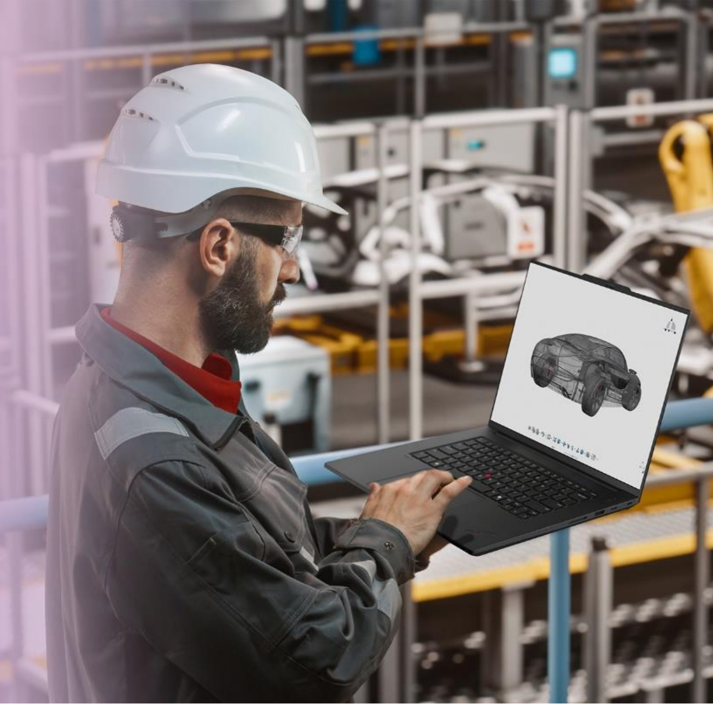
AI PCs in Manufacturing

Lenovo | AMD



Executive Summary

Manufacturing is undergoing a transformative digital shift as advanced technologies redefine production processes, supply chain management, and operational efficiency. Traditional PCs are capable of handling foundational manufacturing processes such as inventory tracking, operational reporting, CAD rendering, and machine monitoring. They provide reliable performance in less intensive environments. However, traditional PCs often face limitations when tasked with real-time processing of massive industrial datasets, advanced predictive analytics, and integration with interconnected systems like IoT and AI-driven platforms. Because these challenges cannot be addressed by a single device, they highlight the need for a comprehensive technology ecosystem that includes servers, edge computing, IoT devices, and a new category of PCs, known as "AI PCs", working in unison.

AI PCs are powered by advanced processors like the AMD Ryzen™ AI PRO 300 Series[1] and represent a critical component of the emerging industrial AI ecosystem. AI PCs leverage their advanced processing capabilities and integrated neural processing unit (NPUs) to enhance local execution of predictive analytics[1], streamline workflows, and facilitate system integration. When paired with robust backend systems and other components of the AI technology stack, AI PCs empower manufacturers to improve productivity, reduce costs, and maintain a competitive edge.

This blog explores how AI PCs, as part of a larger technology framework, can modernize

[1] Lenovo

manufacturing by enabling advanced use cases, including real-time quality control, collaborative robotics, and equipment performance optimization.

Navigating the Future Trends and Challenges in Manufacturing

The manufacturing transformation discussed in the opening paragraph of this article is being fueled by advances in smart factories, including operational automation and the growing deployment of Industrial Internet of Things (IIoT) devices. 76% of manufacturers are using automation in their factories and 40% of manufacturing leaders are currently utilizing IoT in full-scale production environments.[2,3]

While IoT and robotics can help optimize production lines and reduce human error, manufacturers still face operational challenges in adopting and scaling these technologies effectively.

One of the key challenges to scaling AI within the manufacturing sector is the limitation of cloud-based compute power. 44% of respondents in a recent survey[4] cited this as a barrier, particularly in engineering and design tasks such as factory simulation and digital twinning, both of which demand immense computational resources. While cloud-based providers can typically meet these demands, not all manufacturers have access to such solutions. Additionally, inadequate data quality and governance further hampers AI adoption. Approximately 43% of respondents highlighted poor

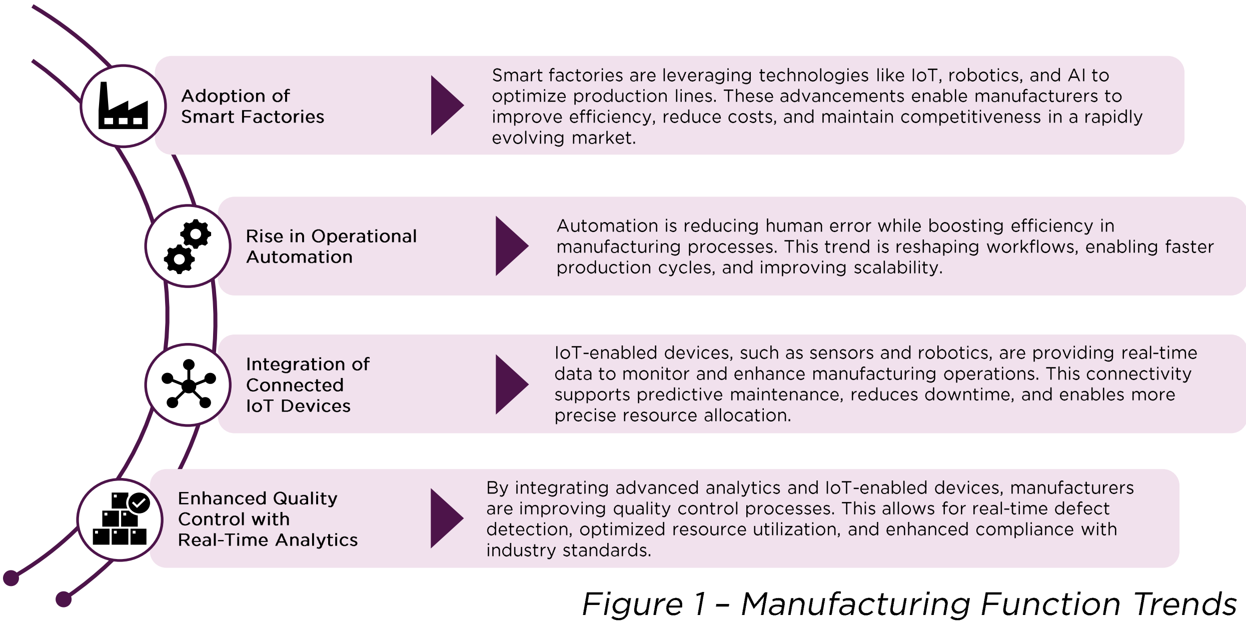


Figure 1 – Manufacturing Function Trends

[2] Katana
[3] Gartner, The 3-Step Process of Contextualizing IoT and Manufacturing Data to Enable Smart Factories, 12 September 2024
[4] MIT - Taking AI to Next level in Manufacturing

data quality as a significant issue in engineering and design, while 42% pointed to data governance challenges in factory operations. Despite the vast quantities of data generated by factory-floor equipment, much of it remains unsuitable for AI models, limiting scalability and effectiveness.

Challenges of Traditional PCs

Adopting AI across manufacturing functions, without exclusively relying on the cloud, requires the ability to locally process data in real-time with seamless integration with

Traditional PC Limitations	Key Challenges	Impact on Manufacturing
Limited Processing Power	• Traditional PCs face difficulty in processing the vast datasets generated by IoT sensors and automation systems in real-time. • A factory with **1,000 IoT sensors produces over 1 million data entries per day** which can overwhelm legacy systems.[5]	• Data analysis processing delays slow down decision-making, affecting production schedules and resource planning. • Limited processing capabilities increase costs and inefficiencies in predictive maintenance and logistics.
Limited Automation and Reliability	• Traditional PCs lack AI-driven capabilities to automate routine tasks such as inventory tracking and scheduling efficiently. • Their battery is not optimized to sustain prolonged AI workloads, hindering their performance in demanding manufacturing environments.	• Without intelligent automation in tasks like scheduling, inventory, and logistics, **manufacturers lose up to 32% in cost savings potential**.[6] • When used for advanced AI workloads, energy inefficiencies in traditional systems could lead to delays and operational costs due to frequent battery-related disruptions.
Inadequate Security Measures	• Traditional device security solutions fall short against threats that target AI applications like prompt injection and local file vulnerability - leaving sensitive information at risk. • Also, they struggle to meet stringent regulatory requirements due to limited built-in compliance tools.	• Data breaches compromise sensitive operational data and intellectual property. • Globally, the manufacturing sector was the most targeted by cyberattacks, **representing 20% of all cyber extortion campaigns.**[7] • The **average cost of a manufacturing data breach is $4.35 million per year** for a company.[8]

Figure 2 – Challenges in Traditional PCs and its impact on Manufacturing

[5] AI In Manufacturing
[6] Automation with intelligence
[7] IBM Index
[8] IBM

Lenovo

different platforms and systems. These requirements often exceed the capabilities of traditional PCs. Although traditional PCs provide foundational support for certain manufacturing processes, addressing the challenges outlined below typically requires a broader technology ecosystem that includes edge computing, servers, and IoT devices. AI PCs, when integrated with these solutions, can play a key role in complementing the ecosystem by enabling localized processing, real-time analytics, and improved operational workflows.

Leveraging AI PCs to Revolutionize Manufacturing

When deployed as part of a broader infrastructure strategy that includes robust backend systems and edge or server solutions, AI PCs, powered by AMD Ryzen™ AI PRO 300 Series processors[10,11], can help to address the above manufacturing challenges. While large-scale IoT networks and ERP platforms rely on edge and server systems, AI PCs complement these technologies by processing data locally and improving coordination across IoT devices and production systems. With AMD PRO Security features like Memory Guard for full-memory encryption and Secure Boot to block unauthorized software, AI PCs enhance data protection against physical theft and cyber threats. This localized security reduces cloud reliance and ensures compliance with strict manufacturing standards.

AI PCs can also improve predictive analytics by optimizing inventory, forecasting equipment failures, and enhancing supply chain responsiveness. They deliver real-time insights at workstations, complementing edge and server infrastructure. By addressing data

What are AI PCs?	*Unlike traditional systems, where AI processing is primarily performed on cloud servers that require constant connectivity and potentially impose high latencies, AI PCs incorporate specialized hardware, such as AI-enhanced processors (i.e., NPUs) to perform these operations locally on the device. This approach reduces reliance on the cloud, enhances real-time performance, and improves data security by minimizing the transfer of sensitive information.*[9]
Advantages of AI PCs	*AI PCs provide benefits across diverse applications, enabling organizations to unlock their full potential:* • ***Personalized**: AI PCs harness AI capabilities to streamline workflows, optimize performance, and enhance user experience.* • ***Productive**: They evolve workdays with AI-driven content creation, predictive insights, and intelligent decision-making.* • ***Protected**: AI PCs bolster digital defenses with proactive security measures, fraud detection, and cyber-resilience.*

Figure 3 – Defining AI PCs and their associated advantages

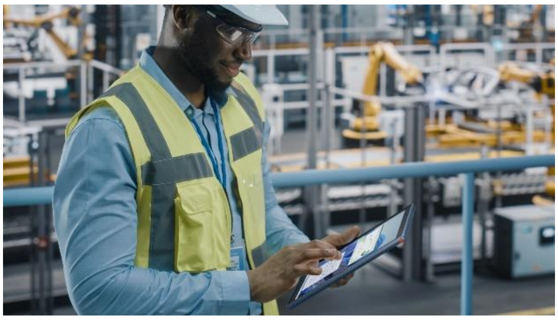
[9] Gartner Press Release
[10] AMD Ryzen™ AI for AI PCs
[11] AMD and AI

silos, security gaps, and processing delays, AI PCs streamline workflows and bolster operational resilience.

Tangible Benefits

By integrating AI PCs into their broader AI technology stack, manufacturers can efficiently execute advanced AI applications for predictive maintenance, inventory optimization, quality control, and production planning.

- **Optimized Resource Allocation**: AI PCs automate routine tasks such as inventory tracking, production scheduling, and logistics, reducing manual errors and improving operational efficiency. By processing real-time data from IoT-enabled systems, they dynamically allocate resources, streamline workflows, and minimize waste, resulting in cost savings and enhanced scalability.
- **Enhanced Precision and Quality**: AI PCs serve as single-source controllers in manufacturing, directly interfacing with individual machines to enhance precision and production quality. By running advanced analytics and machine vision systems locally, they detect defects in real time and provide immediate feedback to the controlled machine. This enables precise adjustments within the production workflow, reducing rework and ensuring compliance with quality standards. While AI PCs typically focus on individual machine operations, their ability to process data locally ensures high-speed performance and consistent production quality.



- **Proactive Decision-Making and Operational Agility**: AI PCs support advanced predictive analytics by processing real-time data from IoT sensors and operational dashboards. When integrated into predictive maintenance platforms, they can help manufacturers anticipate and address equipment issues before failures occur. This capability minimizes downtime, optimizes resource utilization, and ensures greater reliability in dynamic manufacturing environments.
- **Sustainable Manufacturing:** AI PCs promote sustainable

manufacturing by optimizing energy usage and reducing resource waste. Integrated with energy management systems, they identify inefficiencies, enabling manufacturers to implement cost-saving measures that lower their environmental impact. With extended battery life[12], AI PCs deliver reliable performance even during long shifts and demanding workflows, supporting consistent and energy-efficient operations.

Key Use Cases for AI PCs in Manufacturing

AI PCs can enhance manufacturing by enabling advanced applications that traditional systems cannot achieve. These capabilities rely on a comprehensive AI technology ecosystem that integrates AI PCs with modern data architecture, edge computing, IoT devices, on-device inference engines, and secure orchestration tools. AI PCs provide localized processing for real-time analytics and decision-making, while edge and server systems manage large-scale data aggregation and coordination. As part of this ecosystem, AI PCs contribute to transformative improvements in efficiency, quality, and scalability.

Below are key use cases where AI PCs can drive innovation in manufacturing:

Figure 4 – AI PC use cases

[12] AI PCs Performance

- **Enhancing Quality and Efficiency with Smart Edge Computing**
  AI PCs with edge processing capabilities enhance manufacturing when integrated with IoT-enabled sensors, machine vision systems, and edge infrastructure. They run AI software to analyze real-time data, detect inefficiencies, optimize resource utilization, and identify defects or anomalies. Diagnostics and resolutions rely on the software running on these systems, with tools like Copilot assisting in issue resolution by providing relevant manuals or guidance. This integration enables real-time decision-making, continuous production, and compliance with quality standards, improving operational efficiency and quality assurance.
  Example: In a bottling plant, AI PCs run software that monitors sensor data to detect bottlenecks and surface flaws in containers, ensuring uninterrupted operations and high-quality output.

- **Assisting Robots for Collaborative Efficiency**
  Collaborative robots or cobots often rely on servers or edge computing systems. AI PCs can complement these systems by running real-time analytics and AI models locally. This enables cobots to adapt to dynamic workflows, execute precision tasks, and maintain worker safety in environments where immediate decision-making is critical.
  Example: On a smart assembly line, AI PCs support cobots in performing repetitive fastening tasks with millimeter precision and avoiding collisions with human workers by processing localized sensor data in real time. Servers or edge devices manage broader coordination across multiple cobots and systems.

- **Boosting Performance Optimization for Manufacturing Assets**
  Software that analyzes metrics such as temperature, pressure, and load in real time when integrated with IoT devices and operational dashboards. This software enables dynamic adjustments to machine parameters, optimizing equipment performance, reducing wear

and tear, and extending asset lifespan. While the AI PC provides the computational power for localized data processing, the optimization process is driven by the software running on the device.

Example: A factory uses AI PCs to execute software that monitors conveyor load data and adjusts speeds dynamically, reducing mechanical stress and extending belt durability.

- **Streamlining Procurement and Invoicing Processes**
  AI PCs enhance procurement operations by running AI-driven software that automates invoicing, purchase order management, and supplier evaluations. Integrated with ERP systems and IoT devices, this software can analyze procurement data in real time to identify cost-saving opportunities, flag discrepancies in invoices, and ensure timely payments. By automating repetitive tasks and improving data accuracy, AI PCs reduce processing time and enhance overall efficiency in procurement workflows.

  Example: A manufacturing firm uses AI PCs to process supplier invoices in real time, matching them with purchase orders and delivery receipts. Discrepancies are flagged instantly, reducing errors and ensuring timely payments while maintaining cost control.

- **Advancing Warehouse Management and Inventory Optimization**
  AI PCs run software that integrates with inventory tracking systems, IoT sensors, and logistics platforms to enhance warehouse operations. The software enables automated replenishment processes and helps optimize storage layouts. This improves stock management while reducing fulfillment time and holding costs. While AI PCs provide the localized computational power needed for real-time data processing, the functionality is driven by the software executing these tasks.

  Example: A warehouse uses AI PCs to execute software that monitors real-time inventory levels, triggering automatic reorders and ensuring timely restocking to meet production demands without delays.

Conclusion

The integration of AI PCs marks a new technology frontier in manufacturing. These cutting-edge systems can, as part of a larger technology framework, help to address the limitations of traditional technologies, enabling faster, more efficient, and highly precise operations across the entire manufacturing ecosystem. From optimizing production workflows and streamlining resource management to enhancing quality control and operational agility, the synergy of all these advanced tools working together can drive transformative progress in modern manufacturing.

Next-gen AI performance has arrived. The benefits of AI are now available for your organization, without compromise with the Lenovo ThinkPad T14s Gen 6 powered by AMD Ryzen AI 7 PRO 360 processors.