SOPHIZO

INDUSTRY PLAYBOOK · MANUFACTURING & INDUSTRIAL

Downtime is a data problem. Stop solving it with phone calls.

Agentic AI for predictive maintenance, production scheduling, and quality at industrial scale.

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Fractional AI & RevOps Leadership
sophizo.net

Unplanned downtime costs $1.4 trillion globally each year. Most plants still respond to it the same way they did in 1995.

Sensors are everywhere. Telemetry is plentiful. The problem is that nobody is stitching it into a real-time decision. Agentic AI shortens the loop from anomaly to action into minutes. And turns the same loop into a learning system that prevents the next failure.

Why this matters now

A bearing fails on Line 3, and the path from anomaly to maintenance ticket to spare-parts pull to scheduled stop runs through a clipboard. Agentic AI treats the plant floor as one continuous decision system. The factories that figure this out are not just more efficient. They are harder to compete with.

> *If a bearing on Line 3 failed at 2 a.m. tonight, who is the first human to know. And how?*

Operational AI on the factory floor is regulated as a safety system, a product, and a workforce decision.

Beyond the six global regimes, manufacturing & industrial carries the overlays below. Each one has its own enforcement model and its own evidence expectation.

ISO/IEC 23894 ISO/IEC 23894 AI Risk Management

GLOBAL HIGH

Applies to. Industrial AI systems including predictive maintenance, quality vision, autonomous production lines.

Key obligation. Risk-based approach integrated with existing ISO 31000 enterprise risk management.

Evidence. AI risk register, treatment plans, monitoring records.

EU Machinery Reg EU Machinery Regulation 2023/1230 (AI safety-critical)

EUROPEAN UNION
CRITICAL

Applies to. Any AI-enabled safety component in machinery placed on the EU market. Applies from January 2027.

Key obligation. Conformity assessment by notified body for safety-critical AI. Documentation of AI behavior under foreseeable misuse.

Evidence. Risk assessment, technical file, EU declaration of conformity, post-market surveillance.

OSHA AI OSHA + state worker safety AI guidance

UNITED STATES, FEDERAL + STATE
ELEVATED

Applies to. AI used in worker monitoring, autonomous mobile robots, robotic process automation in safety-critical paths.

Key obligation. General duty clause applies. Robotic safety standards (ANSI/RIA R15.06 / ISO 10218) extended to AI behaviors.

Evidence. Risk assessments, training records, incident logs.

Supply chain AI Supply Chain AI Disclosure Laws (CA AB 1018, NYC LL 144 analogs)

UNITED STATES, STATE-LEVEL
MODERATE

Applies to. AI-driven supplier selection, vendor scoring, and procurement decisions in regulated states.

Key obligation. Disclosure of automated decision-making in supplier relationships above certain thresholds.

Four capability domains. One operating layer.

01 Predictive Maintenance Orchestration

- Anomaly detection across IoT and SCADA
- Auto-generated work orders with parts pulls
- Failure-mode learning across the fleet
- HITL escalation for safety-critical assets

02 Production Scheduling and OEE

- Multi-constraint scheduling agents
- Real-time replanning when reality breaks the plan
- OEE diagnostics by line, shift, and SKU
- Energy-aware scheduling

> *When IT and OT disagree on agent permissions, which one wins in your shop?*

Capability domains, continued.

03 Multi-Agent Inventory and Quality

- Replenishment agents that talk to suppliers
- Vision-based quality with retraining loops
- Defect root-cause investigation
- Recall-impact simulation

04 Industry 4.0 Governance

- OT/IT convergence policy
- Zero-trust agent identity on the plant floor
- Simulation-first deployment of high-risk agents
- Safety-case documentation for regulators and insurers

What production deployments look like at scale.

20 to 50%
EFFICIENCY AND OEE UPLIFT

171%
MEDIAN ROI

12 to 18 mo
PAYBACK INCLUDING LEGACY INTEGRATION

Production-stage benchmarks compiled from Deloitte 2024 Smart Manufacturing study, ARC Advisory Group manufacturing analytics, and Gartner 2025 Industry 4.0 forecast. Your spread depends on sensor coverage, MES integration depth, and OT/IT governance.

The AI Officer Mandate.

Three responsibilities a Fractional AI Officer owns from day one in manufacturing & industrial.

01
Operational resilience. Agents are designed to fail safely, not silently.

02
Industry 4.0 governance that treats agents as engineered components subject to FMEA, not as IT projects.

03
Cross-functional alignment between plant ops, IT, OT, and EHS so agent rollout does not stall on org charts.

06 · A 90-DAY PATH

How a Sophizo engagement starts in Manufacturing & Industrial.

DAYS 1 TO 30

Diagnose

MAP THE OPERATING REALITY

- AI system inventory across the operation
- Risk and value-tier mapping by use case
- Vendor and integration audit
- Board-ready findings memo

DAYS 31 TO 60

Architect

DESIGN THE AUTONOMY BOUNDARY

- Agent permissions and escalation policy
- Evidence file and audit trail design
- First production pilot scoped with rollback plan
- Cross-functional governance committee charter

DAYS 61 TO 90

Operate

SHIP AND INSTRUMENT

- First agent in production with HITL controls
- Operator coaching and policy refinement
- P&L instrumentation by use case
- Quarterly review cadence established

What we will not do.

We do not run your MES upgrade, sit on the safety committee, or sign off on FMEAs. We do not propose closed-loop control on safety-critical assets inside the first 90 days of any engagement, regardless of how mature your data looks on paper. We pass on plants where IT controls all OT permissions and OT has no veto, because the first agent failure becomes a finger-pointing exercise instead of a learning loop.

07 · WHAT THE BOARD NEEDS TO HEAR

Five things the board needs to hear about AI on the plant floor.

Five cited insights for the next risk-committee meeting. Each one is sourced. Each one is what an experienced AI Officer would put in front of the board if they walked in tomorrow.

01 · THE DOWNTIME LINE

Unplanned downtime is now a 1.5 trillion dollar global cost.

The 2023 Siemens and Senseye True Cost of Downtime study put the Fortune Global 500 figure at $1.5 trillion annually. The average industrial downtime event costs roughly 129 dollars per minute, before any cascading service impact. Predictive maintenance ROI is the lowest-friction agent business case in manufacturing.

Source. Siemens / Senseye, The True Cost of Downtime, 2023.

02 · THE OT BOUNDARY

Most plant-floor AI fails at the OT and IT boundary, not at the model.

NIST Special Publication 800-82r3 (September 2023) and IEC 62443 set the explicit expectation that ICS environments need their own change control, identity, and segmentation discipline. The plants that operationalize this make agent rollout boring. The ones that do not stall in pilot for years.

Source. NIST SP 800-82r3, Guide to Operational Technology Security, September 2023; IEC 62443-3-3.

03 · THE BENCHMARK

The WEF Lighthouse Network shows the operating model matters more than the stack.

The Global Lighthouse Network's 2024 annual report tracks 153 designated factories. Average productivity gains in the cohort sit around 50 percent. Cost of poor quality dropped roughly 22 percent. The technology stacks vary widely. What does not vary is C-suite governance and cross-functional ownership.

Source. World Economic Forum, Global Lighthouse Network 2024 Annual Report.

Two more, then the framework.

04 · THE SAFETY FRAME

OSHA liability stays with the employer when an agent acts.

OSHA's enforcement posture treats automated decision systems as employer tools. The plant manager and the EHS officer remain accountable for safety outcomes regardless of which model influenced the action. That places the burden of safety-case documentation squarely on the deploying organization, not the vendor.

Source. OSHA Compliance Directive CPL 02-02-079 (current); BLS 2024 Workplace Injury and Illness data.

05 · THE PAYBACK

Predictive maintenance ROI is real and back-loaded.

Deloitte's 2024 Smart Manufacturing study reports median PdM ROI of 171 percent at 18 months across surveyed sites. ARC Advisory Group's 2024 APM market study finds adoption stalled at roughly 35 percent of plants beyond pilot. The economics work. The change management is the moat.

Source. Deloitte 2024 State of Smart Manufacturing; ARC Advisory Group 2024 APM Market Study.

The OT-IT Boundary Map.

Every plant-floor agent action sits in one of four zones. Decide who has authority in each before deployment, not during the post-incident review. The whiteboard cost of mapping zones is dwarfed by the cost of resolving authority during a near-miss.

ZONE 1

Telemetry

Read-only data flowing out of the plant. No risk class. Default open.

ZONE 2

Recommendation

HMI surface with proposed action. Operator approves before commit.

ZONE 3

Supervised loop

Agent adjusts non-safety-critical setpoint inside a documented envelope.

ZONE 4

Safety-critical

No agent authority. Human approval and dual sign-off. No exceptions.

CROSS-ZONE

Authority map

Signed jointly by EHS, OT, and CISO. Reviewed quarterly.

From John Utley.

> *I have walked plants where IT believes OT is reckless and OT believes IT will never understand a turbine. Both are wrong, and the agent project dies in the middle. Settle the boundary on a whiteboard before you write a procurement spec. Otherwise you are buying a six-figure consensus problem.*

John Utley

FOUNDER, SOPHIZO · SEATTLE, WA

John Utley founded Sophizo to give growth-stage companies the AI and revenue architecture work historically reserved for the Fortune 500. He writes and advises on agentic AI governance, predictive forecasting, and operating-model design for boards and operators across manufacturing & industrial and adjacent sectors.

Test your operating picture against these.

1

If a bearing on Line 3 failed at 2 a.m. tonight, who is the first human to know. And how?

2

When IT and OT disagree on agent permissions, which one wins in your shop?

3

Your last unplanned-downtime hour cost roughly $40,000. Why is the post-mortem still a slideshow?

Frequently asked questions.

Our OT and IT teams do not always agree. How do you handle that?

We bring them to the same table on day one and write the agent governance policy together. Most plant-floor AI failures are not technical. They are a mismatch between IT's notion of access control and OT's notion of safety. We resolve that before deployment, not after a near-miss.

Can agents control PLCs directly?

Only when the safety case justifies it and the plant is instrumented for reversal. The default is recommend-and-escalate, with a documented path to closed-loop control once the agent has proven itself in shadow mode for a measurable interval.

How do you handle integration with legacy MES and ERP?

We integrate at the data layer first. Pulling read-only signals into the agent environment. Then build write-back paths only where they are warranted. This sidesteps the multi-year MES upgrade most plants cannot afford to wait for.

If this maps to your operating reality, we should talk.

The Diagnostic Sprint is two weeks. Board-ready output. Tailored to manufacturing & industrial.

ENGAGE
sophizo.net/checkout/diagnostic-sprint

INDUSTRY PAGE
sophizo.net/industries/manufacturing

EMAI
john

Primary research behind this brief.

Every claim, statistic, and citation in this playbook traces back to one of the primary sources below. Pressure-test any of them with your team. We have done the same.

01. Siemens AG and Senseye.

The True Cost of Downtime, 2023.

02. National Institute of Standards and Technology.

SP 800-82 Revision 3, Guide to Operational Technology Security, September 2023.

03. International Electrotechnical Commission.

IEC 62443-3-3 System Security Requirements.

04. World Economic Forum.

Global Lighthouse Network 2024 Annual Report.

05. Occupational Safety and Health Administration.

Compliance Directive CPL 02-02-079.

06. US Bureau of Labor Statistics.

2024 Workplace Injury and Illness Data.

07. Deloitte.

2024 State of Smart Manufacturing.

08. ARC Advisory Group.

2024 Asset Performance Management Market Study.

Editorial note. This brief is a field reference compiled by Sophizo Research. It is not legal, accounting, or clinical advice. Cite the primary regulator guidance for binding interpretation. Where statistics are quoted, the most recent published figure as of early 2026 is used.