



Lenovo
**Manufacturing
Solutions**

Smarter
technology
for all

Lenovo



Our Vision:

In the face of challenges emanating from various fronts, the manufacturing industry grapples with the scarcity of invaluable resources such as technology, talent, supply chain, data insights, and security. These resources may not be easily accessible, affordable, or reliable. Navigating the ever-evolving landscape of Industry 4.0, and even spearheading transformative progress in this era, presents a formidable task.

Lenovo's vision is to be a catalyst for success in the huge wave of Industry 4.0. Drawing upon our rich practical experience in IT and OT integration, robotics, automation, AI, data intelligence, IOT, we're committed to addressing our customers' specific needs with utmost efficiency and effectiveness. Together with you, our valued customers, we aspire to soar to new heights in the Industry 4.0 transformation.



Our Acknowledgement: Industry 4.0 Lighthouse

Lenovo Hefei, the world's largest single PC factory, strived to deliver productivity, quality, and sustainability even under the worst manufacturing circumstances during Covid-19. We're recognized by World Economic Forum as the Industry 4.0 Lighthouse.

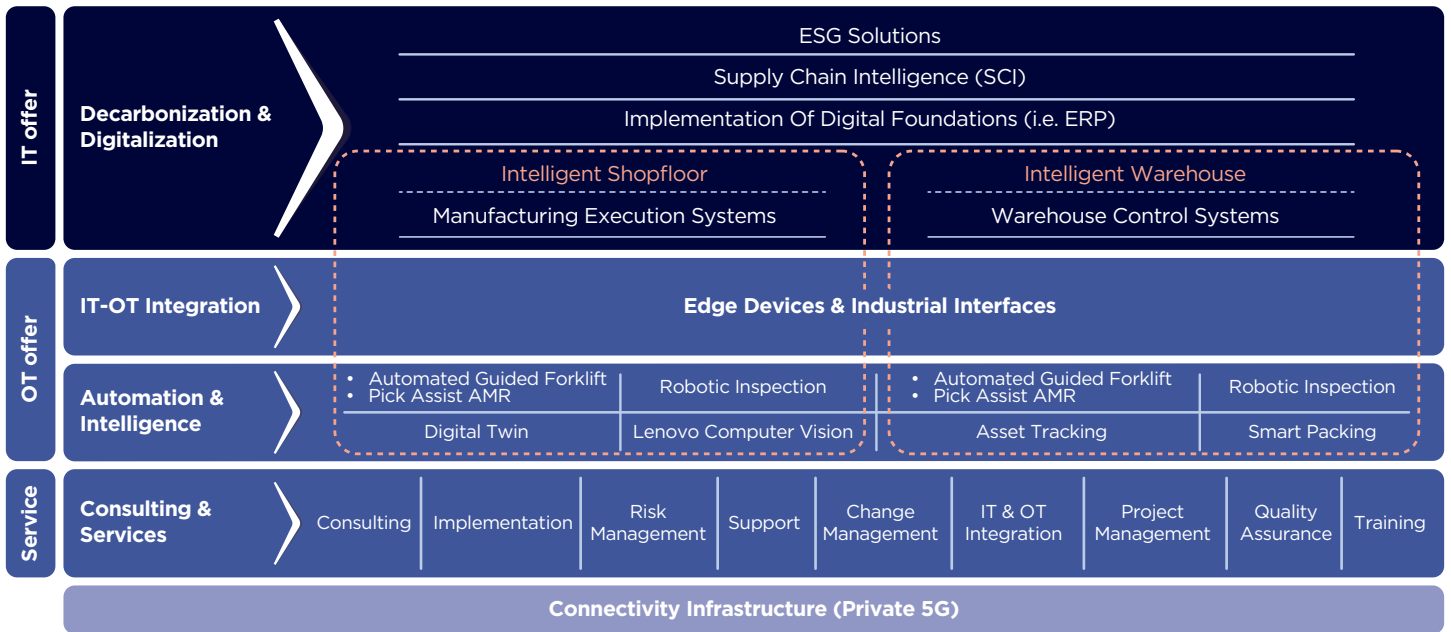


Our Technologies

Our Results

- End-to-end AI-based production planning and scheduling **20%** Increase on average scheduled orders
- Smart workforce planning and optimization **31%** Increase on work-hour utilization rate
- Lights-out flexible assembly testing automation **80%** Reduction on changeover time
- Smart bottleneck identification and close loop problem solving **30%** Increase on units per worker per hour

Our Solution Overview



Our Approach to Smart Manufacturing



Timeline

Week 1	Week 2	Week 3	Week 8-10	Week 10 onwards
Requirements Description & Site Visits <ul style="list-style-type: none"> Business Context Operational Pain Points Industry 4.0 and Sustainability Aspiration Problem Statements Workshop with Project Team 	Projects Review & Prioritization <ul style="list-style-type: none"> Solutions Definition Outline Use-cases Use-cases and Projects Prioritization Workshop with Project Team 	Roadmap and Solutioning <ul style="list-style-type: none"> Engagement with Budget Pricing (ROI) and KPI Impacts 1 x Outline Use-case Proof of Concept Proposal Submission Digitalization Strategy Scoped 	POC and Impacts Validation <ul style="list-style-type: none"> POC Implementation 	Scale up <ul style="list-style-type: none"> POC Sign-off Full Scale Implementation
Deliverables <ul style="list-style-type: none"> Current State KPI Identification 	Deliverables <ul style="list-style-type: none"> Future State Business / KPI Impacts Top 3 Use-Case 	Deliverables <ul style="list-style-type: none"> Proposal for 1 Use-Case 	Deliverables <ul style="list-style-type: none"> Pilot & Validate Use-Case Validate KPI Impact - Productivity, Quality, etc Validate ROI 	Deliverables <ul style="list-style-type: none"> Final Report Presentation Preparation of Full Scale Implementation

Our Key Offerings:



Asset Tracking

Incorporated Real Time Locating System (RTLS) technology, our Asset Tracking service automatically identify and track the real-time location of objects or people. With targeted tracking items equipped with tags and utilizing wireless transmission technologies such as Bluetooth AOA and ultra-wideband (UWB), our system provides accurate and reliable location tracking services in various scenarios. These applications span across warehouse management, inventory management, personnel management, and security monitoring.

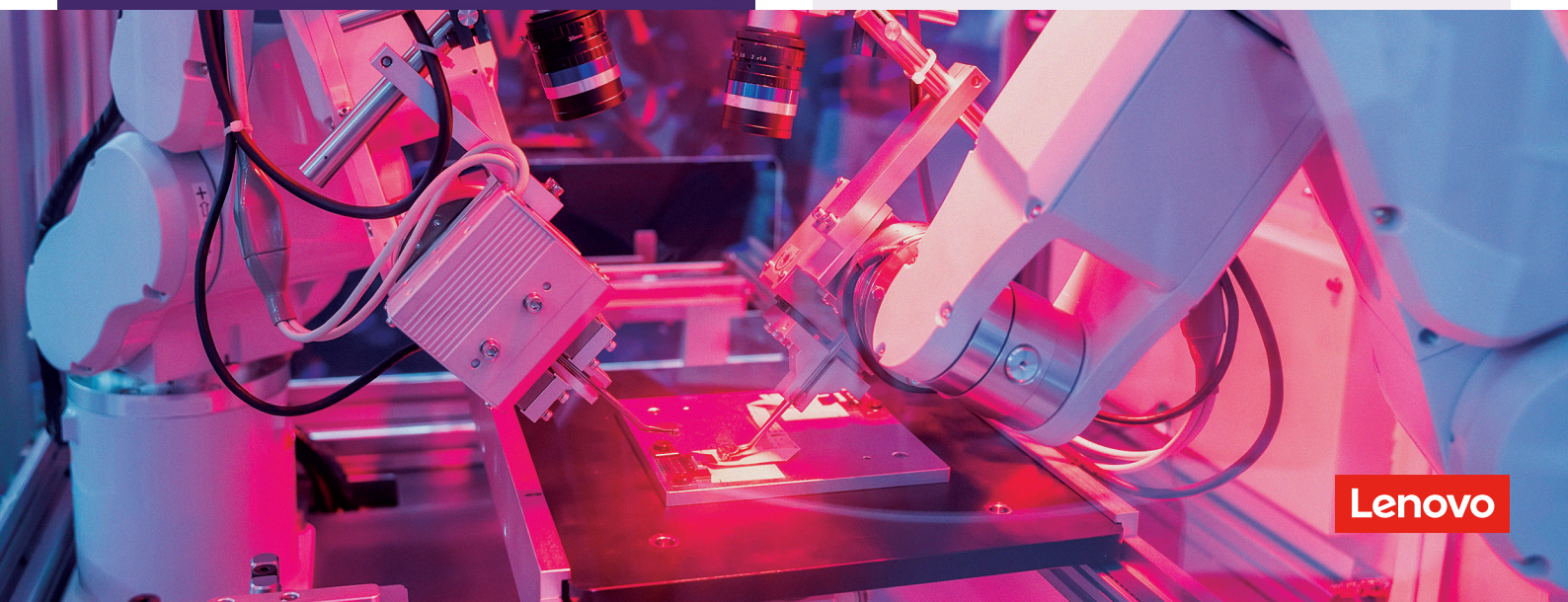
This service offers the best cost optimization, precise positioning (up to 0.5m accuracy), and portable tags in various sizes. By leveraging this advanced positioning technology, businesses can enhance operational efficiency, improve security, and elevate employee welfare. The value-added functions include historical data tracking, real-time synchronization and tracking of cameras in different locations, dynamic rollcall, attendance reporting, generation and supervision of patrol work schedule and monitoring reports.



Pick Assist AMR

It utilizes the most advanced “order-to-person” collaborative mode, eliminating the need for manual route planning, warehouse redesign, or human intervention. When the order comes in, the robot intelligently plans its optimal path based on the order details. It then guides the nearby worker to place the goods onto the robot’s carrier. Once the order is placed, the robot autonomously proceeds to the next pick-up point. The worker does not follow any single robot, but simply moves within a small area and cooperates with different robots.

This service offers maximum convenience to manufacturers as it’s ready to use out-of-the-box. It provides significant cost advantages, saving 50%-80% on labor costs, with a return on investment within 10 months to 2 years. It offers unparalleled flexibility, allowing manufacturers to select the quantity and type of robots based on the dynamic business needs and facility size. You can even choose the service on a subscription, on-demand model. And with our value-added AI functions such as Smart Packing, Advanced Planning and Scheduling, and Optimal Material Assignment integrated into the service, the benefits can be maximized.



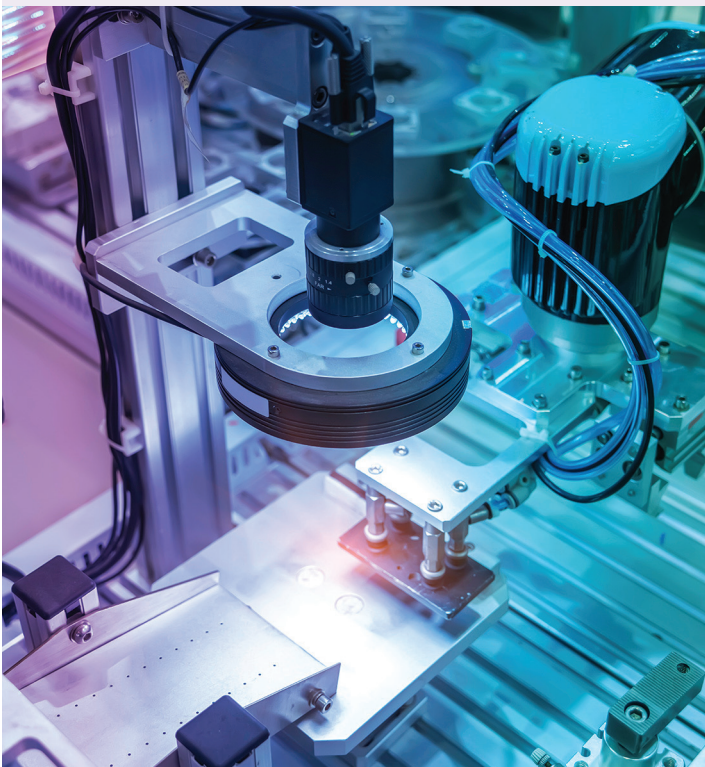
Our Key Offerings:



Lenovo Computer Vision

Integrated with Lenovo's outstanding two-phased AI model training mechanism, we offer this computer vision application in industrial settings and manufacturing environments. It involves the use of advanced imaging devices, edge servers, machine learning algorithms, and AI technologies to capture, analyze and interpret the real-time visual data for different use scenarios, including quality inspection, safety supervision, equipment monitoring, and general monitoring.

With this service, manufacturers find it's easy to have an always-on, reliable and precise monitoring assistant which have no physiological limitations such as visual field, color, resolution, and brightness. The employee welfare and working efficiencies can be greatly enhanced at the same time.



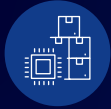
Automated Guided Forklift (AGF)

A solution designed to revolutionize intralogistics operations. With its comprehensive full-stack capabilities, the AGF is capable of seamlessly handling various scenarios and surpassing traditional core applications. From efficiently loading and unloading trucks to executing high-level put away and picking tasks, this innovative forklift empowers your warehouse's entire materials handling process. By leveraging advanced technologies such as autonomous driverless platform, 5G communication, AI, environmental perception, deep learning, and servo control, the AGF redefines the concept of industrial vehicles.

By delving into complex scenarios and facilitating superior human-machine collaboration, the AGF optimizes logistics efficiency, enhances space utilization, and generates significant value for our customers. Its autonomous operation enables unparalleled efficiency and productivity, particularly for repetitive tasks. Implementing the AGF in your intralogistics workflow can lead to a remarkable 30% increase in overall transfer efficiency, with a typical return on investment achieved within 1 to 3 years. In summary, the AGF's ability to enhance efficiency, reduce errors, and provide unmatched flexibility is transforming the management and movement of goods within your warehouse.



Our Key Offerings:



Warehouse Execution System (WES)

A unified data and command gateway between the Warehouse Management System (WMS) and Warehouse Control System (WCS), providing a comprehensive overview of warehouse operations. It offers real-time reporting of errors and exceptions, ensuring uninterrupted operation. The WES has two distinct scenarios: first, as a flexible robotic process orchestration system in smart factories, and second, as a smart warehouse system in various warehousing businesses. This system enables the configuration and optimization of business workflows, allowing users to leverage their domain expertise while leaving operational details to the system.

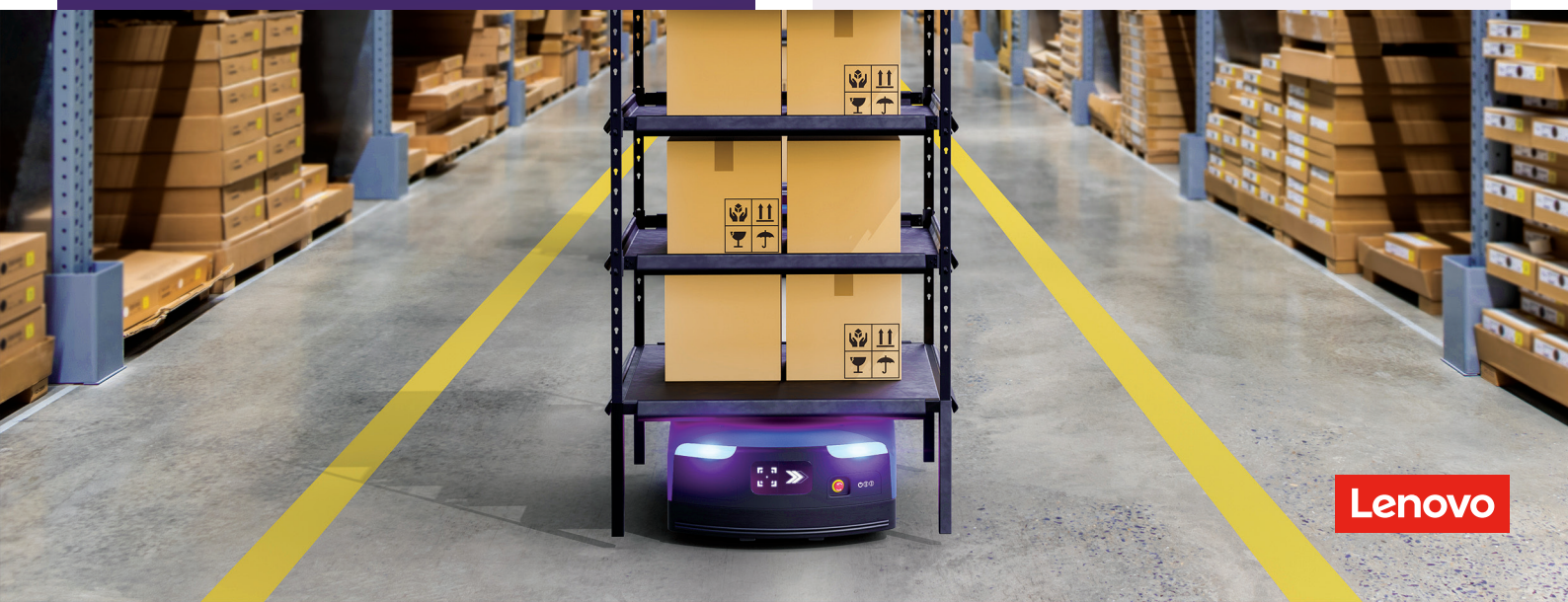
Additionally, the WES offers holistic data dashboards and an integrated exception handling system. All exceptions from automation systems are efficiently managed within a single platform, preventing large-scale shutdown by isolating single point failures. The system seamlessly integrates with existing WMS/ERP/MES systems and employs advanced technologies and artificial intelligence algorithm. It also facilitates the easy configuration of maintenance procedures for different robots or automated equipment. By implementing the WES, businesses can expect to improve operational efficiency by more than 10% and significantly reduce efforts in robotics management.



Automated Storage & Retrieval System (AS/RS)

Also known as 4-way pallet shuttles, this system is an innovative robot-based solution designed specifically for high bay warehouses. With the unique design, distributed control architecture, and intelligent AI-powered software, it automates the storage and retrieval of pallets, and represents the new generation of pallet shuttles. The accompanying software is tailored for large-scale robotics operations, enabling efficient scheduling, algorithm optimization, and seamless inbound and outbound pallet transfers without the need for user interference. This system can be customized to adapt to various warehouse layouts and can be easily adjusted to cater to high selectivity or high-density storage requirements.

By implementing this AS/RS system, businesses can significantly enhance inventory management with real-time visibility and dynamic response, resulting in an outstanding 200% increase in efficiency and a return on investment within three years. Notably, key market-leading parameters include a motion speed of up to 1.5m/s^2 with an acceleration of 2m/s^2 , positioning accuracy of $\pm 2\text{mm}$, and a shuttle vehicle thickness of 125mm.



Our Key Offerings:



Supply Chain Intelligence (SCI)

A centralized hub that revolutionizes supply chain management. It serves as a nerve center, providing immediate visibility, coordination, and management across the entire supply chain ecosystem. By aggregating data from various sources and leveraging advanced technologies such as data analytics and artificial intelligence, it encapsulates the journey from data to insights to decisions and actions.

As one of the pioneering full-function Supply Chain control tower, it helps businesses with end-to-end transparency, enabling them to monitor key performance indicators, track inventory in real-time, and anticipate market demand. This heightened visibility allows for agile responses to market changes, reduce lead times, minimizes stockouts, and optimizes resources allocation. Moreover, this control tower facilitates collaboration by providing cross-functional teams with access to the same information, fostering synchronized actions and improved communication.

It has proven to bring a lot of astonishing results to business, including: 50-60% decision making time reduced, 10-20% working efficiency improved, 20-30% decision accuracy improved, and 20% manufacturing and logistics cost reduced. It has received the following acknowledgement:

- 2021 Global Industry Chain Supply Chain Digital Economy Top Ten Cases awarded by the China Federation of Logistics & Purchasing by standing out from more than 200 cases in the competition.
- Gartner Power of Profession Award (2021)¹
- IDC Supply Chain Technology Leaders Recognition Program (2022)²

¹ Gartner
www.gartner.com/en/articles/these-are-the-best-supply-chains-of-2023
² IDC
www.idc.com/getdoc.jsp?containerId=prAP49377822



ESG Solutions

An innovative solution that addresses the pain points businesses face in ESG (Environment, Social, and Governance) management throughout the entire manufacturing process. It tackles challenges such as ineffective data collection and analysis, complex management processes, and diverse stakeholder expectations. With its automated and traceable data processing feature and highly configurable closed-loop workflows, ESG Solutions provides a comprehensive solution. It incorporates major ISO standards (14001/45001/50001) and RBA specifications, covering 12 crucial ESG KPIs, 14 common factory operational management aspects, and a library of 700+ regulations and industry standards. This ensures thorough support for enterprise ESG management.

It not only effectively reduces the human costs associated with ESG management, but also enhances standardization and flexibility. The system's automated data processing capabilities and highly configurable workflow management improve the efficiency of ESG management processes, contributing to data integrity and accuracy. Moreover, its architectural design offers exceptional scalability and industry adaptability. Customers can select functional modules-based on their specific management needs, allowing for a tailored approach to ESG management. By adopting ESG Solutions, businesses can take a significant step towards sustainable development and empower various industries to create social value.

