From monolith to agentic AI readiness

A practical path for manufacturers to introduce AI-powered efficiency that scales.

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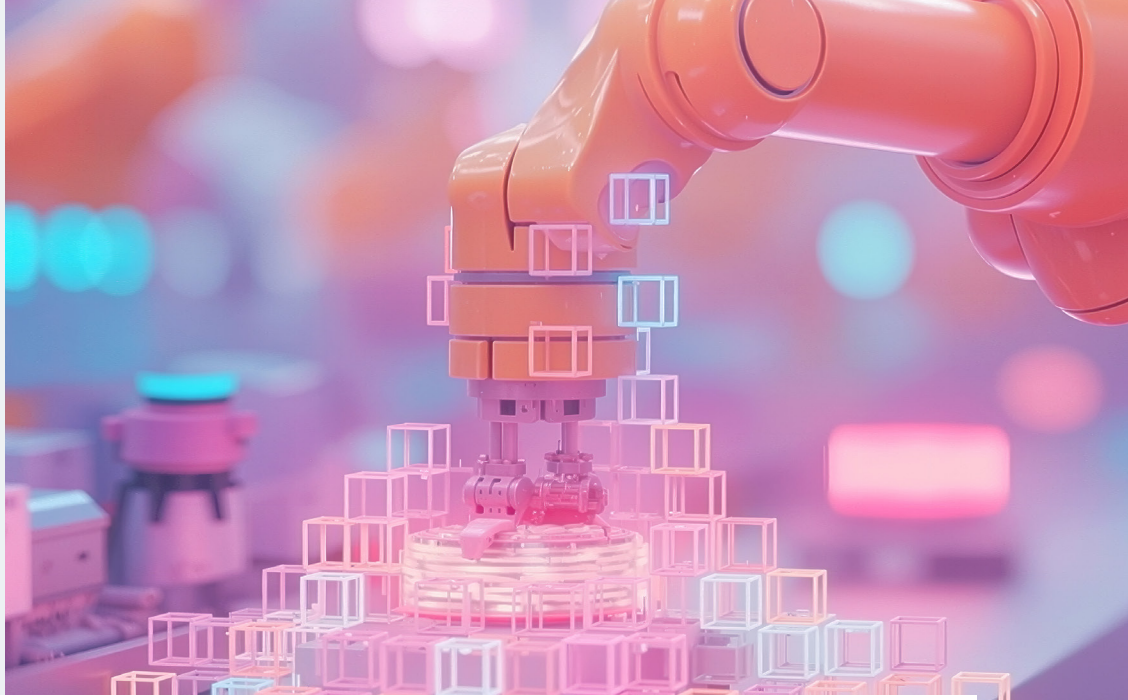
Design. Engineering. AI.

Engineering excellence must become digital advantage



German manufacturing built its global position through engineering excellence. Business R&D performance stands at 143% of the EU average, yet digitalization performance is only 82.8%.[1,2] Closing that gap is increasingly important as manufacturers pursue connected services, software- and AI-defined products and greater efficiency.

Modernization provides the bridge, but initiatives are often postponed because they initially appear to be “all cost.” Seen as business reimagination, modernization reduces operational and talent risk, increases agility, limits vendor dependency and creates the foundation for real-time operations, AI-native workflows and agentic AI.

The opportunity is substantial: 84% of manufacturers report measurable value from AI, yet only 20% of use cases scale consistently.[3] Skills, adoption and operating models all influence success, but technical readiness remains fundamental. This ebook focuses on two of the biggest barriers: legacy systems and fragmented data.

1 European Commission, European Innovation Scoreboard 2025: Germany country profile, July 2025.
2 European Commission, Summary: Europe scores well in innovation, Germany ranks 9th in the group of strong innovators, July 2025.
3 Deloitte, AI in Manufacturing 2026: From pilot value to scaled industrial impact, Accessed August 2026.

Two constraints keeping AI implementation small

Legacy dependencies

Many manufacturers' core capabilities still depend on decades-old mainframes, embedded code, application monoliths and complex ABAP/SAP landscapes. Tightly interwoven business logic makes even small changes slow and costly—and makes it difficult for agents to access capabilities securely through standard interfaces.

Data readiness

Agentic AI also needs trustworthy, governed data at operational speed. Yet gaps in data literacy, quality, ownership and governance create silos. Batch-heavy platforms such as DataStage and Teradata, proprietary tools and decades of accumulated integration logic make these environments difficult to change. As a result, teams struggle to deliver reusable data products quickly enough to support new AI use cases.

40%

of German manufacturers say they still find digital data exchange too complicated for their company.[4]

4 Bitkom, Industrie 4.0: Schon 42 Prozent der Unternehmen setzen KI in der Produktion ein, March 27, 2025.

The solution path: One value chain, three stages

Start

Legacy, monolithic systems | Fragmented operational data | Isolated AI pilots

Thoughtworks and AWS engagement

Stage one

- Mitigate risk through incremental modernization using the Strangler Fig pattern
- Apply AI-first reverse engineering across applications, mainframes, embedded systems, SAP and legacy data ecosystems
- Design a resilient target architecture

Stage two

- Create trusted data products
- Support automated and AI-first design, delivery and deployment
- Prepare governed data for AI consumption

Stage three

- Embed agents into operational workflows
- Scale successful use cases
- Measure business performance continuously

Outcomes

Faster time to market | Lower delivery cost | More reliable operations | Risk mitigation for critical systems | Revenue growth

Stage one:

Modernize with minimal risk

Manufacturers cannot pause production while replacing the systems behind procurement, R&D and product lifecycle management, logistics, production or sales. That is why Thoughtworks uses incremental modernization and the Strangler Fig pattern: building new capabilities beside the existing system, exposed through a secure interface and validated against current behavior. Traffic moves only when the replacement performs reliably. This limits the scope of each change and avoids a high-risk, big-bang cutover.

Modernizing one capability at a time first requires a clear understanding of the existing system. AI-assisted reverse engineering automatically analyzes legacy code and transforms it into a knowledge graph and detailed specifications. These capture architecture designs, dependencies, APIs and the mappings between code, functions and business capabilities. This significantly reduces manual effort, lead time and modernization investment, while creating documentation that may have been missing for years or known only to a few specialists.

That recovered knowledge becomes a blueprint for the rebuild. Approved specifications guide AI-assisted development, testing and validation while maintaining traceability from existing behavior and business requirements to the replacement system. Human review and business validation remain central throughout. Together, these techniques make modernization faster, less labor-intensive and less risky.

Proof in practice

A global industrial equipment manufacturer worked with Thoughtworks to modernize a complex mainframe workload on AWS. Using AI-assisted analysis and automated validation, **work originally scoped for 18 months was delivered in approximately five.**

Read the case study.

Stage two:

Make trusted data ready for real-time use

AI cannot scale when every use case must negotiate a different dataset, ownership model and quality standard. Thoughtworks treats data as a product: reusable, discoverable and governed for a defined consumer and business outcome, with ownership, lineage and data-quality rules built in. With the Data Product Workbench, teams begin by describing a defined use case. An AI-native designer uses that description and open data product standards to create the product design. The design then generates a fully editable specification that accelerates automated development and deployment.

Human review remains central: teams can refine attributes, data-quality parameters and specifications before deployment. This specification-driven approach can reduce data-product delivery time by 60–80%, enabling simple products to be created in hours and complex products in two weeks or less. Finished products and their metadata are registered in the organization's data catalog, where they can be governed and maintained. AI agents can consume them through standardized model context protocol (MCP) connections.

The Legacy Data Migration Accelerator analyzes legacy landscapes and automates migration to modern platforms through a standardized delivery model, resulting in up to 60 times faster migration and up to 90% shorter end-to-end lead times.

This specification-driven approach can reduce data-product delivery time by

60–80%[5]

5 Thoughtworks, Modernizing at scale through AI-powered data transformation, accessed September 2026.

Stage three:

Move agents from isolated pilots to governed operations

Stage one separates core capabilities from legacy systems and rebuilds through secure interfaces. Stage two prepares trusted data for analytics, AI and real-time use cases.

In this final stage, Thoughtworks applies both foundations to a high-value workflow, working with the manufacturer to build a production-ready agent on Amazon Web Services (AWS).

The agent can use approved data and interact with modernized systems to complete governed tasks. Thoughtworks defines what actions it may take, where human judgment remains essential and how outcomes will be measured. A repeatable release process allows teams to test and improve the agent as models, workflows and requirements change.

As agents spread across the enterprise, governing them individually becomes difficult. Agent/works™ by Thoughtworks provides a single control plane for registering, observing and managing agents across frameworks, models and tools. It validates policies before execution, applies permissions and runtime controls, maintains audit trails and provides visibility into performance, resource use and cost—helping manufacturers apply consistent standards at scale.

Proof in practice

An industrial original equipment manufacturer (OEM) worked with Thoughtworks to modernize its digital aftermarket experience. Using machine telemetry and purchase history, the solution **increased revenue 85% year over year.**

Read the case study.

Organizational readiness: The success factor across all stages

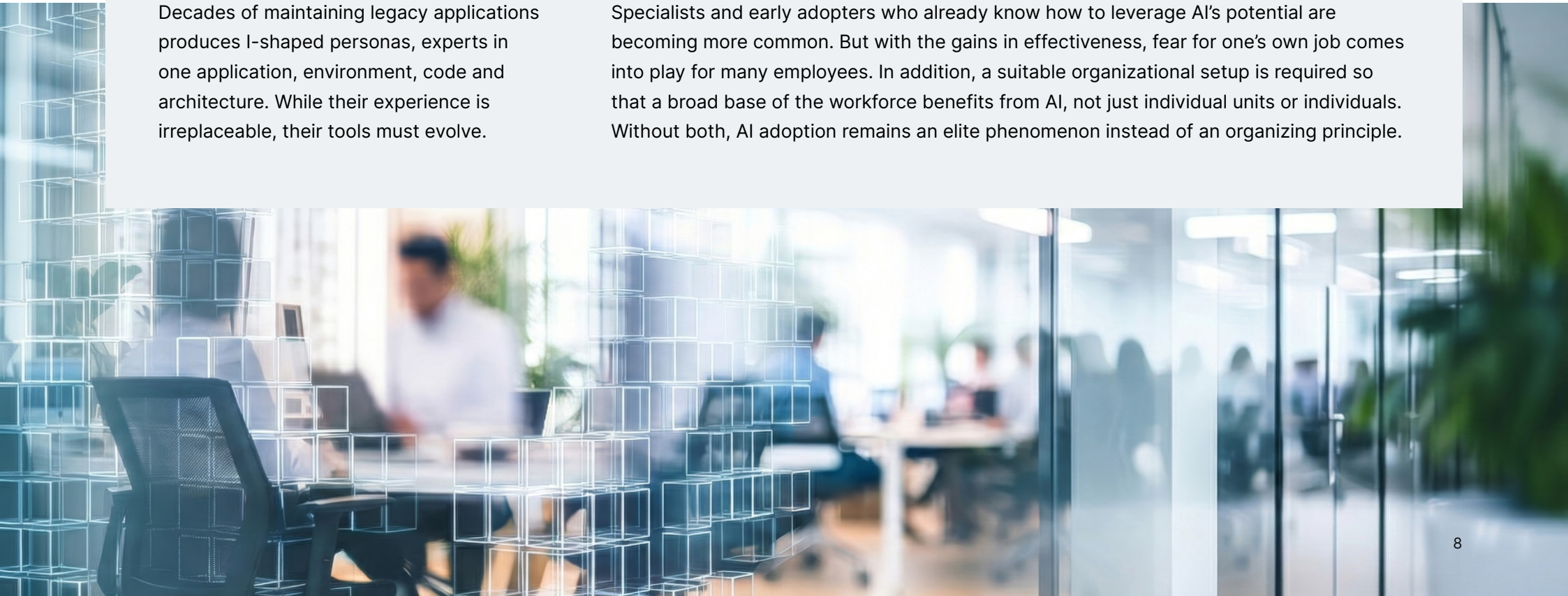
The best technology path fails if the organization can’t walk it. In both legacy modernization and implementing AI at scale, organizational hurdles are often underestimated.

Challenge 1

Decades of maintaining legacy applications produces I-shaped personas, experts in one application, environment, code and architecture. While their experience is irreplaceable, their tools must evolve.

Challenge 2

Specialists and early adopters who already know how to leverage AI’s potential are becoming more common. But with the gains in effectiveness, fear for one’s own job comes into play for many employees. In addition, a suitable organizational setup is required so that a broad base of the workforce benefits from AI, not just individual units or individuals. Without both, AI adoption remains an elite phenomenon instead of an organizing principle.



The Thoughtworks answer: Upskilling by doing

Beyond training and change management, at Thoughtworks we believe above all in learning through real work. For this, we developed a framework for Talent Development & Enablement:

70% through delivery
Solve real problems alongside embedded practitioners.

20% through peers
Share knowledge through communities of practice and coaching.

10% through training
Build targeted technical, domain and leadership skills.

The co-delivery model as the enablement engine

In our delivery model, Thoughtworks consultants and client employees are united into one team. We bring methodological and technology competence and support our clients through hands-on, direct delivery until the client can evolve the product and solution independently of Thoughtworks with no lock-in effect and no heavy dependencies.

Let’s build your AI momentum

Postponing modernization carries long-term costs: slower change, reliance on scarce skills, fragile data flows and AI investments that remain trapped in pilots.

Thoughtworks combines modernization expertise, AI-assisted accelerators and AWS technology to help manufacturers reduce risk and turn isolated technical wins into repeatable operational value. Modernization is more than a cost consideration, it’s the first step in building what comes next.

aws PARTNER

- AI Services Competency
- Data & Analytics Services Competency
- Mainframe Modernization Services Competency
- Migration and Modernization Services Competency

In a complimentary 60-minute working session, Thoughtworks modernization and data experts examine your current AI readiness and recommend a practical way forward on AWS.

Book your AI readiness session

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