CASE STUDY

Smart Factory in a Day — The RunPilot Story

Executive Brief

A CES Global Executive Case Study

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Executive Summary

On a single night in July 2026, CES's AI platform — Lumi — assembled RunPilot: a complete, production-grade smart factory platform capable of connecting to any factory equipment, tracking real-time performance, and answering operator questions in plain English. It ran on a €200 edge device. It carried zero licensing fees. And it was built overnight — not over the 6 to 18 months a traditional integration would require, and not at the $500K to $1.5M a traditional SCADA/MES project would cost.

This was not a demo. It was a working platform: 8 industrial protocol drivers, a visual workflow builder, an on-device AI assistant, real-time OEE tracking with automatic insights, and a comprehensive security architecture — all assembled by Lumi's AI workforce drawing on years of accumulated manufacturing domain expertise.

This case study explains what RunPilot delivers, why it matters for manufacturing executives, and what it means for organizations still locked out of smart factory value by cost, complexity, and the knowledge problem that has defeated every generation of digitalization initiative.

The headline: CES can build a smart factory accelerator tailored to your operations — overnight. The path to 85% world-class OEE, which only 3—6% of manufacturers currently reach, starts with a €200 device and two hours of configuration, not a multimillion-dollar platform program.

1. The Smart Factory Challenge

Why 70%+ of Pilots Fail

The promise of the smart factory has been circulating for a decade. The reality is a graveyard of pilots. McKinsey found that only 30% of companies are capturing value from Industry 4.0 solutions at scale. The other 70% are stuck in pilot purgatory — launched something, proved a narrow point, and could not expand.

The failure is not a technology problem. The technology works. The failure is a cost, complexity, and knowledge problem — three barriers that compound on each other and have been impenetrable for most manufacturers, particularly small and medium enterprises.

THE THREE BARRIERS TO SMART FACTORY VALUE	
BARRIER	**WHAT IT LOOKS LIKE IN PRACTICE**
COST	$500K—$1.5M for traditional SCADA/MES $50K—$150K per-site just for connectivity 15—25% annual maintenance on top 60—70% of costs are hidden until it's too late to change course
COMPLEXITY	10+ PLC brands — each a different language 6—18 months to integrate a single facility Requires specialized integrators at $75—$150/hr, every time something changes Data locked in silos — 79% of mid-size manufacturers report their data is too siloed
KNOWLEDGE GAP	Domain expertise locked in veterans' heads Tribal knowledge walks out when they retire Consultants charge $500K—$2M to extract it and produce a document that starts decaying the moment it's written

The SMB Lockout

For enterprise manufacturers, these barriers are serious. For small and medium enterprises, they are prohibitive. Only 44% of SMB manufacturers have any MES or monitoring solution in place. Only 40% have a comprehensive digital strategy at all — while 76% of larger manufacturers have at least started.

The result is a widening competitive gap. Manufacturers who delay smart factory integration report up to 23% higher unplanned downtime costs and 18% lower OEE than their integrated peers. For organizations still relying on spreadsheets and clipboards to track production performance, every quarter of delay is a quarter of recoverable value left on the floor.

The market opportunity is real: Industry 4.0 value creation potential is estimated at $3.7 trillion globally (WEF/McKinsey, 2025). Most manufacturers cannot access it.

THE CES APPROACH

2. Knowledge Cloning

The Problem with Traditional Consulting

Every smart factory implementation begins the same way: consultants arrive, spend months interviewing engineers, shadowing shifts, and extracting the knowledge that lives in the heads of the people closest to the process. Why does Compressor 3 run hot on humid days? Why was the fill volume tolerance tightened from ±5ml to ±3ml after that customer complaint? What does the bearing sound like when it's starting to wear?

This knowledge — tribal, experiential, irreplaceable — is the foundation of any effective smart factory system. Extracting it takes months. Codifying it into a usable platform takes another 12 to 18 months. The total engagement costs $500K to $2M, produces a system tuned to one facility, and leaves the knowledge in a static document that begins decaying the moment it is written.

When the consultant leaves, the knowledge goes with them. When the veteran retires, their mental model of the process goes with them. The next integrator starts from scratch.

Lumi's Knowledge Cloning Architecture

CES's platform, Lumi, operates on a different principle. Rather than extracting knowledge once and losing it, Lumi accumulates knowledge continuously — protocol specifications, operational patterns, alarm management strategies, equipment behaviors, market benchmarks — and makes it operationally available at the moment of need.

When CES engineers worked on manufacturing domain problems over the preceding months, every protocol specification analyzed, every operational pattern observed, every architectural decision made was captured in Lumi's memory system. Not stored as a static document — indexed semantically, linked to related knowledge, and retrievable by meaning rather than keyword.

FROM KNOWLEDGE LOSS TO KNOWLEDGE CLONING	
TRADITIONAL MODEL	**LUMI KNOWLEDGE CLONING**
Expert knowledge lives in consultants' heads	Knowledge is captured continuously and indexed in Lumi's memory system
Discovery takes 2—4 months per engagement	Domain knowledge is available immediately — no re-discovery
Platform built by one team, sequentially	7 specialist AI agents execute in parallel, sharing common knowledge
Knowledge walks out when the project ends	Knowledge compounds — every deployment makes the next one faster
6—18 months to build a production platform	Overnight — same output, same quality, fraction of the cost

The Overnight Build

When the RunPilot build was initiated, Lumi's AI workforce — seven specialist agents covering SCADA engineering, data architecture, AI engineering, security, frontend development, and edge computing — drew on that accumulated knowledge simultaneously. The manufacturing domain expertise that would have required months of consultant interviews was already operational in Lumi's memory system. Each agent retrieved what it needed at millisecond speed.

The result: by morning, RunPilot existed. Not as a prototype — as a full, tested, security-audited platform ready for customization and field deployment. The same system that a traditional engagement would have produced in 6 to 18 months at $900K to $1.9M total cost.

This is knowledge cloning: the accumulated expertise of manufacturing domain specialists — ingested once into Lumi's memory, applied instantly across every future build, every future engagement, every future factory. The knowledge does not walk out the door. It compounds.

RUNPILOT

3. What It Delivers

In Business Terms

RunPilot is a smart factory accelerator — a complete platform that sits on a €200 edge device, connects to any factory equipment, and gives manufacturing teams the visibility and intelligence they need to move from spreadsheet-tracked OEE to world-class performance.

No technical background required to understand what it does. No coding required to configure it.

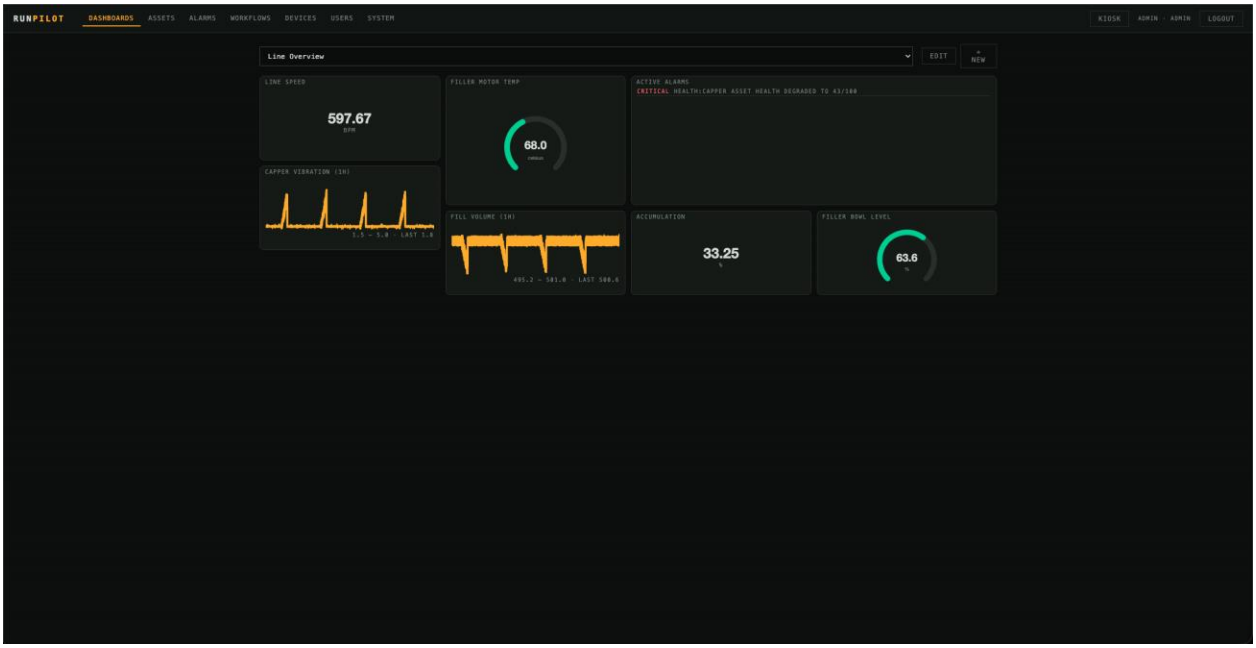


Figure 1: RunPilot Line Overview dashboard — live production KPIs including line speed (597 BPM), motor temperature, active alarms, vibration trends, fill volume, and filler bowl level — all from a browser on a €200 edge device.

It connects to any factory equipment in minutes.

Most factories run equipment from five or six different manufacturers, each speaking a different language. Siemens PLCs, Modbus-connected sensors, OPC-UA compatible machines, Mitsubishi controllers — they have never talked to each other without a custom integration project. RunPilot speaks all eight major industrial protocols out of the box. Connection is configured through a browser interface — no code, no integrator, no YAML files. The maintenance engineer who wirethe new motor can configure its monitoring the same afternoon.

Operators build monitoring logic — no IT required.

The visual workflow builder lets process engineers drag sensor readings to transform nodes to alert rules and deploy them — without filing a ticket, without waiting for a vendor's next available slot. When a process engineer needs to know "alert me when filler temperature exceeds 85°C for more than five minutes," they describe it to the AI in plain English and get a validated workflow on their screen. They review it and deploy.

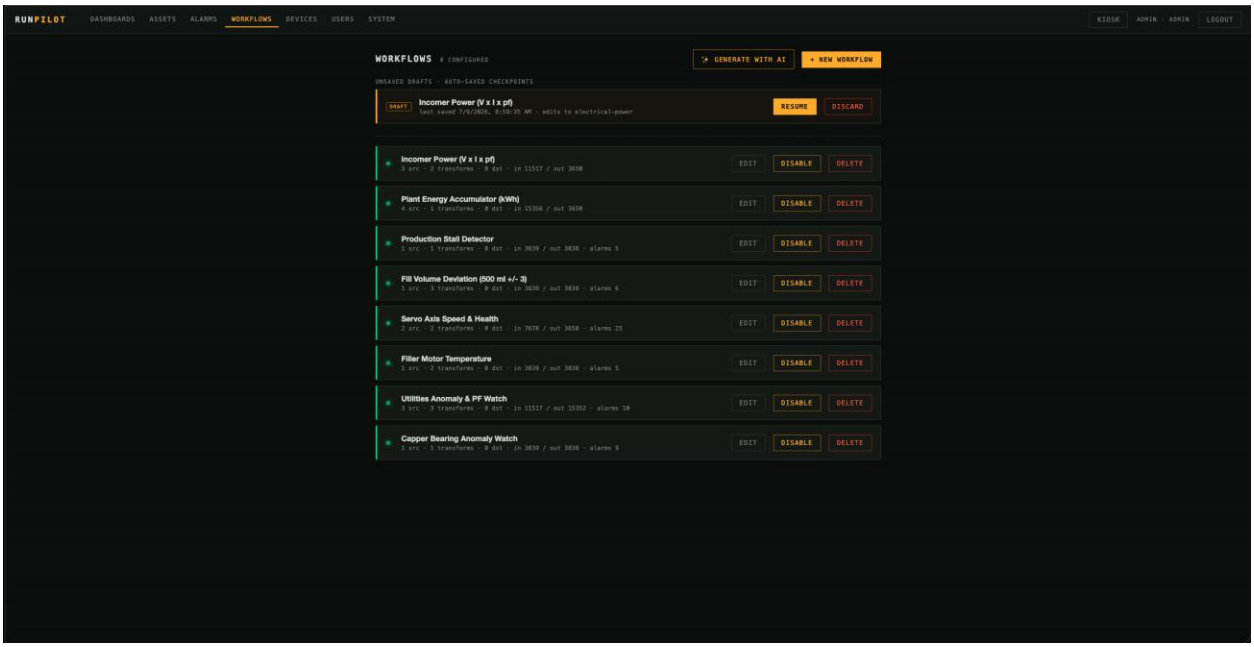
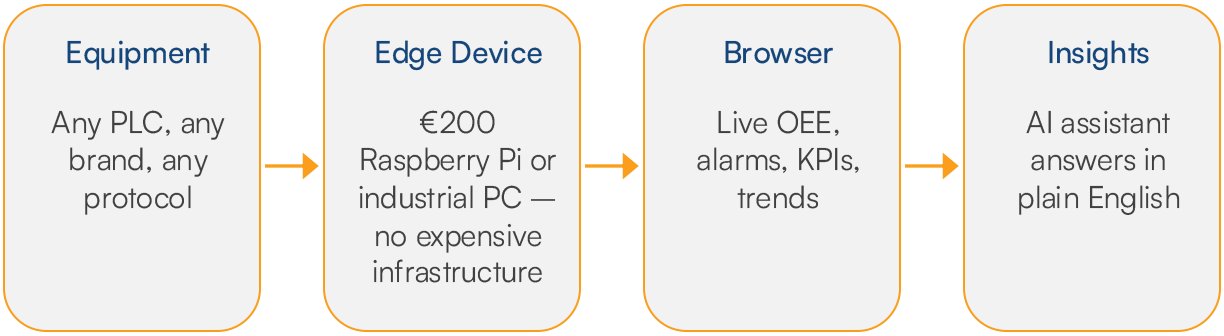


Figure 2: RunPilot Workflows — eight production monitoring workflows configured and running, from power monitoring to predictive maintenance, each built by process engineers without code.

THE RUNPILOT VALUE CHAIN



← 2 hours from plug-in to first insight

The AI assistant operators can actually ask.

Operators can ask RunPilot questions in plain English: "Why did energy spike at 2:30pm?" "What's the capper vibration limit?" "Summarize what happened during the last shift." The AI reads from the live production data, the alarm history, and the plant's own knowledge base to answer. The assistant does not operate equipment autonomously — it advises, explains, and alerts. Humans decide what to do with the information.

Real-time OEE with automatic root-cause insights.

OEE — Overall Equipment Effectiveness — is the universal scorecard of manufacturing performance. Most factories track it manually: clipboards, spreadsheets, shift-end estimates. Research shows manual OEE tracking inflates the number by 8 to 18 percentage points. Factories that believe they are running at 75% efficiency discover, when they measure properly, that they are running at 57%.

RunPilot captures OEE automatically from the equipment itself: Availability, Performance, and Quality tracked in real time against theoretical maximums, with AI-generated analysis of where the losses are occurring and why. The shift-handover report is drafted automatically from alarms, production counters, and KPI data — operators review and sign off, rather than spending 20 minutes writing it.

Runs on a €200 device. Zero licensing fees. Ever.

Traditional smart factory platforms charge per device, per sensor, per user, per site. Licensing alone runs $50K+ before implementation. Annual maintenance is 15—25% of that, compounding every year. RunPilot is open-source software — there are no per-device fees, no per-tag fees, no per-user limits. The hardware is a standard Raspberry Pi 5 or industrial PC. If the organization already has edge hardware, the incremental cost is zero.

No vendor lock-in.

RunPilot reads the PLCs the plant already owns and feeds data to the cloud platforms the enterprise already chose — Kafka, Azure Event Hubs, AWS Kinesis, InfluxDB, TimescaleDB, or any major cloud service. When a better tool becomes available or requirements change, the organization can adapt without dismantling its investment.

4. The Numbers That Matter

Cost Comparison

The cost difference between RunPilot and traditional alternatives is not a rounding error — it is a different order of magnitude.

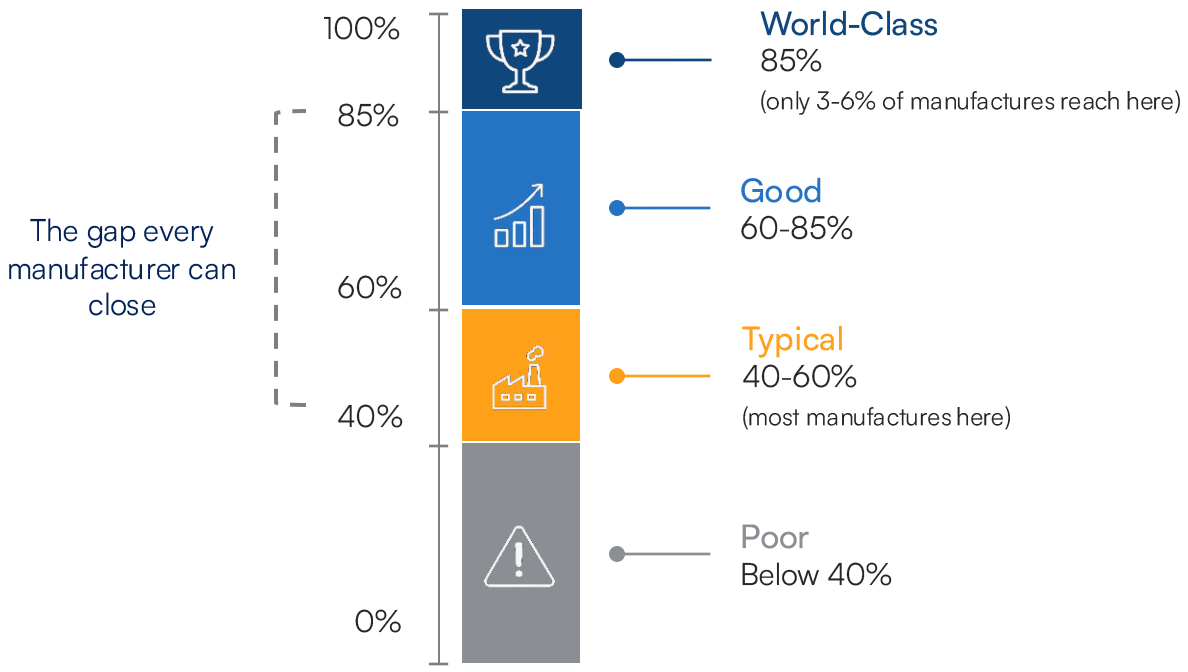
COMPONENT	TRADITIONAL SCADA/MES	YESTERDAY	TODAY AND TOMORROW
Software licensing	$100K—$400k	$17K—$150K/year	€0 — open source
Implementation	$275K—$800k+	$50K—$150K	Browser self-service
Hardware	Industrial gateways	Vendor-specified	€200 Raspberry Pi 5
Annual maintenance	15-25% of license costs	$17K—$35K/year	€0
Time to first value	6-18 months	3—6 months	2 hours
Typical 3-year TCO (SMB)	$500K—$1.5M+	$200K—$500	~€1,000 hardware

The gap is not incremental. A manufacturer who chooses RunPilot over a traditional SCADA implementation frees up $500K to $1.5M that would otherwise be locked in a platform contract — capital that can go into production, people, or expansion.

The OEE Opportunity

The financial case for smart factory investment is not speculative. It is calculated from the gap between where most manufacturers actually perform and where world-class performance sits.

THE OEE PERFORMANCE SPECTRUM



The financial value of closing that gap is substantial at every scale:

OEE IMPROVEMENT	FINANCIAL IMPACT
4 percentage points	$31K+ per line per year (conservative, smaller operations)
5 percentage points	Profit increased from $6.1M to $16.8M in documented case study
10 percentage points	$300K—$2M+ in annual recoverable production value per line
43 percentage points	+$6,000/day production value for one window manufacturer

The ROI case for RunPilot does not require reaching world-class OEE. A modest improvement on a single line produces a payback measured in days, not years — and the €200 hardware investment is recovered in the first week.

Knowledge Preservation: The Hidden Urgency

The manufacturing industry faces a skills crisis that makes knowledge preservation a strategic imperative, not a secondary concern.

2.1 million skilled manufacturing worker positions will go unfilled by 2030. The average age of experienced process engineers and maintenance specialists is rising. When a veteran with 20 years of plant knowledge retires, the tribal knowledge they carry — the operational patterns, the equipment quirks, the process history — walks out with them.

> RunPilot's knowledge base captures that expertise before retirement. The 6 operational skill playbooks and equipment manuals that ship with the platform are the manufacturing equivalent of cloning the veteran engineer's judgment into a system any operator can access in plain language, at any hour.

Traditional alternatives leave this knowledge capture to expensive consulting engagements — $500K to $2M to extract and document what a veteran engineer knows. RunPilot makes the capture ongoing, self-service, and permanent.

5. Your Workforce — Empowered, Not Replaced

Addressing the Real Question

Every conversation about AI in manufacturing eventually reaches the same question: what happens to the people?

It is a legitimate question. 40% of workers worldwide now fear losing their job to AI — a number that has risen 12 percentage points in two years. The manufacturing sector has specific history here: the automation wave of the 2010s restructured many assembly lines without sufficient investment in the people those lines displaced.

RunPilot was designed with a different philosophy. The evidence from the field is clear: smart factory implementations that center on worker augmentation produce better outcomes — for the business and for the workforce — than implementations built around headcount reduction.

What Actually Changes

The most valuable people on any factory floor are the ones who understand how the process actually works. The maintenance engineer who knows Compressor 3's quirks. The process engineer who understands why a particular setting produces a particular quality outcome. The shift supervisor who can tell from the sound of a machine that something is wrong.

RunPilot amplifies those people — it does not replace them.

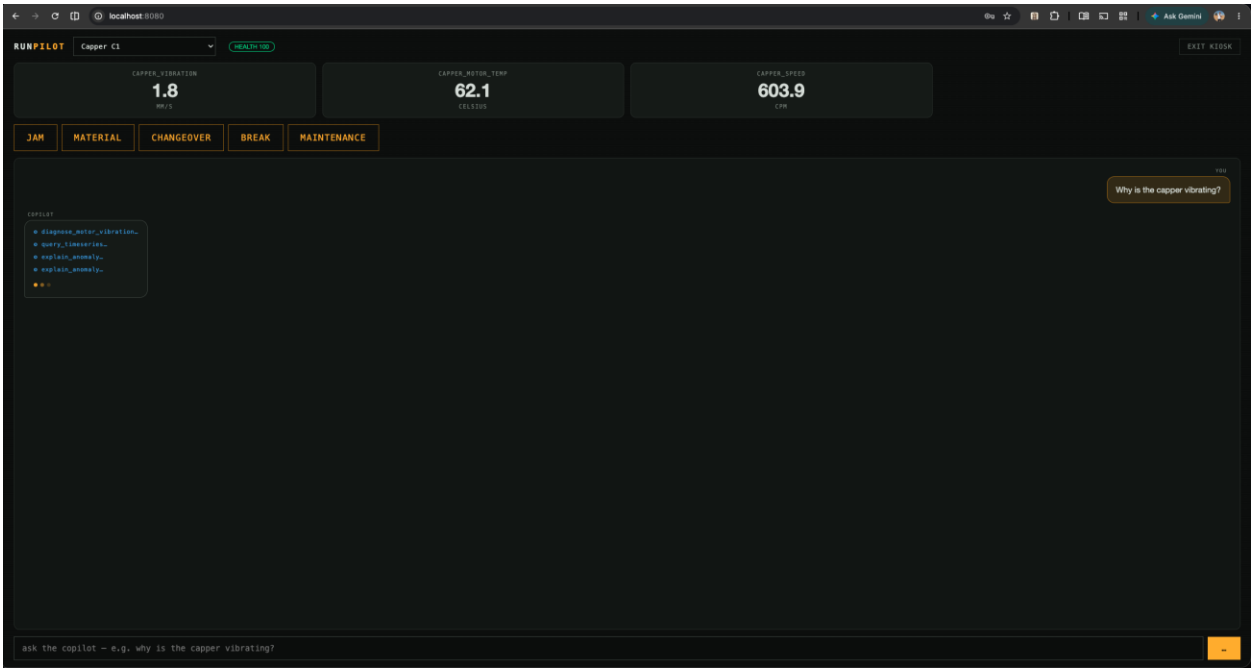


Figure 3: RunPilot Kiosk mode — an operator asks "Why is the capper vibrating?" and the AI Copilot investigates using diagnostic tools, timeseries queries, and anomaly analysis — all in plain English, no technical training required.

THE WORKFORCE SHIFT: WHAT AI HANDLES VS WHAT HUMANS DO	
AI HANDLES	**HUMANS DECIDE**
Reading sensor data continuously — every tag, every second	What the data means for their specific process
Detecting anomalies and flagging them immediately	Whether to act, how to act, and when to escalate
Drafting shift-handover reports from production data	Reviewing, correcting, and signing off before handover
Answering "what happened?“ from alarm and KPI history	Deciding what to do about it
Translating a sentence description into a monitoring workflow	Reviewing the workflow before deploying it to live equipment

The process engineer who previously had to file IT tickets to change monitoring thresholds now configures them directly from the browser. The maintenance team that previously relied on scheduled inspections now gets anomaly alerts before failures develop. The operations manager who previously estimated OEE from shift logs now reads accurate, real-time numbers with AI-generated root-cause analysis.

No new IT hires required. No coding skills required. No vendor calls to make a configuration change.

Factory Workers as Digital Transformation Agents

Traditional smart factory implementation places IT departments and external integrators in control. The plant team is consulted but not empowered. RunPilot inverts this.

The visual workflow builder means a process engineer can build monitoring logic for the process they understand better than any integrator ever will. The AI-assisted authoring means operators who have never written code can create and deploy alerts. The browser-based device management means the electrician who wired the new motor can configure its monitoring without involving a vendor.

This is the principle the European Commission has called Industry 5.0: technology that amplifies the people closest to the process, rather than technology that requires intermediaries between them and its digital representation. The goal is not automation for its own sake. It is operators and engineers with AI as their tool — more capable, better informed, and with their expertise now permanently captured rather than lost to attrition.

> 72% of manufacturers expect AI to augment workers rather than replace them (McKinsey). RunPilot is built to make that expectation a reality — not a communication talking point.

The Retraining Argument Is Real — With a Caveat

The skills required on the factory floor are shifting. 59% of employees will need upskilling or reskilling by 2030 (WEF). The capability gap between what AI can now handle and what experienced workers know how to leverage is real.

RunPilot shortens that learning curve. Because it is configured in plain language and a visual interface — not in code — the retraining required is minimal: how to interpret an OEE dashboard, how to review an AI-drafted workflow before deploying it, how to use a knowledge base to answer equipment questions. These are skills that translate naturally from existing process expertise. The veteran engineer does not need to become a programmer. They need to learn to work with a system that already understands their equipment.

6. Call to Action

Start Tonight

The traditional smart factory conversation begins with a steering committee, a budget request, an RFP, and a 6-month vendor evaluation. RunPilot begins differently.

CES can build a smart factory accelerator tailored to your operations overnight. Using the same knowledge cloning approach that produced RunPilot — drawing on accumulated manufacturing domain expertise, assembling specialist AI capabilities, and delivering a working platform ready for field deployment — CES can compress months of consulting and development into a single engagement.

The recommended path:

THREE STEPS TO SMART FACTORY VALUE	
STEP 1: ONE LINE, ONE DEVICE Connect a single production line to a €200 edge device. Configure the monitoring your team needs. Measure actual OEE for the first time.	Hours, not months Immediate OEE visibility. No commitment beyond the hardware cost. Proof of concept with real data.
STEP 2: CAPTURE THE KNOWLEDGE Load your plant knowledge base. Build operator skills from your process engineers' expertise. Add workflows your team designs.	Weeks, not quarters Tribal knowledge preserved before the next retirement. AI that understands your specific operations.
STEP 3: SCALE WHEN READY Expand to more lines, more sites. Feed data to the cloud platforms you already own. Add AI-generated insights as confidence builds.	On your terms No vendor lock-in. No licensing cliffs. No steering committee required to proceed.

No Licensing Cliffs. No Vendor Lock-In.

The economics of RunPilot are intentionally different from every incumbent platform. There are no licensing fees that scale with the number of sensors, users, or sites. There are no per-device costs that make expansion a budget event. The platform feeds data to whatever cloud infrastructure the organization already runs — it does not require adoption of a new analytics stack to realize value.

When requirements change — and they will — the platform adapts without a new procurement cycle. The knowledge captured in the system stays with the organization, not with the vendor.

The Conversation CES Is Ready to Have

CES built RunPilot using the same AI workforce it uses to deliver all of its software — the Lumi platform described in the companion Agentic SDLC whitepaper. The team that understands both the manufacturing domain and the agentic architecture is ready to apply both to your operations.

To begin:

The first conversation is not a sales process. It is a discovery session: what equipment does your facility run, where is the OEE opportunity, and what does the tribal knowledge gap look like before the next round of retirements? From that conversation, CES can scope an overnight build that delivers a working accelerator — customized to your protocols, your processes, and your team.

Contact CES to schedule a Smart Factory Discovery Session.

The organizations that start building their smart factory knowledge base today will have compounding operational intelligence in 2028 that organizations starting in 2028 cannot replicate. The knowledge advantage is not in the tools — it is in the accumulated operational context those tools operate within.

About CES and the Creators

CES is a technology organization at the forefront of Agentic AI platform design. CES built Lumi as its own software delivery infrastructure and used it to construct RunPilot — proof that the knowledge cloning and overnight build described in this case study are not theoretical. They are operational. CES's work combines deep technical expertise in agentic systems architecture with practical manufacturing domain knowledge and hands-on experience in the organizational change required to realize AI's potential at scale.

Ankur Nair is Co-Creator of Lumi at CES. His work focuses on agentic systems architecture, distributed AI infrastructure, and the design of platforms that operate as organizational intelligence rather than point-solution tools. Ankur brings a perspective shaped by the practical demands of building software at scale — the failures and costs that motivate the architectural decisions in Lumi, and the operational discipline required to make autonomous systems trustworthy.

Anurag Sharma is Co-Creator of Lumi at CES. His work spans the strategic and technical dimensions of AI adoption in manufacturing and software organizations — the governance frameworks, organizational design, and value realization models that determine whether AI investments compound or fragment. Anurag brings a perspective shaped by the organizational challenges of the smart factory transition: the human roles that evolve, the governance structures that enable trust, and the measurement frameworks that distinguish genuine productivity gains from self-reported optimism.

Together, Ankur and Anurag built Lumi not as a product roadmap exercise but as the infrastructure CES uses to deliver software — and RunPilot as the proof that Agentic AI can compress years of manufacturing platform development into a single overnight build.