerates everything from R&D to execution. As these models mature, explainability will be paramount, ensuring that AI decisions remain transparent, auditable, and trusted.

Those who embrace this transition won't just modernize, they will lead. They will unlock new levels of agility, resilience, and sustainable growth that define the future of manufacturing.

Manufacturing Reimagined: The Shift from Mechanization to Intelligence



Naushad Khambhawala
Vice President,
Delivery Head-Manufacturing

For decades, manufacturing excelled through scale, precision, and process excellence. Operational models were mechanized, linear, and labor-centric—built to deliver predictability and control. Yet, the manufacturing world of tomorrow demands more than just efficiency; it demands agility, insight, and adaptability.

The shift isn't incremental, it's transformational. More than a tool for automation, AI is becoming the heartbeat of innovation across the manufacturing value chain. From minimizing unplanned downtime to maximizing resource utilization, from enhancing product accuracy to accelerating sustainability goals, AI is rewriting the rules.

Consider the evolution beyond traditional automation: AI-driven robotics now orchestrate assembly lines with precision and speed previously unimaginable. Manufacturing processes are being customized down to the individual product specification. Real-time decision-making is empowering operations to move faster, smarter, and leaner. These advancements culminate in the rise of 'dark factories'—fully autonomous facilities delivering relentless efficiency around the clock.

This is not a vision of some distant future. It's happening now—across continents, across sectors led by bold, forward-thinking organizations. Witnessing this transformation is exhilarating. AI forces us to rethink everything: shifting from reactive fixes to proactive foresight, from one-size-fits-all to tailored solutions, and from isolated silos to connected, data-driven ecosystems.

To succeed in this AI frontier, we need more than enthusiasm. We need foresight that is as sharp as the technology itself, a clear understanding of emerging trends, and a roadmap that turns potential into reality. This report distills the most critical AI trends reshaping manufacturing in 2025 and beyond. It's the result of close collaboration with industry leaders, reflecting both the challenges and the pragmatic pathways they are forging.

Early in my career, I watched a master craftsman perfect a complex machine component by feel, intuition, and years of experience. It was an art that took decades to develop. Today, AI technologies are the new craftsmen, learning from vast data, sensing nuances invisible to the human eye, and delivering precision at unprecedented speed. Just as the craftsman's hands shaped the future then, AI is shaping the future now. The question isn't if AI will redefine manufacturing—it's how quickly and boldly we will embrace this transformation.

Research Methodology



Indranil Mitra
Vice President,
LTIMindtree Research

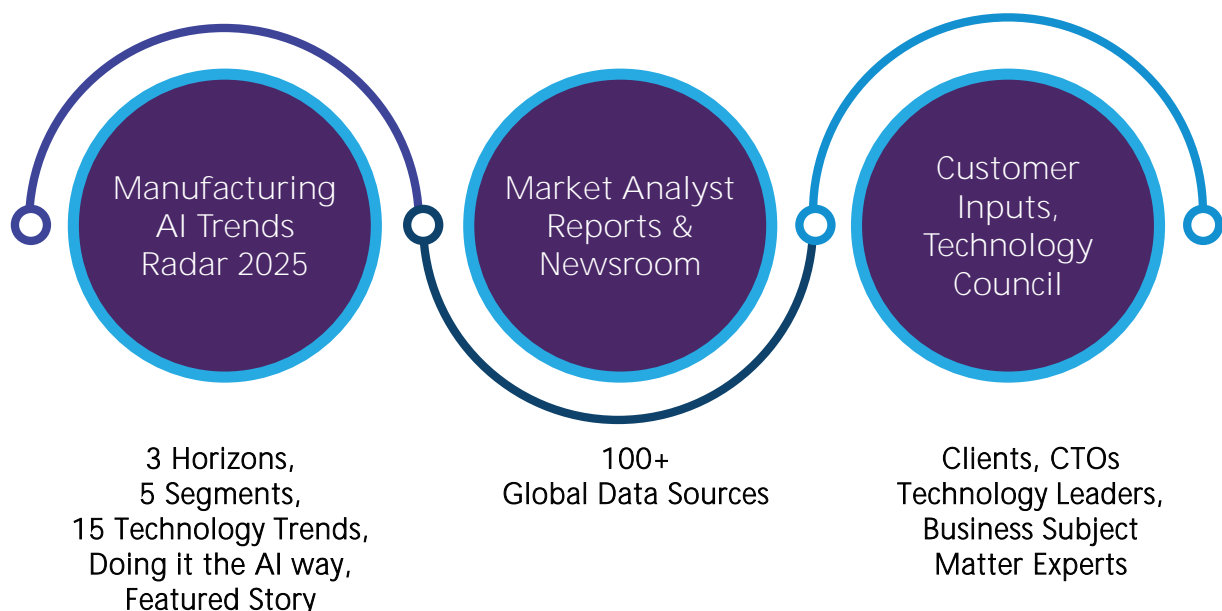
The creation of the Manufacturing AI Trends Radar 2025 powered by LTIMindtree Crystal was not a solitary effort. It was a deliberate, multi-layered exploration, steered by deep industry understanding and anchored in methodical rigor.

We began with a wide-ranging exploration of the current AI ecosystem in manufacturing. This involved drawing insights from primary survey data, one-on-one discussions with LTIMindtree business leaders and functional heads, and the deep expertise of our in-house research teams. This deliberate blend of perspectives allowed us to shape a well-rounded view of the technologies best aligned with evolving business needs.

To move from insights to actionability, we employed a structured statistical framework that assessed each AI trend across key dimensions such as market potential, current adoption maturity, and likely trajectory. This helped us surface trends that hold not just promise, but strategic relevance for real-world transformation.

Throughout this process, we actively collaborated with LTIMindtree's leadership to validate and refine our findings. Their inputs grounded emerging trends in practical realities, adding depth and credibility to our analysis.

The radar is built as a strategic tool. It helps manufacturers cut through complexity with clarity. It supports informed investment decisions. Most importantly, it spotlights the AI trends that hold the greatest potential for measurable business impact.



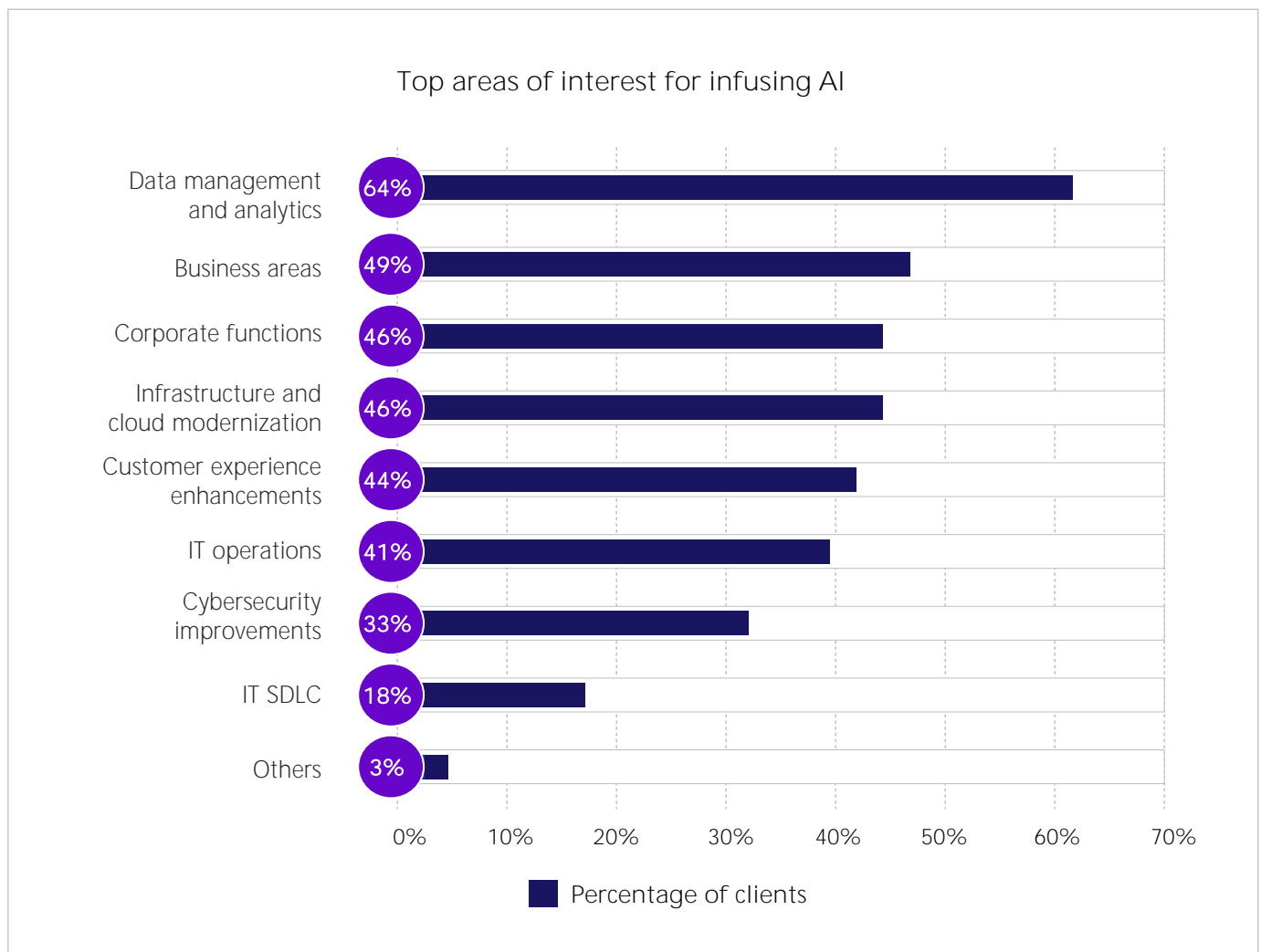
Understanding Manufacturers' Sentiments Towards AI

So, where are manufacturers placing their bets?

Leading the way is data management and analytics at 64%, a clear reflective of AI's growing role in extracting value from enterprise data. This is closely followed by AI application in core business areas (49%), infrastructure and cloud modernization (46%), and corporate functions (46%). Investments also span customer experience enhancement at 44%, operations at 41%, cybersecurity (33%), and even AI-driven software development life cycle (SDLC) improvements (18%).

The emphasis is unmistakable: manufacturers are building intelligence into the foundations-where data, decisions, and delivery intersect.

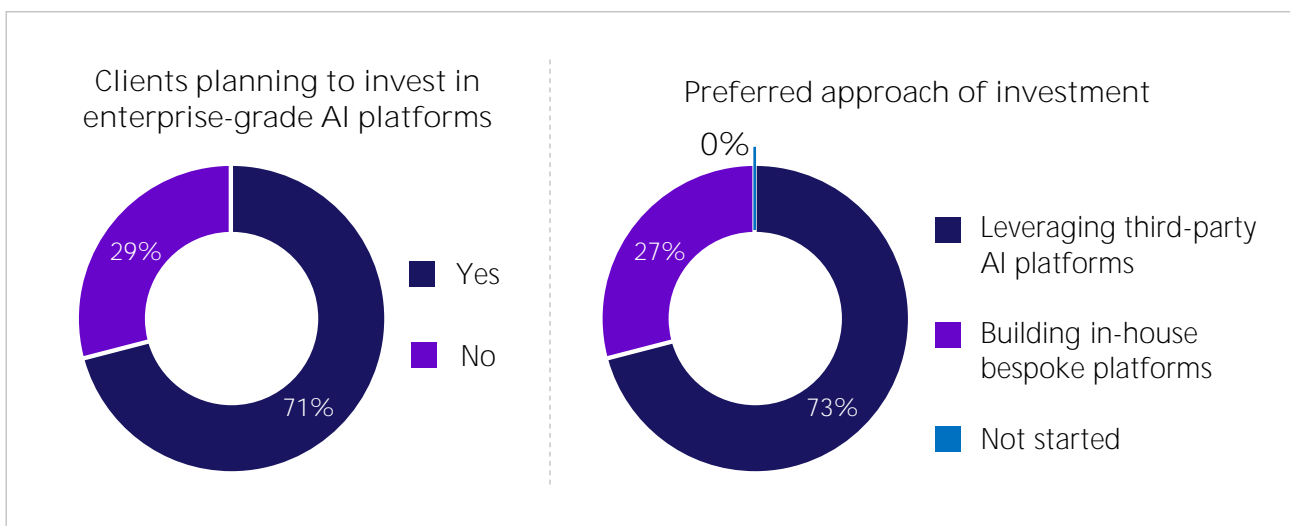
These segments represent areas where AI is expected to have the most significant impact on manufacturing, driving innovation and efficiency across functions.



Understanding Manufacturers' Sentiments Towards AI

As AI takes root across the manufacturing value chain, the conversation has moved decisively from if to how. Our survey captures this sentiment with clarity, where manufacturers are not just experimenting with AI; they are aligning it with their strategic priorities to drive real, measurable outcomes.

The data reveals a sector primed for transformation. A striking 71% of manufacturers plan to invest in enterprise-grade AI platforms, signaling a shift from passive interest to active implementation. Yet even with this momentum, the journey is complex, demanding clarity, confidence, and alignment across business functions.



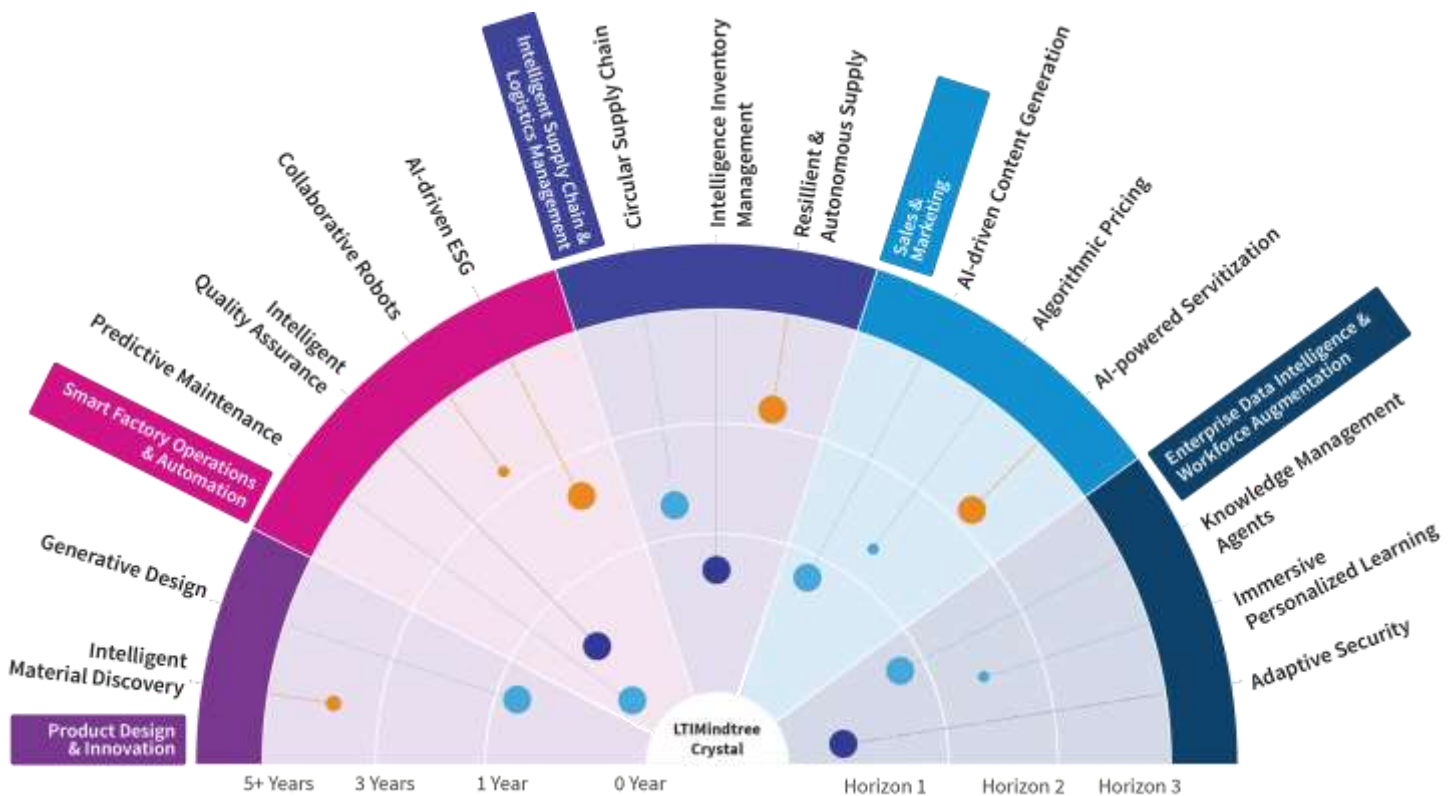
Diverse paths to implementation







Approaches to adoption vary. 73% of manufacturers favor third-party AI platforms, valuing speed, specialization, and scalability. Meanwhile, 27% are building in-house solutions, reflecting a drive for customization and strategic control.

This mix of intent and execution highlights the need for structured decision-making. Frameworks such as the Manufacturing AI Trends Radar help organizations navigate complexity, prioritize investments, and translate ambition into sustained advantage.

The direction is clear: manufacturers see AI as a powerful enabler of resilience, innovation, and future-readiness. And they are moving with purpose.

Manufacturing AI Trends Radar 2025



Horizon	Adoption Phase	Market Potential
Horizon 1 <i>(0 - 1 year)</i> Trend will be in the market within 0-1 year	 Emerging Trend is still under R&D	 Low
Horizon 2 <i>(1 - 3 years)</i> Trend will be in the marketplace within 1-3 years	 Improving Trend creates hype and promotes innovation	 Medium
Horizon 3 <i>(3 - 5+ years)</i> Trend will be in the marketplace after 3 - 5+ years	 Mature Trend is accepted by the masses	 High

Navigating the Radar

	Product Design & Innovation	Smart Factory Operations & Automation	Intelligent Supply Chain & Logistics Management	Sales & Marketing	Enterprise Data Intelligence & Workforce Augmentation
Horizon 1	<ul style="list-style-type: none"> • Generative Designs 	<ul style="list-style-type: none"> • Intelligent Quality Assurance • Predictive Maintenance 	<ul style="list-style-type: none"> • Intelligent Inventory Management 	<ul style="list-style-type: none"> • Ai-driven Content Generation 	<ul style="list-style-type: none"> • Knowledge Management Agents
Horizon 2		<ul style="list-style-type: none"> • Ai-driven ESG 	<ul style="list-style-type: none"> • Resilient And Autonomous Supply Networks 	<ul style="list-style-type: none"> • Algorithmic Pricing 	<ul style="list-style-type: none"> • Adaptive Security • Immersive Personalized Learning
Horizon 3	<ul style="list-style-type: none"> • Intelligent Material Discovery 	<ul style="list-style-type: none"> • Collaborative Robots 	<ul style="list-style-type: none"> • Circular Supply Chain 	<ul style="list-style-type: none"> • Ai-powered Servitization 	



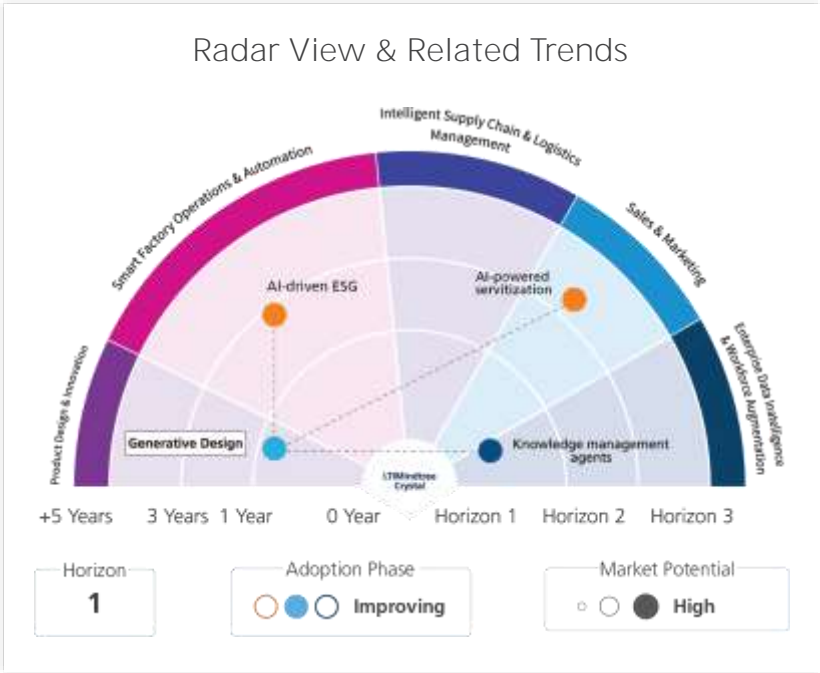
Product Design & Innovation

How AI embeds intelligence to achieve autonomous workflows, enhance quality, enable predictive upkeep, and support sustainable manufacturing






Generative Design

AI-driven algorithms now generate optimized product designs based on performance requirements, design constraints, and raw material availability. These tools foster innovation by exploring a wider design space, reducing material waste, and enhancing prototyping efficiency. When integrated with 3D modeling tools, they swiftly transform inputs into detailed outputs, accelerating the transition from concept to prototype and reducing time to market.



Doing it the AI way

 Stage	 Traditional Way	 AI Way
Input	Manual analysis of design constraints, experience-based assumptions, and material selection.	Inputs include goals, constraints, materials, and performance data fed into AI algorithms.
Processing	Designers create limited options based on expertise, often time-consuming and iterative.	AI generates numerous design iterations, evaluating each for performance and feasibility.
Output	Few optimized designs with limited innovation; high dependency on individual creativity.	Multiple optimized, innovative, and manufacturable design options based on AI evaluation.
Infrastructure / Tools	CAD tools, engineering drawings, manual simulation software like AutoCAD or SolidWorks.	AI-driven tools like Autodesk Generative Design, cloud computing, and topology optimization platforms.

Key takeaway

Generative design transforms product development by enabling engineers to explore thousands of high-performance, cost-efficient design variations rapidly. Its true value is realized through accurate input constraints and manufacturability checks. With ray tracing technology, designers can visualize photorealistic renders in real time, enabling instant feedback and faster iterations. This accelerates innovation while ensuring functional, production-ready outcomes.

Key application areas

1. Tool and fixture design: Generates optimized designs for faster, more accurate manufacturing processes.
2. Heat dissipation structures: Designs components with improved thermal performance for electronics and machinery.
3. Topology optimization: Maximizes strength and reduces waste by optimizing material layout within parts.
4. Chassis and frame design: Produces high-strength, low-weight structures for vehicles and machinery.

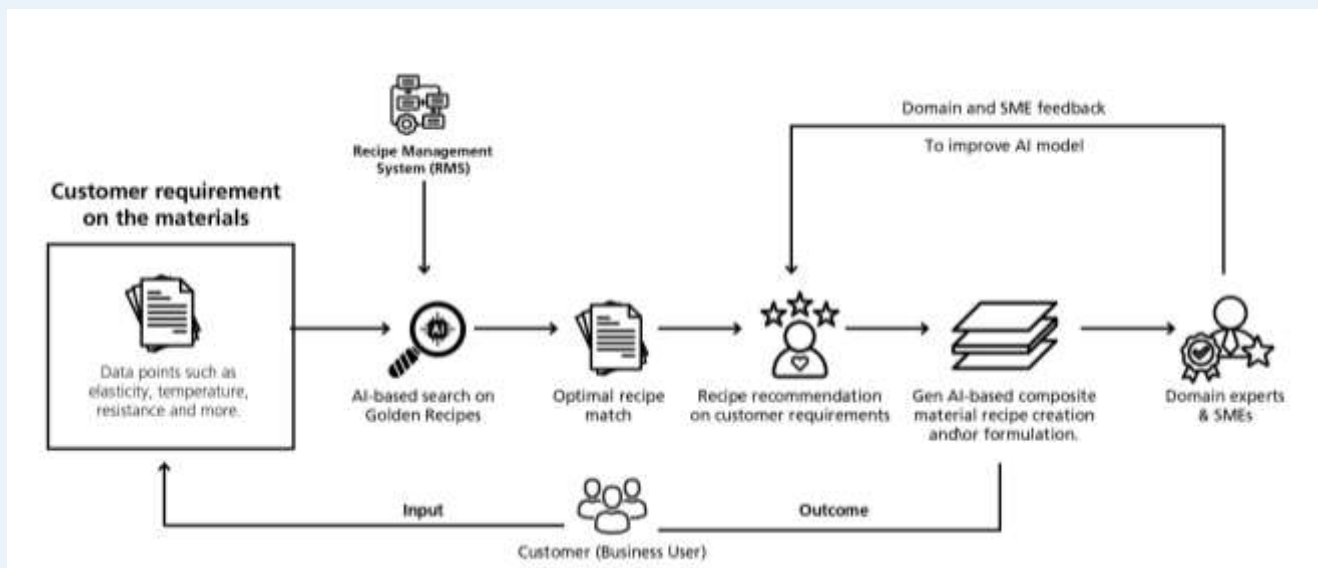
Featured story

A global manufacturer accelerates R&D with AI, managing 35K+ material recipes efficiently.

Business challenges

A leading manufacturing client partnered with LTIMindtree to overcome key challenges in material formulation. The client struggled to identify optimal recipes due to the complex interplay of material properties like temperature tolerance, elasticity, and resistance. These difficulties were compounded by the absence of centralized, validated recipes, reliance on manual experimentation, and inconsistent results driven by subjective decisions. As a result, R&D efforts lacked scalability and efficiency—slowing down innovation and increasing operational overhead.

LTIMindtree solution



Business benefits

35K+ recipes for product development: A recipe management system (RMS) includes a large library of pre-existing recipes.

Data points based on customer input: Recipes are recommended based on key parameters like temperature, elasticity, and other requirements.

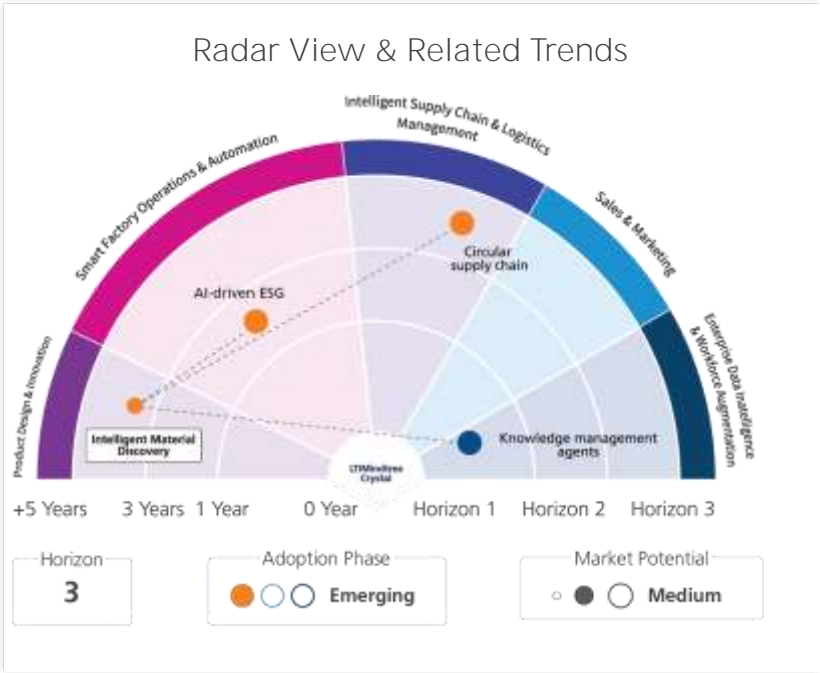
Central repository for golden recipes: A unified platform holds validated, scenario-based recipes for reference.

AI-based feedback for optimal selection: A recommendation engine suggests the most suitable recipe based on the customer's needs.




Intelligent Material Discovery

AI is reshaping how materials are discovered and engineered. Advanced models now predict a material’s properties based on its structure or composition—and vice versa. By leveraging data from sources such as molecular dynamics, density functional theory, and finite element analysis, AI helps researchers understand and anticipate how materials will behave under different conditions, even before physical synthesis or testing.

This approach shortens development cycles and enables the creation of materials with custom-tuned properties such as strength, conductivity, heat resistance, or flexibility, tailored precisely to meet specific manufacturing needs.



Doing it the AI way

 Stage	 Traditional Way	 AI Way
Input	Relies on trial-and-error, manual lab testing, and slow material database search.	Uses AI to analyze vast datasets and simulations to predict promising materials.
Processing	Time-consuming experiments and iterative testing cycles.	Rapid high-throughput simulations and machine learning for material-property predictions.
Output	Limited material options after long R&D cycles.	Identifies optimal materials quickly with enhanced performance and sustainability insights.
Infrastructure / Tools	Lab instruments, spreadsheets, and static databases.	Specialized AI/ML platforms and libraries, high-performance computing (quantum computing), and cloud labs.

Key takeaway

Intelligent material discovery is seen as a transformative force that accelerates innovation, reduces R&D costs, and promotes sustainable, high-performance product design. For AI to be truly effective in this domain, several factors must align such as model transparency, access to high-quality and diverse data, and adherence to scientific principles. Striking the right balance between speed and scientific accuracy is essential to realizing its full industrial potential.

Key application areas

1. Inverse materials design: Determines the optimal material composition and structure needed to achieve desired material properties.
2. Optimizing synthesis processes: Analyzes experimental data and simulations for producing new materials efficiently.
3. Discovery of sustainable materials: Identifies eco-friendly material alternatives with lower environmental impact.
4. Smart material integration: Discovers stimuli-responsive materials with self-healing, shape-memory, or embedded sensing capabilities, enabling more adaptive and intelligent products.

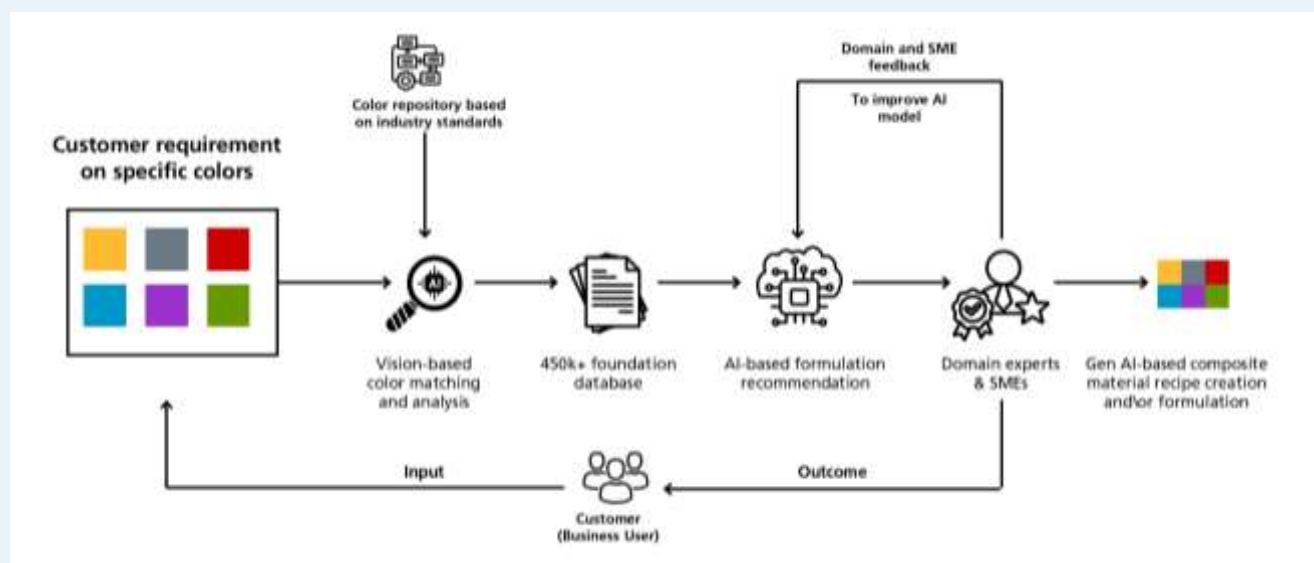
Featured story

A global manufacturer speeds color formulation with AI, enhancing sustainability and R&D efficiency.

Business challenges

A global manufacturing client partnered with LTIMindtree to address inefficiencies in its traditional color formulation processes. The existing approach was slow, resource-intensive, and largely dependent on trial and error. This led to long turnaround times, inconsistent results, and underuse of valuable historical data. The need to meet rising demand for sustainable materials and cater to growing customization across industries added further complexity. This made it difficult for the client to scale innovation efficiently.

LTIMindtree solution



Business benefits

Material property optimization: AI analyzes pigments, binders, and additives to suggest formulations that meet exact color specifications.

Dataset-driven learning: Models learn from past formulation data, color spaces (such as LAB or RGB), and spectral data to recommend optimal combinations.

Faster R&D: Predictive capabilities reduce reliance on trial and error, accelerating the formulation process and cutting development time.

Sustainable alternatives: AI can recommend eco-friendly pigments or substitutes based on sustainability goals.

Cross-industry applicability: Relevant for industries including textiles, automotive coatings, paints, food coloring, and personal care products.



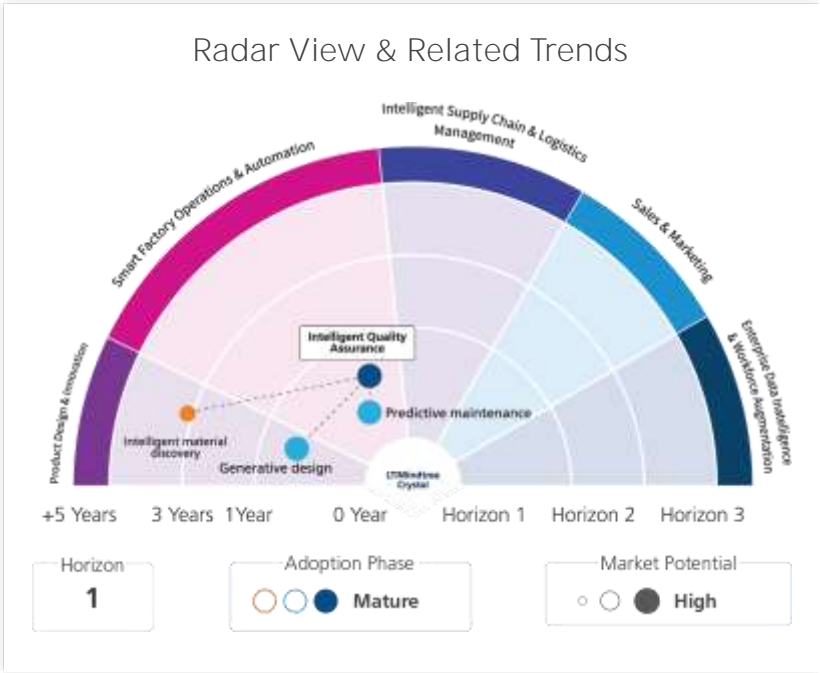
Smart Factory Operations & Automation

How AI embeds intelligence to achieve autonomous workflows, enhance quality, enable predictive upkeep, and support sustainable manufacturing






Intelligent Quality Assurance

Intelligent Quality Assurance (IQA) utilizes AI/ML, often in combination with advanced computer vision and sensor data, to automate and enhance quality control processes in smart factories. This approach improves defect detection accuracy and speed, predicts potential quality issues, and significantly reduces scrap, rework, and associated costs. By shifting from reactive checks to proactive, data-driven quality management, IQA helps manufacturers move closer to zero-defect production.



Doing it the AI way

 Stage	 Traditional Way	 AI Way
Input	Manual inspection, fixed Automated Optical Inspection (AOI) rules, batch images, limited sensor data.	Real-time, high-resolution sensor feeds (vision, IoT), integrated Manufacturing Execution System (MES) and Enterprise Resource Planning (ERP) streams, vast historical datasets.
Processing	Human subjective analysis, pre-programmed algorithms, isolated data processing.	Real-time anomaly detection and defect classification, automated root cause analysis based on data correlation.
Output	Pass/fail results, delayed reports, reactive adjustments, limited traceability.	Instant defect alerts, automated process adjustments, predictive failure warnings, auditable digital records.
Infrastructure / Tools	Manual tools, traditional AOI/X-ray machines, basic image processing software.	Advanced vision systems (event-based sensors), GPUs/Edge AI, cloud platforms, integrated Quality Management System (QMS) software.

Key takeaway

AI enables exceptional accuracy and efficiency in quality control. However, widespread adoption still faces several challenges. These including the critical need for large volumes of high-quality, labelled data, complex integration with legacy factory systems, and substantial upfront investment. Overcoming these barriers is essential for fully realizing the full potential of AI-driven, proactive quality management, and zero-defect manufacturing.

Key application areas

1. Automated defect detection: AI-powered computer vision identifies product flaws more accurately and quickly than human inspectors.
2. Predictive quality control: AI forecasts potential product or process issues before they occur.
3. Reduced waste and rework: AI helps minimize defective output, reducing the need for scrapping or reworking products.

Featured story

71% faster weld inspection for a global manufacturing leader using AI visual system.

Business challenges

A global advanced manufacturing leader, serving sectors like oil and gas, petrochemicals, and nuclear faced long, manual inspection cycles. Their inspection process was slow, inconsistent, and rigid. Further, they couldn't detect multiple defect types or adapt to changing job specs because they had no defect history or centralized insight to support quality tracking.

LTIMindtree solution

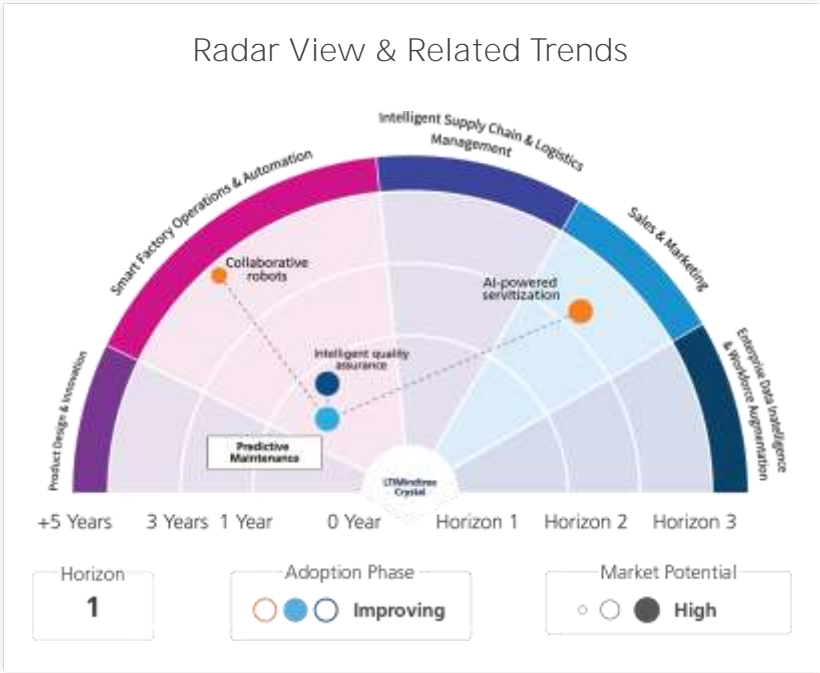
- Implemented an AI-based visual inspection system using technologies such as Line Laser, Realsense 435i Depth Camera, Raspberry Pi 4B Microcontroller, Capacitive 4.3-inch DSI Display, and C++.
- Developed a defect recognition model to detect multiple types of weld defects with high accuracy.
- Enabled customizable acceptance criteria depending on job specifications, allowing tailored inspections.
- Designed backend services to store inspection data and generate insights to support continuous improvement and decision-making.

Business benefits

- Achieved a 71% reduction in inspection cycle time, bringing it down from 14 hours to just 4 hours.
- Enabled high-speed scanning at 18 centimeters per minute, ensuring accurate and seamless quality checks.
- Delivered real-time insights and detailed reporting, enhancing decision-making and accelerating defect detection.
- Ensured traceability and compliance through digital inspection records, supporting regulatory adherence and quality tracking.

Predictive Maintenance

Predictive maintenance powered by AI enables the anticipation of equipment failures through machine learning and sensor data analysis, minimizing unplanned downtime and prolonging asset lifespan. By assessing vibration, temperature, and pressure indicators, AI models identify early signs of failure. Industry reports indicate a 30% reduction in maintenance costs and a 40% decrease in downtime. This shift from reactive schedules to data-driven interventions enhance equipment reliability and operational safety.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Manual logs, scheduled inspection reports.	Real-time sensor data from equipment (vibration, thermal, acoustic).
Processing	Rule-based thresholds and OEM maintenance guidelines.	ML-driven anomaly detection and failure prediction models.
Output	Scheduled servicing and reactive repair requests.	Predictive alerts, Remaining Useful Life (RUL) estimation, dynamic maintenance scheduling.
Infrastructure / Tools	Manual checklists, computerized maintenance management systems (CMMS).	AI engines, IoT platforms, edge analytics, digital twins.

Key takeaway

AI's role in predictive maintenance is redefining asset management in manufacturing. By moving from time-based to condition-based servicing, it reduces maintenance overheads, improves uptime, and increases equipment lifespan. It supports the industry's broader goals of zero unplanned downtime, cognitive automation, hyper-efficiency, and sustainability. As factories become more connected and intelligent, predictive maintenance will serve as a strategic lever for operational resilience.

Key application areas

1. Remaining Useful Life (RUL) estimation: Machine learning algorithms analyze multi-sensor data to predict RUL.
2. Smart maintenance scheduling: Aligns maintenance windows with production cycles to minimize disruption.
3. Root cause analysis automation: AI correlates historical failure records and current data to pinpoint causes more efficiently.
4. Early fault detection: AI identifies anomalies in equipment before visible symptoms emerge.

Featured story

12% downtime reduction for a US medtech giant via predictive maintenance for shop floor equipment.

Business challenges

A US based multinational manufacturer of medical devices, pharma, and consumer goods faced frequent breakdowns. Unscheduled downtimes were rising, leading to low asset utilization and poor technician productivity. Autoclaves showed inconsistent cycle times and repeated failures, especially in vacuum pump subcomponents. Additionally, their performance patterns were unpredictable, making proactive maintenance difficult.

LTIMindtree solution

- Implemented a predictive maintenance model using operational and health data from assets to enable optimized maintenance scheduling.
- Integrated the solution with SAP and process historians to gain insights into maintenance trends and inventory planning.
- Developed and deployed an application suite to cleanse and analyze data using advanced filters, improving data quality and enriching it with asset parameters and temporal context.
- Delivered actionable insights to maintenance engineers through handheld mobile devices, empowering them to take proactive corrective actions.

Business benefits

- Achieved a 12% reduction in downtime by improving visibility into asset health parameters.
- Improved Overall Equipment Effectiveness (OEE) by 8% through better asset utilization.
- Increased technician productivity by minimizing unscheduled maintenance events.
- Enabled consistent cycle times and reduced the risk of subcomponent failures across autoclave operations.

AI-driven ESG

The distributed nature of processes across Environmental (energy efficiency, emissions, waste), Social (worker safety, ethics), and Governance (compliance, reporting) domains makes ESG data collection and consolidation complex. AI can help standardize and operationalize real-time data from factory floors such as machines or HVAC systems to optimize operations and mitigate ESG-related risks. By generating reports aligned with multiple global regulatory frameworks, AI reduces manual effort and improves accuracy.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Manual logs, batch uploads, and disconnected systems with low data granularity.	Real-time IoT sensor feeds, MES/ERP streams, and supply chain APIs offering high-velocity, granular data.
Processing	Static analysis, siloed reports, and historical aggregation with limited foresight.	Predictive analytics, optimization algorithms, and anomaly detection on live factory data streams.
Output	Periodic ESG reports and delayed insights.	Dynamic dashboards, prescriptive actions, automated compliance feeds, and real-time insights.
Infrastructure / Tools	Disparate systems (ERP, MES, manual sheets) and basic databases.	Integrated IoT platforms, cloud/edge AI models, data lakes, and specialized ESG software.

Key takeaway

Despite the strong potential of AI for ESG-focused manufacturing, real-world implementation faces several barriers. Poor data quality, fragmented systems, and integration complexities continue to hold back progress. Moreover, AI infrastructure must be sustainable, and its impact must extend beyond compliance to tangible business value. For CXOs, AI-powered ESG can become a core enabler of sustainable, ethical, and transparent business practices driver of ethical, transparent, and sustainable business operations.

Key application areas

1. Real-time carbon monitoring: Automates emissions tracking across factory operations (Scope 1, 2, and increasingly, Scope 3) for more accurate carbon accounting.
2. IoT/AI factory visibility: Uses real-time data to optimize energy and resource usage.
3. Gen AI ESG reporting: Automates sustainability disclosures while improving accuracy and compliance.
4. Workforce safety and wellbeing: Predicts safety hazards by analyzing workplace data and environmental factors.

Featured story

AI-driven safety monitoring achieves 100% compliance for India's largest engineering firm.

Business challenges

India's largest engineering and construction firm faced mounting safety challenges as operations expanded across diverse and geographically dispersed sites. Maintaining consistent industrial safety standards, especially around personal protective equipment (PPE) compliance was hindered by manual monitoring, limited visibility on the ground, and inconsistent incident reporting. Critical near-miss events often went unrecorded, increasing the risk of serious accidents and regulatory violations. With no centralized oversight, site supervisors found it difficult to detect violations in time or implement proactive safety measures across locations.

LTIMindtree solution

- Deployed an AWS-based computer vision solution at the edge to monitor workforce safety, detect tailgating, and identify hazardous scenarios or noncompliance.
- Implemented a machine learning model that continuously processes video feeds from cameras to trigger real-time alerts in the event of violations.
- Developed a centralized dashboard for site managers and security supervisors, enabling a unified view of incidents and a clear escalation matrix.
- Introduced safety scores and site-level compliance performance reports to support data-driven risk mitigation decisions.

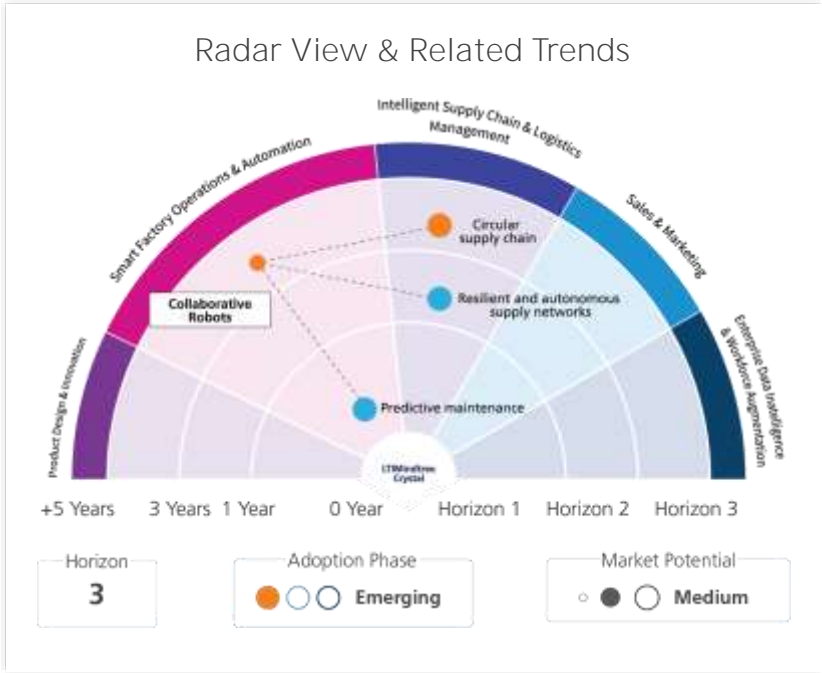
Business benefits

- Achieved 100% safety compliance across over 30,000 personnel through continuous monitoring.
- Improved accountability with automated incident reporting and data-driven safety recommendations.
- Reduced fatality rates by increasing visibility and speeding up emergency response times.
- Enabled round-the-clock worksite monitoring and automated inspections.

Collaborative Robots

Collaborative robots, or cobots, are specialized industrial robots designed to work safely alongside human workers without requiring safety cages or fencing, unlike traditional industrial robots. Increasingly integrated with AI, these robots represent a shift toward human–robot synergy. They operate in close proximity with humans, enhancing productivity without compromising safety.

Cobots offer a rapid entry point into automation. In many applications, they eliminate the need for additional safety infrastructure. They are especially well-suited for small production batches and high-mix/low-volume environments. By assisting with repetitive and ergonomically challenging tasks, cobots enhance human efficiency and reduce physical strain.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Pre-programmed steps, basic sensor triggers, limited operational data.	Multimodal sensor streams (vision, force, lidar), human intent/activity recognition, integrated work cell data.
Processing	Sequential execution based on fixed logic and hardcoded rules.	Real-time analytics for adaptive control, predictive safety, dynamic path planning, and task optimization.
Output	Rigid, predefined movements and actions.	Fluid, context-aware movements, intelligent task sharing, and proactive safety interventions.
Infrastructure / Tools	Isolated systems, physical guarding, traditional programming pendants.	Integrated AI compute, sensor fusion, intuitive visual or lead-through programming, and digital twin integration.

Key takeaway

AI significantly enhances the capabilities of collaborative robots. However, the success of human–robot collaboration (HRC) hinges on human-centric considerations. In addition to ensuring the robot’s inherent safety features, organizations must implement comprehensive system-level safety protocols, invest in workforce training and reskilling, and design intuitive human–robot interfaces. Building trust and addressing socio-economic impacts are essential to realizing the full benefits of collaborative automation.

Key application areas

1. Assembly: Assist workers with intricate tasks and provide ergonomic support.
2. Palletizing: Organize and stack products onto pallets at the end of the production line.
3. Logistics handling: Perform dynamic pick-and-place and palletizing operations.
4. Machine tending: Load and unload machines, freeing human operators for more complex responsibilities.

Featured story

30% manual effort cut by AI-driven drilling operations for a global aerospace leader.

Business challenges

A leading global aerospace manufacturer was heavily dependent on manual drilling operations with limited automation. The lack of real-time visibility and control led to recurring errors and process inefficiencies on the shop floor. Manual log analysis further compromised production accuracy and slowed down decision-making.

LTIMindtree solution

- Automated downloading of files from drilling devices into a centralized, database.
- Developed a client-server model to enable interoperability across networked systems.
- Implemented a real-time dashboard to monitor critical process KPIs.

Business benefits

- Achieved a 30% reduction in manual effort per drilling device.
- Improved incident resolution time through timely intervention enabled by continuous KPI monitoring.
- Integrated the solution with the centralized tool management system, offering a single-pane-of-glass view with actionable insights.
- Delivered a stateless and scalable architecture capable of handling high data volumes across multiple systems.



Intelligent Supply Chain & Logistics Management

AI's impact on building resilient, autonomous, and circular supply networks via predictive risk mitigation and optimized inventory



Intelligent Inventory Management

Intelligent inventory management is essential for manufacturers striving to enhance supply chain agility and operational efficiency. By integrating AI's into demand forecasting, warehouse operations, and IoT- enabled real-time visibility, enterprises can shift from reactive to predictive inventory models.

According to a leading consulting firm, AI-enhanced forecasting can reduce supply chain errors by 20 to 50%. This capability is increasingly critical in navigating demand volatility, managing supply disruptions, and ensuring seamless operations across the manufacturing ecosystem.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Manual data from sales, BOM Bill of Material (BOM) data.	Real-time telemetry from RFID- tagged assets and external data (weather, market trends).
Processing	Rule-based inventory control with static models and fixed reorder points.	Predictive algorithms with continuous learning and optimization using Programmable Logic Controllers (PLC), SCADA, MES, and other data sources.
Output	Periodic reports and reactive inventory decisions.	Dynamic forecasts, prescriptive recommendations (what, when, how much), and automated alerts.
Infrastructure / Tools	ERP systems, spreadsheets, and barcode scanners.	AI platforms, digital twins, cloud analytics, and IoT-based infrastructure.

Key takeaway

Intelligent inventory management is a foundational element of smart manufacturing. The transition from static, rule-based systems to predictive, AI-driven operations enables greater agility, cost savings, and responsiveness across the supply chain. This trend reflects the industry's broader movement toward hyper-automation and self-optimizing networks that can adapt to changing market and production dynamics.

Key application areas

1. Automated replenishment: Intelligent systems trigger restocking based on predicted stock-out risks.
2. Demand forecasting: Machine learning models anticipate material needs using order patterns, seasonality, and other trends.
3. Multi-echelon inventory optimization: AI balances stock levels across plants, warehouses, and distribution centers.
4. Returns and reverse logistics: AI predicts product returns and optimizes re-integration or disposal of returned inventory.

Featured story

A global automotive supplier boosts forecast accuracy amid unstructured order and shipment chaos.

Business challenges

A leading global automotive supplier struggled to manage vast volumes of unstructured orders and shipment data spread across systems. This lack of structured insights led to poor visibility into inventory levels, inconsistent forecasting accuracy, and difficulties in aligning inventory with actual demand—impacting overall supply chain efficiency.

LTIMindtree solution

- Developed two forecasting models using order and shipment data to optimize inventory levels.
- Applied a hybrid approach combining regression and time series models (stacking technique).
- Calculated statistical thresholds by rolling 24 weeks of order data. Quartile values were used to identify upper and lower bounds of customer orders, triggering alerts for anomalies in behavior.
- Integrated 12 major machine learning methods, supporting 20 algorithms with runtime selection and automated model training (self-learn, self-train).

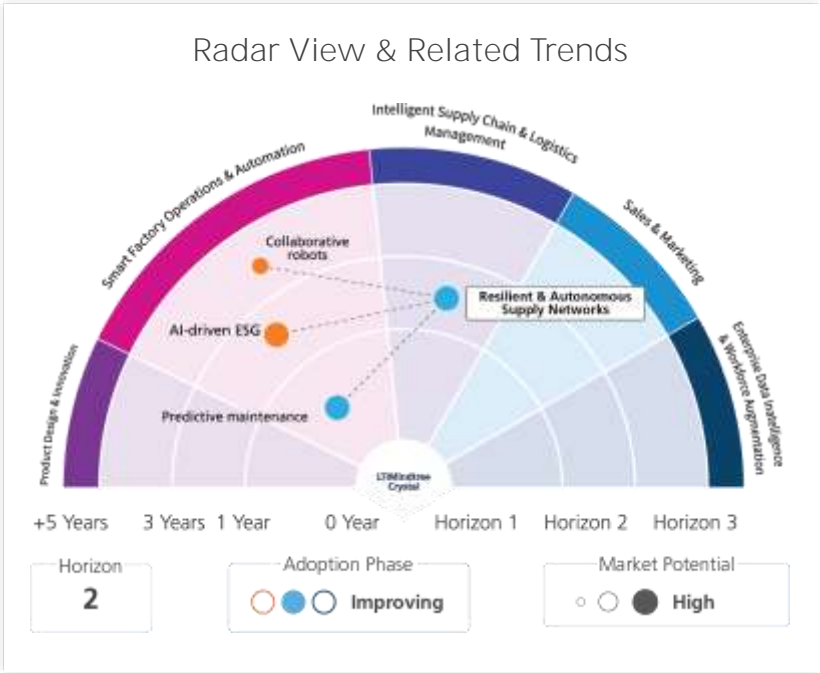
Business benefits

- Automatically adapted to individual parts and customer profiles, regardless of the part count.
- Built converging models for align shipment data with both historical and projected orders.
- Identified statistical thresholds, behavioral patterns, and anomalies with high accuracy.
- Achieved 86% forecasting accuracy with the deployed models.

Resilient & Autonomous Supply Networks

A resilient and autonomous supply network uses AI to identify, evaluate, and mitigate risks early. It transforms traditional process into proactive, data-based, real-time systems. This allows supply chains to remain agile and adaptable in the face of unexpected disruptions.

AI continuously monitors supplier reliability, geopolitical risks, and demand fluctuations. It enables manufacturers to switch or diversify suppliers, assess the impact of political unrest, sanctions, or trade policy changes, and dynamically adjust production schedules. It also helps optimize inventory and align procurement with real-time demand.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Manual data entry and expert judgment prone to human error.	Real-time data from IoT sensors, ERP systems, machine logs, and supply chain feeds.
Processing	Slow rule-based methods, limited by human capacity.	Machine learning-enabled, highly scalable with cloud and edge computing.
Output	Reactive response with static dashboards requiring manual interpretation.	Proactive, automated recommendations with dynamic and interactive dashboards.
Infrastructure / Tools	Siloed legacy systems with manual updates.	Real-time automated data processing via platforms such as Azure AI, AWS SageMaker, IoT, etc.

Key takeaway

As global manufacturing becomes more interconnected, AI is evolving from a support function to a strategic enabler. A resilient supply network fosters proactive, data-driven decision-making across supplier issues, geopolitical events, and demand shifts. Looking ahead, the focus will shift toward greater agility, foresight, and adaptability—transforming potential crises into opportunities for innovation and growth.

Key application areas

1. Supply chain risk prediction: Identifies potential bottlenecks by analyzing data across the entire supply network.
2. Geopolitical sentiment analysis: Tracks news, social media, and policy changes to flag emerging risks.
3. Market risk analysis: Predicts market volatility to inform better investment and sourcing decisions.
4. Third-party vendor risk evaluation: Continuously assesses vendors for compliance, anomalies, or security breaches.

Featured story

A global utility company saves USD 0.5 million annually by automating metering infrastructure amid supply shortages.

Business challenges

A global utility provider faced post-pandemic supply chain disruptions for AMI meters. Their vendor couldn't meet demand, and they lacked a modern metering infrastructure. Manual meter reading caused delays, inefficiencies, and rising operational costs. Not only that but the communication failures and billing issues further strained daily operations.

LTIMindtree solution

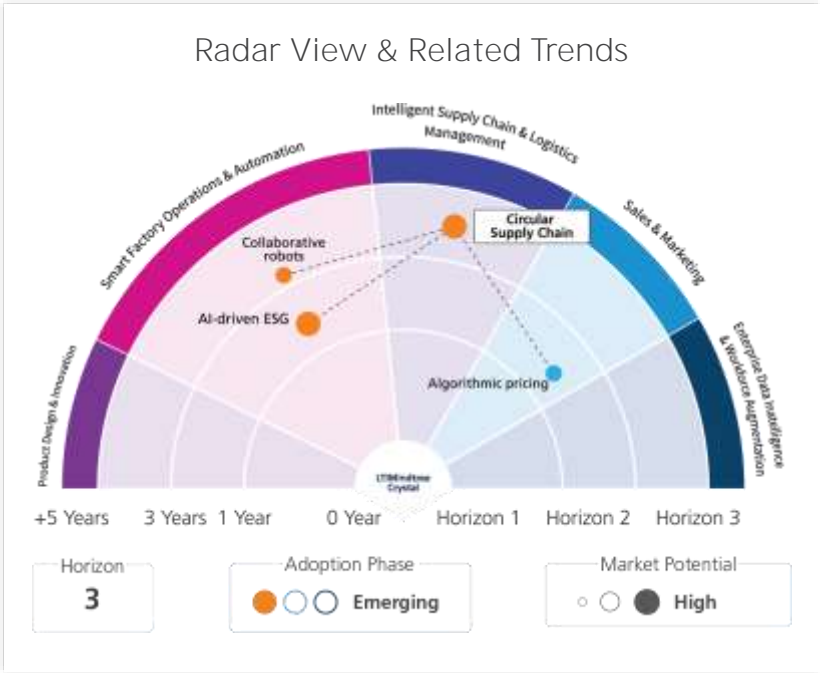
- Processed new meter request data via the outage detection API, enabling near real-time outage data notifications from AMI systems to the client's platforms.
- Integrated multiple data sources and systems for seamless meter data ingestion into the AMI S3 bucket, followed by upload to the multipeak gateway for qualified facility-type meters.
- Implemented a Lambda function to process meter records, with SQS as the event trigger, and SNS and PagerDuty for alert notifications.
- Developed mechanisms to reprocess failed records and files, track errors through Lambda, and alert teams on failed transactions using advanced analytics.

Business benefits

- Enabled stronger risk mitigation by addressing supply chain shortages proactively.
- Achieved annual savings of USD 0.5 million by reducing manual meter reading efforts through AMI automation.
- Reduced communication issues by 50% for meters that previously required manual billing reads.
- Maintained sufficient AMI inventory to support daily operations, enabling smoother growth and maintenance cycles.

Circular Supply Chain

Manufacturing is shifting from traditional linear models, centered on consumption and disposal, to embracing Circular Supply Chains (CSCs) that emphasize reuse, refurbishment, and recycling to improve sustainability. While the promise is strong, CSCs are inherently complex. This is where AI becomes a true differentiator. It introduces the intelligence needed to manage intricate material flows, predict product lifecycles and returns, automate reverse logistics, and enhance efficiency and traceability, making ambitious circularity goals not just aspirational but achievable.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Primarily virgin material data, sales forecasts, limited end-of-life (EoL) product information, and manual return inspections.	Real-time data on product usage and condition (via IoT), secondary material market data, and automated inspection of returns.
Processing	Linear production planning, reactive maintenance, manual EoL sorting (often basic recycling or disposal), and rule-based repair decisions.	AI predicts the optimal EoL path (reuse, refurbish, or recycle); optimizes production and reverse logistics using secondary materials; enables automated robotic sorting and disassembly.
Output	High waste generation, downcycled materials, value loss at EoL, and limited material traceability.	Maximized value recovery from returns, high-purity secondary materials, and verifiable traceability and circularity metrics.
Infrastructure / Tools	Standard ERP/MES systems, spreadsheets for waste tracking, manual sorting lines, and basic recycling facilities.	AI and sensor-augmented systems, products and processes that support circular flows, computer vision and robotics for sorting and quality assurance, and digital twin simulations.

Key takeaway

To go beyond basic recycling and build sophisticated circular systems, manufacturers need advanced capabilities. AI—especially when integrated with IoT and smart contracts, offers the data processing and decision-making power necessary to manage complexity. The future lies in leveraging Explainable AI (XAI) to build trust, fostering ecosystem-wide data collaboration, and scaling AI-driven solutions to effectively operate CSCs.

Key application areas

1. Predictive circular flow management: AI forecast returns and asset lifespans, enabling proactive reuse/repair decisions.
2. Resource Optimization: AI maximizing material/energy efficiency, minimizing waste beyond traditional CSC methods.
3. Automated reverse chain orchestration: AI streamline complex collection, sorting, and value recovery in reverse logistics.

Featured story

A global equipment manufacturer streamlines spare parts supply chain with faster, AI-driven insights.

Business challenges

A leading multinational manufacturing client faced persistent issues in its spare parts supply chain. Fragmented systems, delayed analytics, lack of real-time insights, and a high risk of manual errors made timely, data-driven decisions difficult.

LTIMindtree solution

- Developed a unified, granular view of order management and fulfilment data sourced from disparate systems.
- Implemented nudges, diagnostics, forecasting, and simulation capabilities using Explainable AI to build trust across customer-facing and internal teams.
- Enabled effective tracking of key fulfillment KPIs such as fill rate, back orders, short orders, and sales orders.
- Introduced a cognitive metadata layer using business ontologies, tagging frequently used terms to streamline querying with common business language.

Business benefits

- Achieved insights into root causes of anomalies four times faster.
- Realized a 90% improvement in the insight exploration experience.
- Configured the entire solution in under four days.
- Boosted operational performance by 80%.



Sales & Marketing

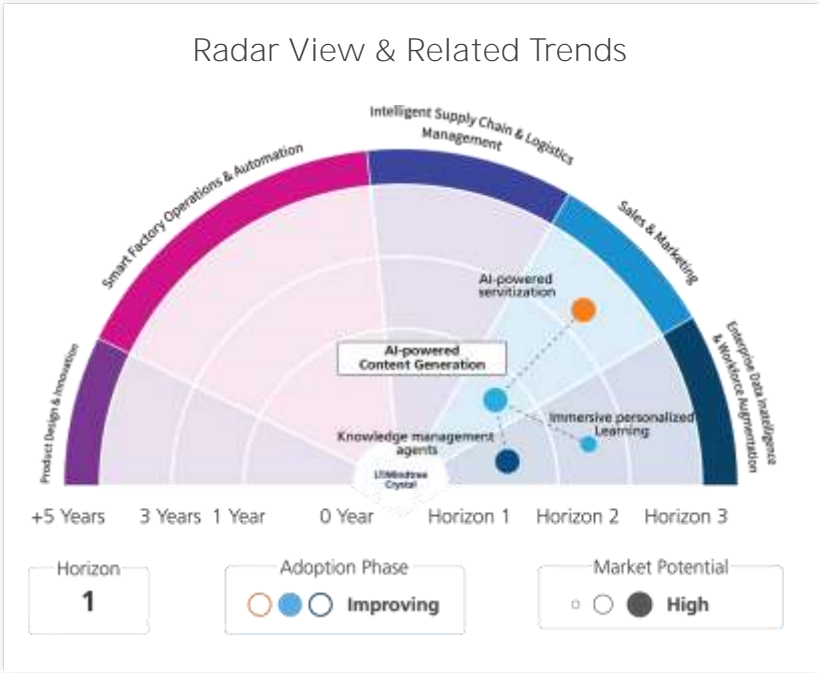
Examining the transformation of customer engagement and revenue streams through AI-driven pricing, servitization, and content generation






AI-driven Content Generation

The manufacturing industry relies heavily on complex technical information, detailed operational procedures, and extensive documentation. AI can generate initial drafts or complete sections of service manuals based on data inputs such as CAD files, bills of materials (BOMs), engineering specifications, sensor data. It also enables scalable, efficient omnichannel marketing, replacing the previously time-consuming campaign processes.

This scalability is especially valuable in today’s fast-paced market, where timely and cohesive messaging is essential for capturing and maintaining customer attention.



Doing it the AI way

 Stage	 Traditional Way	 AI Way
Input	Specialized teams, such as marketers and designers, are needed to create and execute marketing campaigns.	Real-time triggers from analytics based on customer interactions, with minimal human involvement.
Processing	Manually tailored or generic content requires editing, formatting, and is resource intensive.	AI generates images, videos, and summaries based on historical customer behavior, across multiple languages.
Output	Periodic reviews and manual proofreading are needed to create multiple content versions.	AI-assisted tools allow continuous or on-demand content creation with minimal manual effort.
Infrastructure / Tools	Multiple physical versions are manually tracked using spreadsheets or other tools.	Generative AI platforms like ChatGPT and Jasper, enabled by cloud infrastructure, provide real-time content optimization.

Key takeaway

As manufacturing evolves into a digitally integrated ecosystem, AI-driven content generation is quickly becoming essential. Generative AI systems can autonomously create hyper-personalized narratives that enhance customer engagement. These systems adapt in real time to market changes and align with diverse customer segments and their unique journeys. Manufacturers that embrace AI-driven content creation will benefit from improved communication, better customer service, and increased loyalty.

Key application areas

1. Catalog generation: Automatically generate detailed, SEO-optimized, persona-based product description and catalogs.
2. Translation and localization: Quickly translate marketing materials, product descriptions, and website content into multiple languages.
3. Customer service automation: Accelerate tasks such as product troubleshooting, ordering parts, scheduling service, and delivering product information.
4. Product recommendations: Generate automated product recommendations for customers based on historical product sales.

Featured story

A fortune 500 manufacturing leader cuts writing costs by 40% using Gen AI for marketing.

Business challenges

A fortune 500 manufacturing leader struggled to leverage generative AI for automating platform-specific marketing content. They faced challenges in fine-tuning key elements such as titles, tone, and style, and aligning with best practices to improve content effectiveness and resonance with target audiences.

LTIMindtree solution

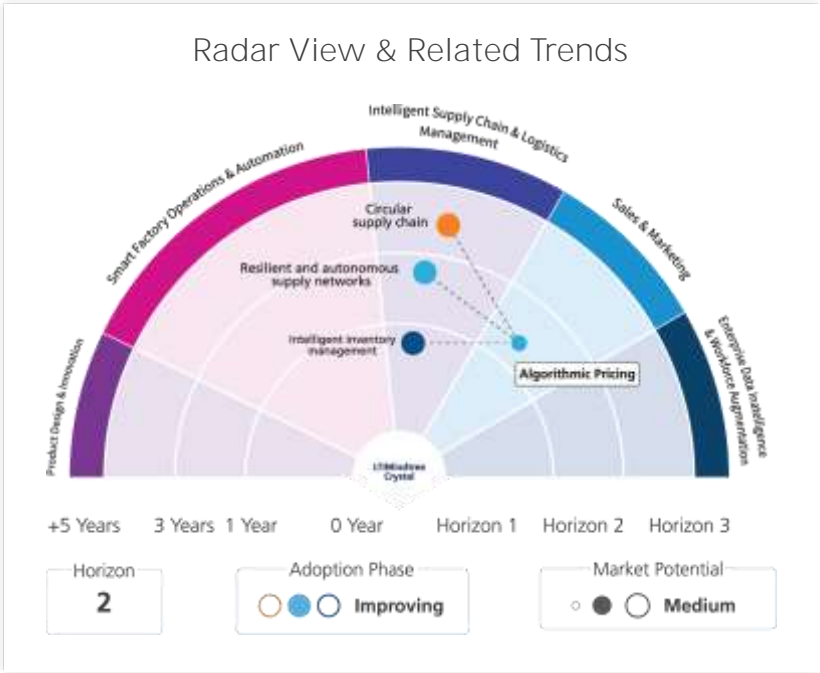
- Designed and developed an end-to-end application for generating marketing content based on user inputs.
- Implemented an automated Q&A generation module to collect relevant information and enhance content accuracy and context.
- Applied prompt engineering techniques to customize large language models for optimal performance across different digital mediums.
- Used retrieval-augmented generation (RAG) to extract supplementary information from user-uploaded documents, enriching content relevance.

Business benefits




- Achieved approximately a 40% reduction in writing costs compared to traditional methods, thanks to faster automated content creation.
- Recorded a 10% increase in platform traffic across email campaigns, LinkedIn, and blog channels due to higher-quality content.
- Improved alignment with brand guidelines and overall marketing strategy, ensuring consistency and coherence across platforms.

Algorithmic Pricing

Algorithmic pricing powered by AI enables manufacturers to dynamically adjust prices by assessing real-time market trends, demand patterns, competitor’s activity, and inventory status. This shift from fixed to adaptive pricing allows for more precise strategies tailored for customer segments and sales channels. The result is improved revenue potential, stronger profit margins, and greater responsiveness to changing market conditions. This, in turn, gives manufacturers a competitive edge in pricing operational efficiency, and customer satisfaction.



Doing it the AI way

 Stage	 Traditional Way	 AI Way
Input	Relies on periodic market surveys and static historical data.	Uses real-time data from market trends, demand, inventory, and competitor pricing.
Processing	Manual analysis by pricing teams; slow and subjective.	AI models dynamically calculate optimal pricing across customer segments and geographies.
Output	Fixed pricing strategies slow response to market shifts.	Adaptive pricing that updates instantly based on changing demand and defined business rules.
Infrastructure / Tools	Excel sheets, basic ERP modules, manual dashboards.	AI engines, predictive analytics, integrated CRM, and pricing platforms.

Key takeaway

Algorithmic pricing equips manufacturers with the agility to respond quickly to shifting market dynamics. As adoption increases, these systems are evolving into self-learning engines that personalize pricing across channels and customer types. However, full automation may overlook strategic judgment and context. Striking the right balance between AI-driven precision and human oversight is crucial to maintain competitive, ethical, and brand-aligned pricing strategies.

Key application areas

1. Geo-specific pricing: Adjust prices based on regional demand, logistics costs, and local economic conditions.
2. Customized pricing: Tailor pricing using customer history, volume, and negotiation patterns.
3. Competitive pricing: Monitor competitor pricing in real time and optimize strategies dynamically.
4. Capacity-based pricing: Optimize inventory by adjusting prices based on current stock levels.

Featured story

A manufacturing leader cuts quote time by 75% with AI-powered pricing overhaul.

Business challenges

A leading manufacturing company, known for its labeling and functional materials, had long used a traditional cost-plus pricing model. However, extensive market research revealed a significant gap between the market's perceived value of their offerings and the actual pricing structure. This misalignment resulted in missed revenue opportunities and reduced pricing agility.

LTIMindtree solution

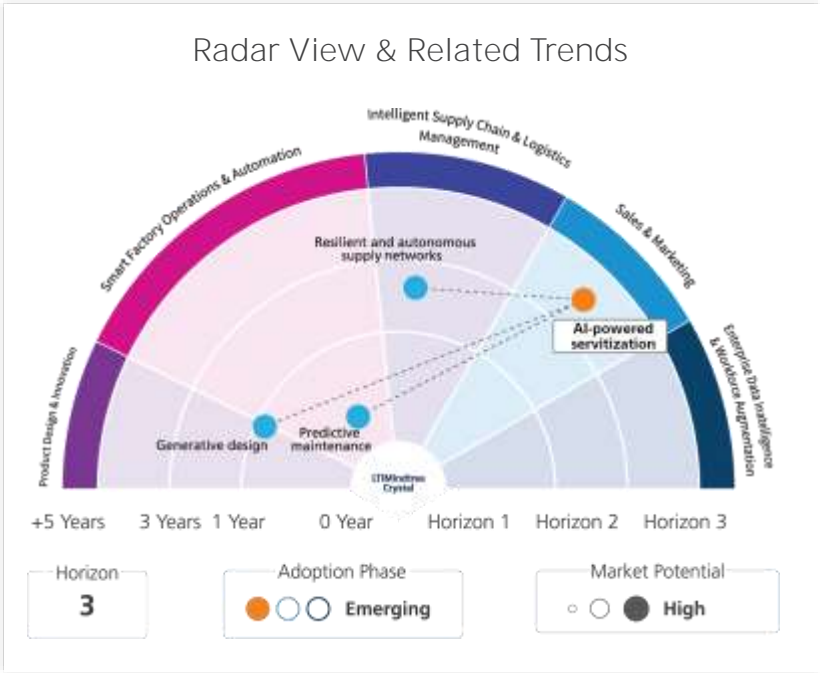
- Implemented a machine learning-driven solution to modernize the client's legacy pricing model. The transformation focused on shifting from cost-based pricing to a value-based model.
- The solution used a minimal feature set to generate real-time price estimates, streamlining the Configure-Price-Quote (CPQ) process.
- Price elasticity was integrated to evaluate customer responsiveness to price changes and fine-tune pricing decisions accordingly.

Business benefits

- Improved revenue and sales with value-based pricing optimization using AI/ML.
- Achieved a 50% reduction in manual effort needed to tailor prices according to customer requirements.
- Reduced quote generation time by 75%, significantly improving sales velocity.

AI-powered Servitization

AI-powered servitization enables manufacturers to move from selling products to delivering intelligent, value-driven services. By embedding sensors and AI, companies gain real-time insights into product usage. This supports predictive maintenance, adaptive offerings, and dynamic pricing models. A continuous data-driven feedback loop encourages product innovation, enhances customer engagement, and opens new streams of recurring revenue. As a result, products evolve into service platforms that adapt to user behavior and market conditions, boosting competitiveness and building customer loyalty.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Customer feedback gathered manually through surveys or after-sales calls.	Real-time data from IoT sensors, CRM systems, and user behavior analytics.
Processing	Sales insights drawn from periodic reviews and historical data.	Predictive models process usage data for dynamic segmentation and personalized engagement.
Output	One-size-fits-all offerings and fixed pricing based on static assumptions.	Personalized service models, subscription-based offerings, and dynamic pricing.
Infrastructure / Tools	Manual CRM systems, spreadsheets, and isolated customer records.	AI-enabled CRM platforms, data lakes, cloud analytics, and digital twin technologies.

Key takeaway

AI-powered servitization is reshaping manufacturing by shifting focus from one-time product sales to value-centric service experiences. Real-time data and predictive analytics enable customized services, subscription models, and continuous engagement. While these benefits improve loyalty and revenue consistency, success depends on strong data integration, organizational alignment, and a shift in mindset—areas where many manufacturers are still in the early stages of adoption.

Key application areas

1. Usage-based pricing models: Adjust pricing dynamically based on real-time product usage.
2. After-sales support automation: Deploy chatbots and AI agents for instant, intelligent service responses.
3. Remote monitoring services: Offer performance tracking to ensure uptime and enable preventive actions.
4. Smart warranty management: Automate warranty triggers using AI-analyzed failure and anomaly detection.

Featured story

A Swedish automotive leader cuts vehicle downtime by 80% with real-time prognostics.

Business challenges

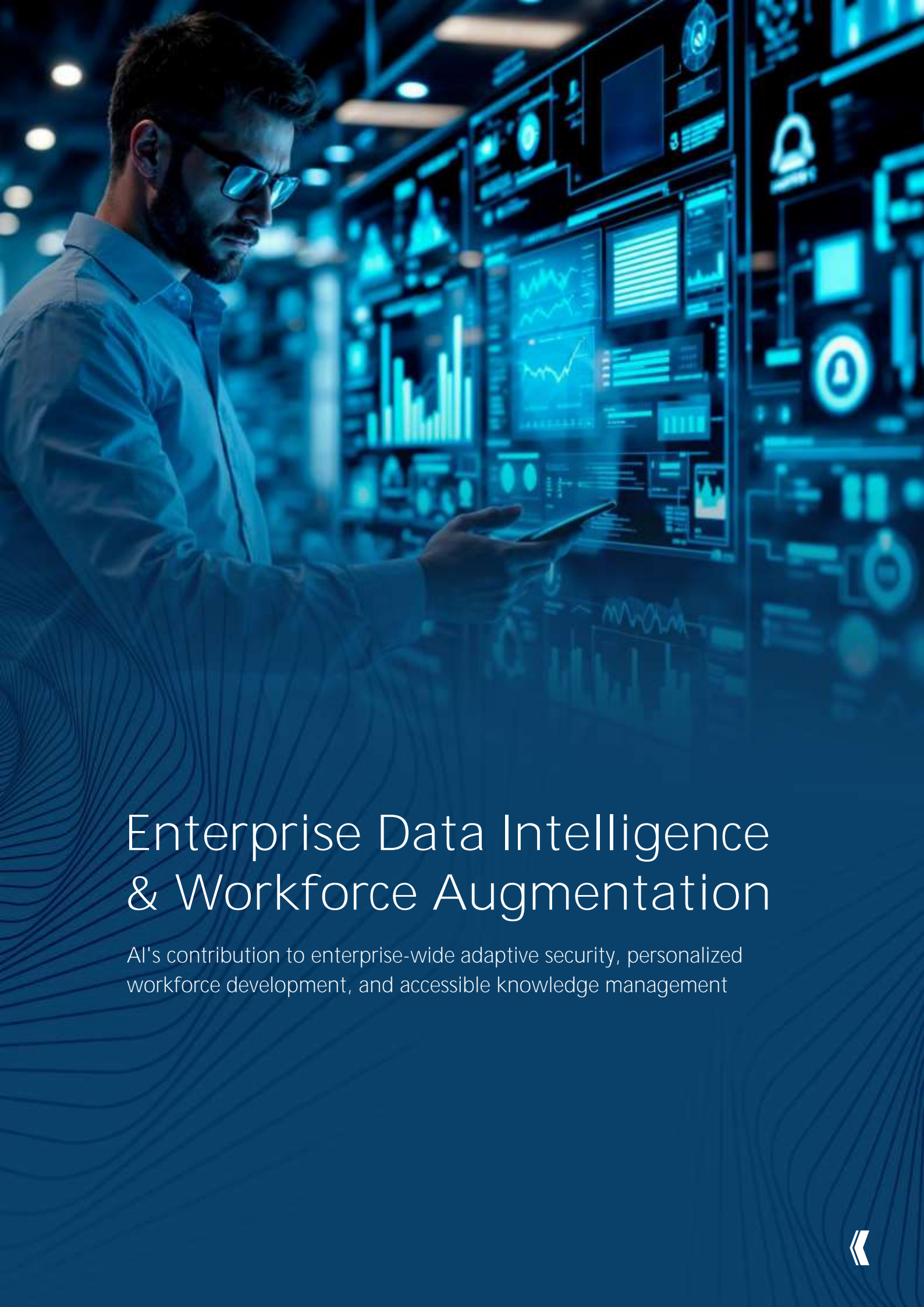
The client, a major Swedish automotive manufacturer, struggled to convert vehicle data into actionable insights for its service network. This resulted in poor real-time visibility, limited customer feedback, and high vehicle off road (VOR) instances—leading to reduced uptime and service inefficiencies.

LTIMindtree solution

- Developed a real-time remote vehicle prognostics system. This system allows drivers to report specific defects, while automatically capturing and sharing the required regulatory data.
- Analyzed fleet performance and driver behavior based on diagnostics and equipment utilization data. It generated specific insights to improve operational efficiency.
- A configurable, rule-based, deviation detection engine was also developed. Customizable by region and vehicle type, the engine alerts fleet stakeholders and provides tailored action plans based on the severity of detected deviations.
- The system offers comprehensive visibility into vehicle performance for both fleet managers and service centers. It enables proactive customer support for repairs and maintenance, significantly reducing expensive roadside breakdowns.

Business benefits

- The solution led to an 80% reduction in vehicle downtime, significantly improving fleet availability and customer satisfaction.
- It achieved a 50% decrease in Mean Time to Repair (MTTR), enabling faster service turnaround and more efficient resource utilization.
- The system now monitors over 170,000 connected vehicles globally, offering real-time insights across diverse geographies and operational conditions.
- On average, 500,000 exceptions and diagnostic events are processed daily, supporting timely interventions and continuous performance optimization.



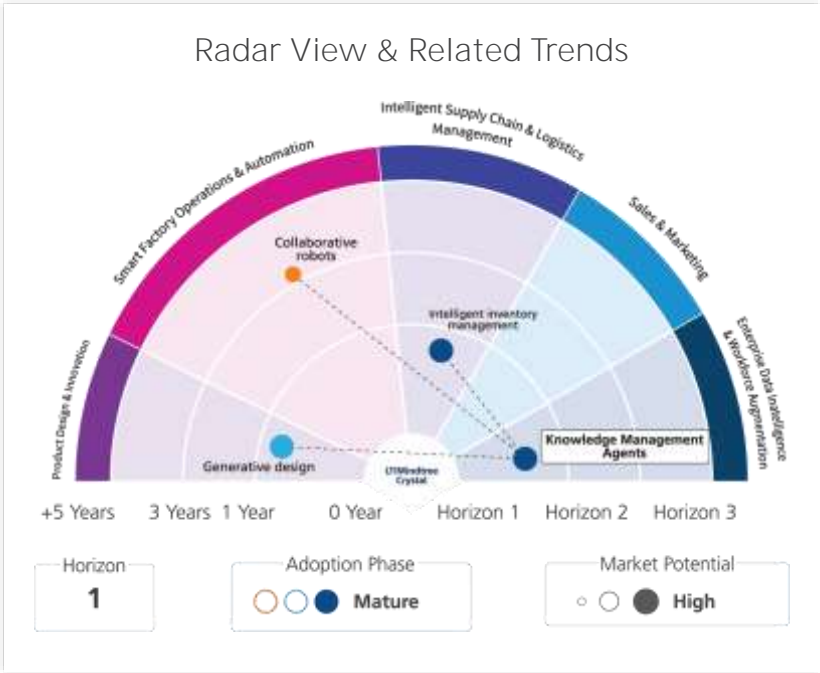
Enterprise Data Intelligence & Workforce Augmentation

AI's contribution to enterprise-wide adaptive security, personalized workforce development, and accessible knowledge management



Knowledge Management Agents

Knowledge management agents leverage advanced tools to enable efficient data retrieval, personalized content recommendations, and automated content curation. These agents ensure precise, context-aware access to data logs and documents necessary for optimizing manufacturing processes, training, onboarding, and more. By reducing the time spent searching through extensive repositories and manuals, they significantly enhance operational efficiency. Their ability to support knowledge discovery, tagging, and classification streamlines workflows across the organization.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Manual data entry and tagging through structured forms and document uploads.	Aggregates information from multiple sources (e.g., documents, machine logs, sensor data, expert input) and applies machine learning for automated tagging and classification.
Processing	Relies on rule-based logic, with slow and limited knowledge discovery; static insights and no real-time data.	Uses natural language processing (NLP), deep learning, and real-time analytics for intelligent, contextual data retrieval.
Output	Static documentation such as manuals and FAQs, often outdated or irrelevant.	Dynamic, personalized, and context-aware knowledge delivery with real-time updates.
Infrastructure / Tools	Traditional content management systems, siloed databases, and manual workflows with minimal integration.	AI-powered knowledge management platforms, including semantic search, knowledge graphs, scalable AI/ML tools, and seamless enterprise system integration.

Key takeaway

Knowledge management agents are poised for significant growth in manufacturing due to the increasing need for intelligent, knowledge sharing and faster decision-making. As smart factory initiatives expand, the ability to capture, contextualize, and deliver real-time knowledge will be a key advantage. Manufacturers should capitalize and explore these agents as strategic tools for efficiency, resilience, and long-term competitive edge.

Key application areas

1. Maintenance support: Offers technicians instant access to updated manuals and procedural guides.
2. Troubleshooting: Helps engineers quickly diagnose root causes by searching across logs, expert notes, incident histories, and more.
3. Production operations: Supplies operators with current standard operating procedures (SOPs), work instructions, and compliance protocols.
4. Workforce training and support: Delivers personalized learning materials and on-the-job guidance via conversational interfaces.

Featured story

An Indian conglomerate boosts data accuracy to 99% and cuts processing time by 70%.

Business challenges

A major Indian multinational, operating across industrial technology, manufacturing, power, engineering, and financial services, faced challenges in extracting accurate information from scanned documents. The documents had inconsistent layouts, poor quality, and high data accuracy requirements. These limitations slowed down processing and reduced operational efficiency.

LTIMindtree solution

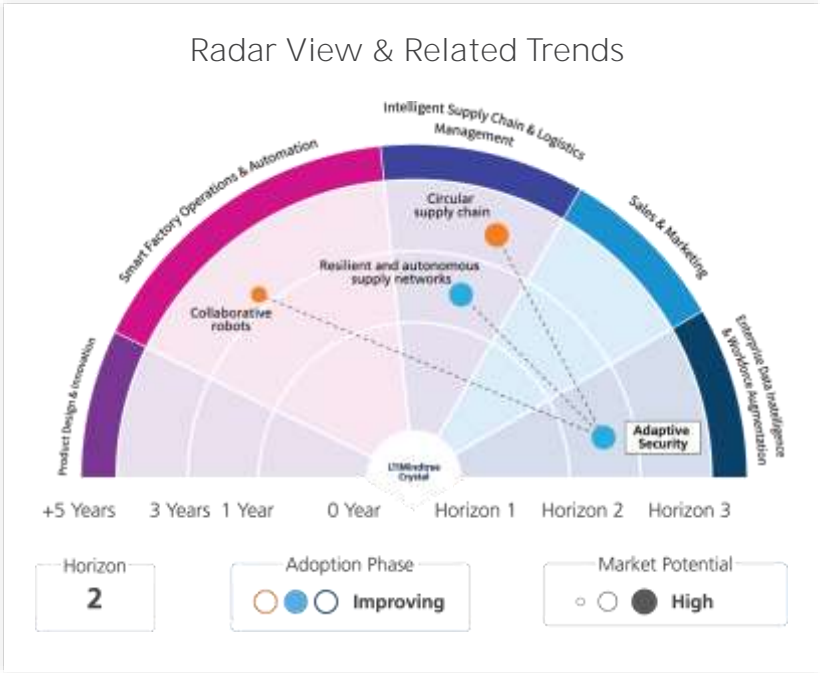
- Custom fine-tuned model: We developed a machine learning model tailored to accurately extract specific information from varied document formats.
- Multimodality techniques: By combining image processing with machine learning, the solution adapted to a range of layouts and content types.
- Image processing for noise reduction: Advanced methods cleaned noisy scans, improving the reliability of Optical Character Recognition (OCR) results.
- Backend services and API integration: Seamless backend integration enabled automatic data extraction and validation through APIs.
- Enhanced OCR: The system used improved (OCR) to ensure precise extraction from even low-quality documents.

Business benefits




- Achieved up to 30% reduction in manual data entry, improving team productivity.
- Improved data accuracy to 95–99%, minimizing rework, compliance issues, and penalties.
- Reduced processing time by 50–70%, enabling faster service delivery and decision-making.
- Enabled staff to focus on high-value tasks, resulting in a 25% increase in employee satisfaction.

Adaptive Security

Adaptive security in manufacturing is a dynamic approach to cybersecurity that goes beyond traditional, static defenses. It acknowledges the constant evolution of the manufacturing environment, especially with the rise of Industry 4.0, the Internet of Things (IoT), and particularly Cyber-Physical Systems (CPS). These technologies introduce new threats that demand real-time vigilance. Adaptive security continuously monitors, analyzes, and responds to these threats. It adjusts defenses in real time to minimize risks and maintain operational continuity.



Doing it the AI way

 Stage	 Traditional Way	 AI Way
Input	Relies on predefined rules, signatures, historical static threat data, and manual data collection.	Uses dynamic, real-time inputs from IT, OT, CPS, logs, sensors, and external threat intelligence feeds, with adaptive rules and policies.
Processing	Involves manual analysis with rule-based systems and high human involvement.	Applies intelligent threat scoring, dynamic policy adaptation, and automated context-based responses.
Output	Generates reactive alerts and reports based on predefined criteria.	Delivers predictive analytics and proactive, real-time threat detection and response (e.g., isolation, patching).
Infrastructure / Tools	Uses firewalls, antivirus software, and siloed intrusion detection systems for security.	Employs AI-powered threat intelligence platforms, automated response systems, and ML-based anomaly detection.

Key takeaway

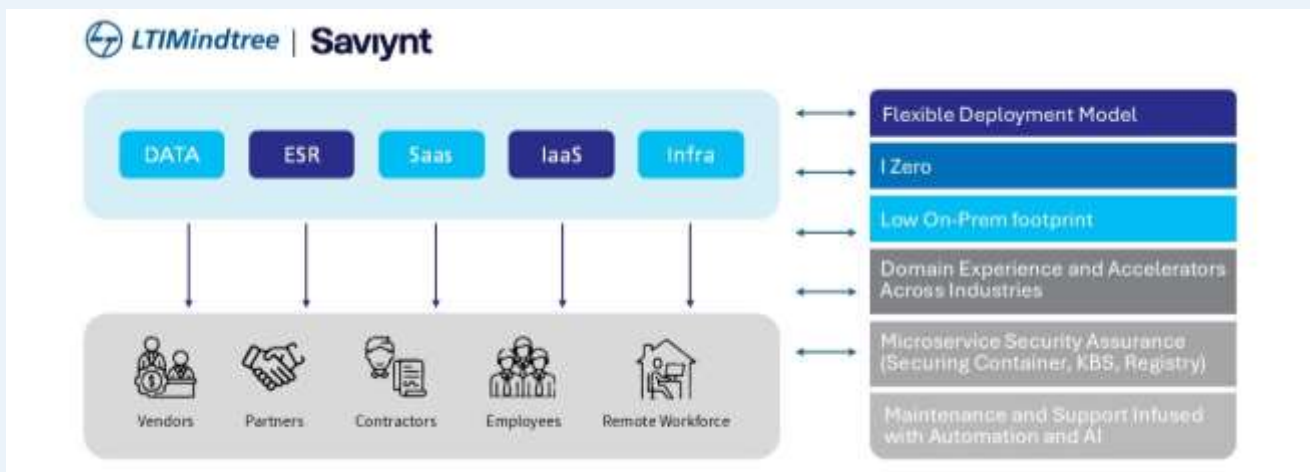
Manufacturing environments are inherently complex, with diverse systems, protocols, and devices. These factors make implementing and managing adaptive security particularly challenging. Many facilities still depend on legacy systems that lack built-in security, making them especially vulnerable. Adaptive security is not a one-time deployment. It requires ongoing monitoring, evaluation, and adjustments to stay aligned with the continuously shifting threat landscape.

Key application areas

1. Predictive threat detection and response: Monitors network traffic and user behavior to identify anomalies before they escalate.
2. Automated incident response: Reduces response time and increases accuracy through automated detection, triage, and remediation.
3. SecOps augmentation: Automates, accelerates, and enhances Security Operations (SecOps) tasks to reduce manual efforts.
4. Adaptive access control: Dynamically adjusts access based on user behavior, device health, and contextual threat intelligence.
5. Secure remote access: Implements safe and controlled access for remote workers, vendors, and service providers.
6. Vendor risk management: Establishes structured programs to assess and manage the security risks of third-party vendors and service partners.

LTIMindtree capability

A fortune 500 manufacturing leader struggled to leverage generative AI for automating platform-specific marketing content. They faced challenges in fine-tuning key elements such as titles, tone, and style, and aligning with best practices to improve content effectiveness and resonance with target audiences.



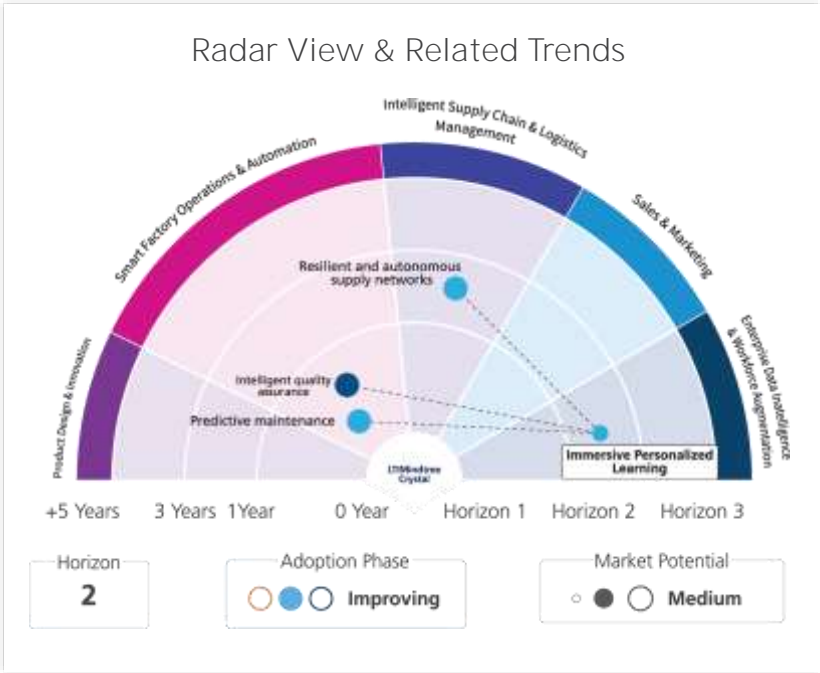
LTIMindtree's intelligent identity governance solution powered by SAVIYNT offered the following:

- Integrated processes: Our digital identity solution integrates seamlessly with organizational tools, policies, and regulatory frameworks to support smooth adoption.
- Efficient and scalable systems: The solution scales effortlessly as new infrastructure, systems, and applications are onboarded, ensuring optimized operations.
- Lower risk exposure: Continuous compliance monitoring helps manage risks more effectively.
- Enhanced productivity: Enables secure work-from-anywhere models without compromising safety.
- Operational efficiency: Achieves cost savings through robust security posture and simplified regulatory compliance.
- Faster onboarding: Uses templated implementation programs to accelerate application integration.

Immersive Personalized Learning

Manufacturing organizations are increasingly adopting immersive, personalized learning approaches for machine operations, safety procedures, and crisis management. By integrating Artificial Intelligence (AI) with Augmented and Virtual Reality (AR/VR), these methods overlay digital information onto the physical world. This provides workers with interactive, personalized training and real-time guidance.

Studies show that workers trained with Virtual Reality (VR) retain up to 80% of skills after three months, compared to just 20% with traditional methods. Additionally, they demonstrate more than a 30% improvement in task performance due to hands-on practice in realistic, simulated environments.



Doing it the AI way

Stage	Traditional Way	AI Way
Input	Generic training materials (manuals, videos, lectures); standardized tests; limited, subjective instructor feedback.	Trainee-specific data (skills, experience, learning style, prior performance); real-time metrics (VR/AR interaction data, physiological signals).
Processing	Instructor-led delivery; group-based activities; linear, one-size-fits-all learning paths.	Dynamic content and difficulty adjustment; adaptive learning journeys; real-time feedback and personalized guidance.
Output	Theoretical knowledge with limited hands-on practice; learning often completed on the job; standardized performance evaluation.	Mastery of complex tasks, improved retention, measurable performance gains, individualized feedback and remediation plans.
Infrastructure / Tools	Physical or lengthy digital training manuals with limited interactivity.	VR/AR/Mixed Reality (MR) headsets and hardware (mobile or high-end); advanced simulation software; AI-powered learning platforms (e.g., LMS with AI).

Key takeaway

The fusion of AI, immersive technology, and personalized learning is transforming workforce development in manufacturing. This approach helps bridge skill gaps, improves operational readiness, and enhances worker safety. While integration may pose challenges, the long-term return on investment—in productivity, adaptability, and talent retention—makes this shift essential for building a future-ready workforce.

Key application areas

1. Equipment training: AI-powered simulations learn from past faults to provide personalized, hands-on guidance, improving learning speed and accuracy.
2. Complex assembly: AR offers real-time visual instructions, guiding workers through each step of intricate assembly process.
3. Safety protocol training: Immersive scenarios enable employees to safely practice emergency protocols and identify workplace hazards without real-world risk.
4. Remote assistance: AR allows remote experts to guide on-site workers live, reducing downtime and enabling fast, effective troubleshooting.

LTIMindtree capability

LTIMindtree leverages AI-powered immersive learning solutions to transform how manufacturing teams acquire, apply, and retain critical skills. By combining advanced simulation tools with personalized learning platforms, we help organizations create scalable, effective training programs aligned with operational goals. To support this transformation, we offer a range of tailored services designed to build a future-ready, agile workforce:

Services offered

- Simulation Training
- Product Training
- Expert Coaching
- Facility Equipment Training
- Safety Product Training
- Expert Capture

Business benefits

These benefits stem directly from LTIMindtree's immersive learning solutions, which combine AI, simulation technologies, and expert coaching to transform workforce training:

- Accelerated workforce upskilling through hands-on simulations and adaptive learning paths tailored to individual needs.
- Lowered operational costs by reducing training time, minimizing errors, and decreasing equipment downtime.
- Improved worker productivity with faster onboarding, real-time guidance, and greater task accuracy.
- Enhanced equipment maintenance through realistic training on troubleshooting and preventive procedures, ensuring fewer breakdowns and better asset utilization.

Acknowledgement

Executive Mentors

We thank Rajesh Sundaram, Naushad Khambhawala, Ashish Varerkar, Komal Machindar, Manoj Karanth and Indranil Mitra for their guidance.

Advisory Council

Advisory Council is a formal body composed of technology experts, domain experts, and leaders from multiple units.

Aditya Kumar Soni, Ajith P N, Amit Mehetre, Anup Karade, Ajay Desale, Bharat Trivedi, Binu Zacharia, Daljit Singh, Dipesh Narang, Ganesan Thyagarajan, Girish Meena, Inderpreet Arora, Kavita Wakade, Lakshmi Pawar, Manish Lokhande, Murali V Satya Sai Kumar Dontu, Rajen Tripathy, Ranjini Karukasseril, Ramseshan Thyagarajan, Rehbar Rehman, Sachin Jain, Sapna Modi, Shivani Puthran, Sneha Hingorani, Snehal Ghadi, and Srijit Maiti

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Our Esteemed Clients

We extend our sincere gratitude to all our clients who have shared their view on AI adoption in the manufacturing domain.

Their thoughtful inputs have been instrumental in shaping the Manufacturing AI Trends Radar 2025. Their insights have helped us uncover critical priorities, investment patterns, and innovation pathways that are redefining the future of manufacturing in the age of AI. This collective intelligence has enabled us to move beyond assumptions towards data-backed foresight. It has helped us identify where AI can deliver the most value.

Thank you for being a vital part of this journey. Your voice is helping us build a more resilient, responsive, and intelligent manufacturing ecosystem.

Glossary

AI: Artificial Intelligence

AOI: Automated Optical Inspection

AR: Augmented Reality

BOM: Bill of Materials

CAD: Computer-aided Design

CMMS: Computerized Maintenance Management System

CPS: Cyber-Physical Systems

CRM: Customer Relationship Management

CSCs: Circular Supply Chains

ERP: Enterprise Resource Planning

ESG: Environmental, Social, and Governance

EoL: End of Life

GPUs: Graphics Processing Units

HRC: Human Robot Collaboration

HVAC: Heating, Ventilation, and Air Conditioning

IoT: Internet of Things

LMS: Learning Management System

MES: Manufacturing Execution System

ML: Machine Learning

MR: Mixed Reality

NLP: Natural Language Processing

OEM: Original Equipment Manufacturers

OT: Operational Technology

PLC: Programmable Logic Controller

PPE: Personal Protective Equipment

QA: Quality Assurance

QMS: Quality Management System

RFID: Radio Frequency Identification

ROI: Return on Investment

RUL: Remaining Useful Life

SCADA: Supervisory Control and Data Acquisition

SDLC: Software Development Life Cycle

SOPs: Standard Operating Procedures

VR: Virtual Reality

XAI: Explainable AI

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