

● **INDUSTRIAL MACHINERY
MANUFACTURING SOFTWARE STACK**

● **FROM SHOP FLOOR SYSTEMS TO
AI-ORCHESTRATED PRODUCTION**

Technology Research Report



Prepared by **Devox Software**
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THE CORE TRENDS REDEFINING ENTERPRISE DOCUMENT PROCESSING



Industrial machinery is going through a major shift. Ten years ago, production relied on traditional shop floor systems — MES, ERP, SCADA, along with manual logs and spreadsheets. Today, these systems are increasingly supported by data-driven models and more advanced automation.

Digital twins, generative models, and agent-based systems are starting to coordinate parts of production — from material planning to maintenance of high-value equipment.

This matters especially in industrial machinery, where companies build complex, highly customized machines designed to operate for decades in demanding environments. In this context, moving beyond traditional shop floor systems opens up real opportunities: higher productivity, less downtime, and new service-based business models built around connected equipment.

This research addresses a clear gap. Most academic and industry work focuses on automotive or high-tech sectors. Here, the focus is on industrial machinery, with a structured view of the software stack — from legacy shop floor systems to more integrated, data-driven production.

The goal is to trace how the manufacturing software stack is evolving in this sector, identify the key technological, organizational, and workforce factors behind this shift, and propose a practical framework adapted to the realities of heavy machinery.

The study covers the historical evolution of the stack, the current state of MES, ERP, and PLM, as well as emerging technologies such as digital twins, generative models, and agent-based systems. It also introduces a six-layer orchestration model, supported by real-world cases, key risks, implementation steps, and directions for further research.

Overall, the shift from traditional shop floor systems toward more coordinated, data-driven production is becoming a structural change. Companies that move early are in a stronger position to shape how the industrial machinery sector evolves.

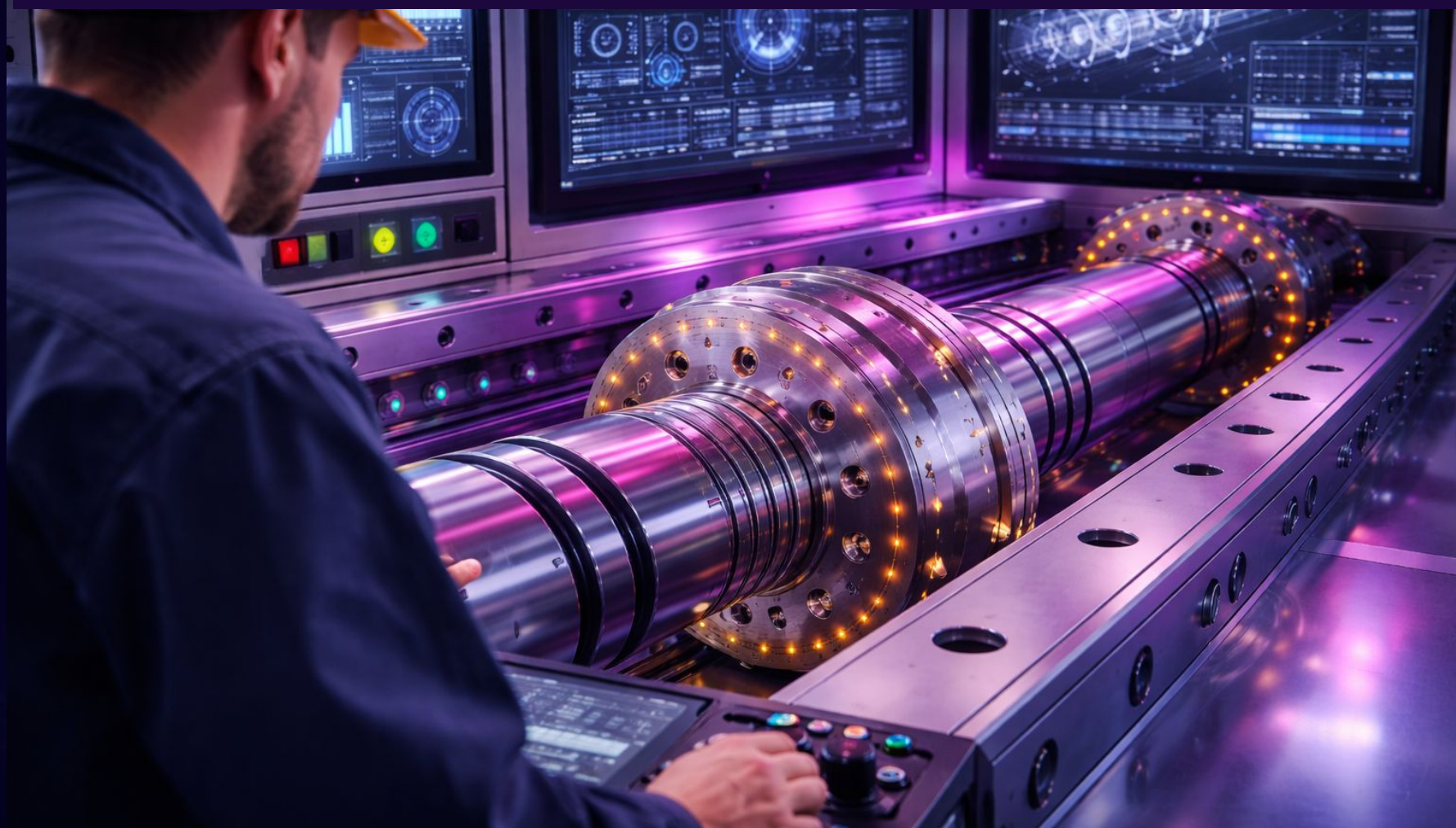
CURRENT MANUFACTURING SOFTWARE STACK IN INDUSTRIAL MACHINERY



In industrial machinery, digital solutions already play a central role in automation efforts. 69% of manufacturers and equipment providers consider them a key part of the modern software stack, alongside MES, ERP, and IIoT integration.

Looking ahead, their role will only grow. According to McKinsey, 94% of respondents expect digital solutions to be important for operational automation in the coming years, driving deeper integration of IIoT on top of existing MES and ERP systems. In practice, manufacturers of industrial equipment focus on a clear set of use cases: remote monitoring, remote maintenance, predictive maintenance, and OEE optimization. These are the areas most actively being integrated into today's software stack, from shop floor systems to IIoT platforms.

The broader market reflects this shift. The global industrial automation market — including software for discrete manufacturing and industrial machinery — is expected to reach \$115 billion by 2025, growing at a 3.5% CAGR since 2019. Within this, IIoT and cloud services stand out as the fastest-growing segment, with a CAGR of 18%. Despite this progress, the core stack still relies on legacy systems such as ERP, MES, and PLM. At the same time, digital solutions are increasingly seen as a key driver of improvement, with most companies prioritizing remote monitoring, predictive maintenance, and OEE optimization as the next steps for integration.



EMERGING TECHNOLOGIES AND THE SHIFT TO AI-ORCHESTRATED PRODUCTION



Digital twins in industrial machinery are growing fast. The market is expected to expand at a 35–40% CAGR through 2030, giving manufacturers a way to move beyond traditional shop floor systems toward more predictable operations, including performance forecasting and maintenance planning.

At the same time, IIoT and cloud services — a core part of this transition — show the fastest growth across industrial automation, with a CAGR of 18.3% between 2019 and 2025. This enables more consistent data flow from the shop floor into production systems.

Adoption is already widespread. 78% of organizations use AI in at least one business function, and 92% of executives plan to increase investments over the next three years. This creates a strong foundation for more coordinated, data-driven production.

The shift is also driven by external pressure. 67% of manufacturers accelerated digital initiatives during the pandemic, while nearly 44% of engineering skills are expected to change within the next five years.

Workforce readiness becomes critical here. Around 50% of employees will require digital upskilling by 2025, making data-driven production approaches an important factor for competitiveness.

Perception is already shifting. 69% of respondents see digital solutions as a key part of automation today, and 94% expect them to play a central role in the future, pointing to a broader industry transition.

Finally, partnerships are becoming a practical path forward. 54% of manufacturing companies are now building IIoT platforms together with OEMs — an almost eightfold increase since 2019 — helping move from fragmented legacy systems toward more integrated production environments.

CHALLENGES, BARRIERS AND RISKS



More than 70% of industrial machinery companies see the rollout and scaling of technologies like IIoT, AI, and digital twins as highly complex. As a result, many initiatives get stuck in “pilot purgatory” and fail to deliver clear improvements in ROI or shop floor performance.

The issue becomes even more visible at the leadership level. Only 1% of executives consider their organizations mature in using AI, even though most are already investing. In many cases, progress slows down due to a lack of alignment and ownership when moving beyond legacy shop floor systems.

Risk and security concerns remain a major blocker. Around 66% of respondents point to these factors as the main challenge when scaling more advanced, autonomous systems in manufacturing.

Skills and training gaps add further pressure. Nearly 60% of organizations highlight limited knowledge as the key barrier to adopting responsible practices, making implementation slower and less consistent.

At the same time, 46% of industrial leaders point to workforce skills as one of the biggest constraints. This applies both to shop floor operators and engineers working with newer systems such as digital twins.

Trust in technology also plays a role. 74% of respondents highlight inaccuracy, while 72% point to cybersecurity as the most critical risks when scaling these solutions, which affects confidence in more automated production environments.

In many cases, organizational challenges create more friction than technical ones. Misalignment between IT and OT, lack of shared ways of working, and gaps in cross-functional skills often slow progress more than the complexity of the systems themselves.

FUTURE RESEARCH DIRECTIONS



Future research in industrial machinery should focus on advancing digital twins, as the market is expected to grow at a [35–40%](#) CAGR through 2030. This creates real opportunities to improve production systems, while also raising open questions around integration with agent-based systems and edge computing on the shop floor.

- In the coming years, the research agenda should cover 14 key [digital twin](#) R&D directions, including standardization, scalability, and integration with generative models. These areas are critical to support the shift from traditional shop floor systems to more autonomous production environments.
- Alongside this, more attention is needed on how people work with intelligent systems. Automation could increase global productivity by [0.8–1.4%](#) annually, yet it also requires new ways of coordinating operators, engineers, software agents, and robotics at the shop floor level.
- Workforce impact remains another priority. Close to [50%](#) of employees will require digital upskilling between 2025 and 2030, which calls for more empirical research into reskilling approaches for environments built around digital twins and AI-driven systems.
- At the same time, the global AI market is projected to reach [\\$335](#) billion by 2026. This underlines the need for more industry-specific research in industrial machinery — from predictive maintenance to broader production coordination — with a clear focus on ROI and cybersecurity.
- Overall, the transition from traditional systems such as MES, ERP, and PLM toward more coordinated, data-driven production already shows strong potential. Digital twins and generative models improve OEE and maintenance practices, while also shaping new competitive advantages, pushing companies to move faster to keep their position.

NEXT-GEN MANUFACTURING ROADMAP



This roadmap serves as a practical guide for industrial machinery manufacturers moving from traditional shop floor systems to fully AI-orchestrated production. Each step builds on the previous one and reflects real organizational, technical, and human challenges. Ready to tailor it to a specific plant or add concrete tool examples?

1

Understand what actually runs your plant

Start with how work truly flows on the shop floor. Follow orders across MES, ERP, spreadsheets, and operator decisions. Focus on handoffs between systems, where most inefficiencies emerge.

2

Fix data before scaling tech

Bring consistency to data formats, ownership, and timing. Ensure information arrives fast enough to support decisions. Reliable data creates the base for every next step.

3

Make machines observable

Capture meaningful signals from equipment: states, cycles, failures, and operator actions. Digital twins should reflect real behavior closely enough to support operational decisions.

4

Start with decisions

Choose specific decisions that slow operations or create variability — scheduling, maintenance timing, resource allocation. Improve them first, then expand toward more autonomous coordination.

5

Align people with the system

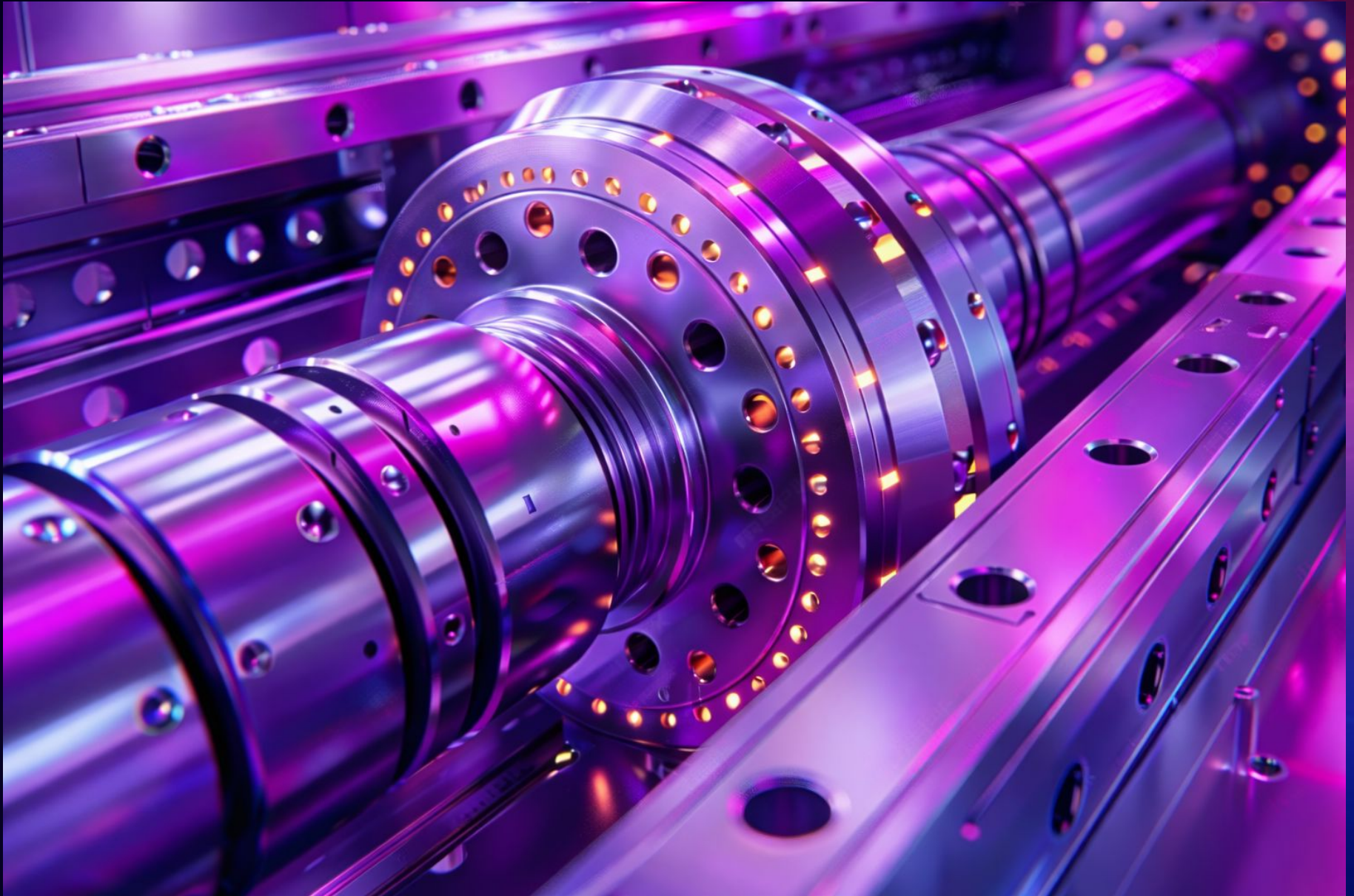
Train operators and engineers to work alongside system-driven decisions. Build feedback loops and clear override mechanisms. Trust grows through transparency and consistent results.

6

Scale what works

Run pilots, measure outcomes, and expand proven improvements across lines and plants. Keep the focus on performance gains and continuous iteration.

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