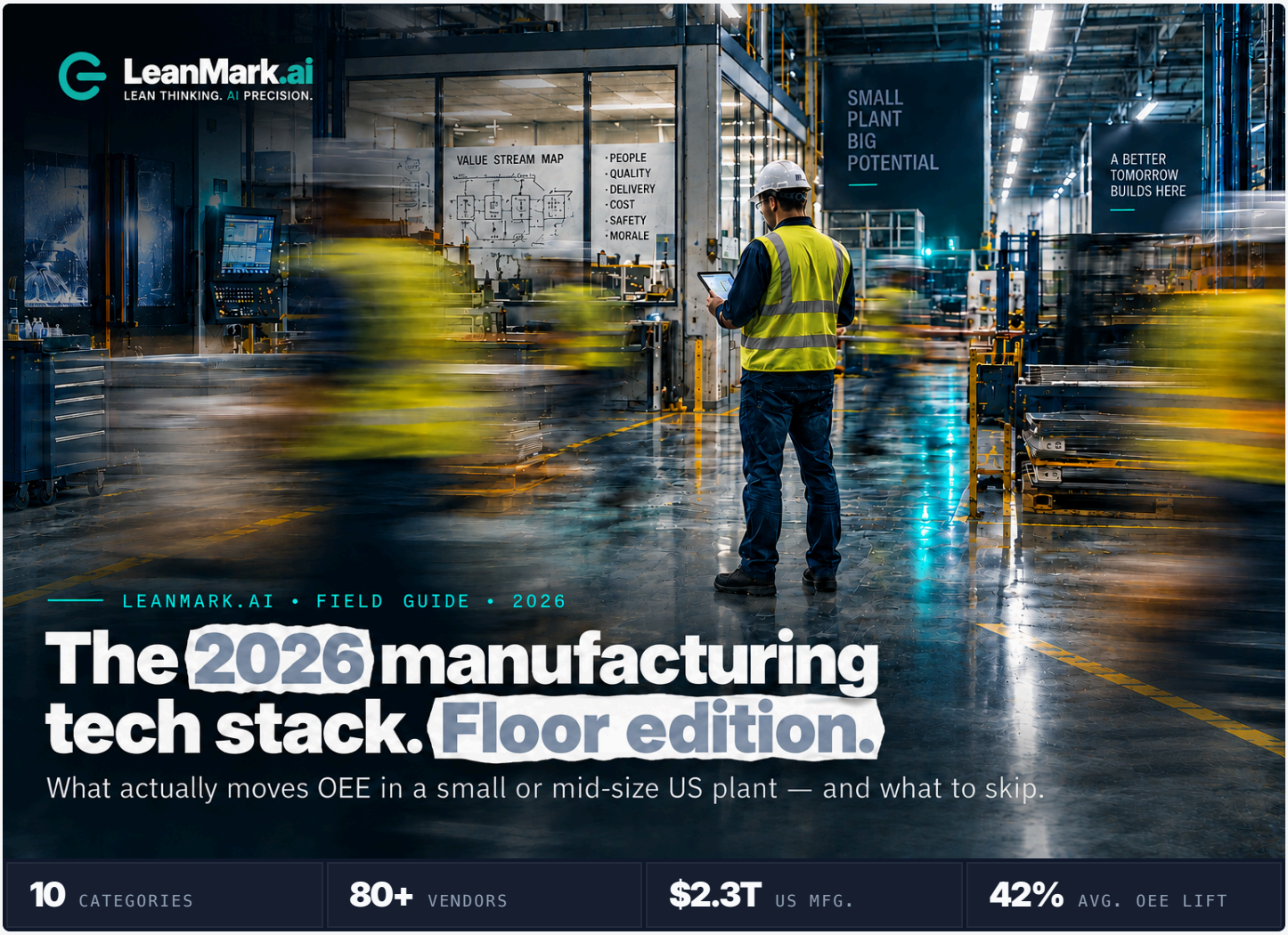


10 stack categories. 80+ vendors. Real price ranges. Every number a small or mid-size US plant needs before signing a software contract — and what to skip.

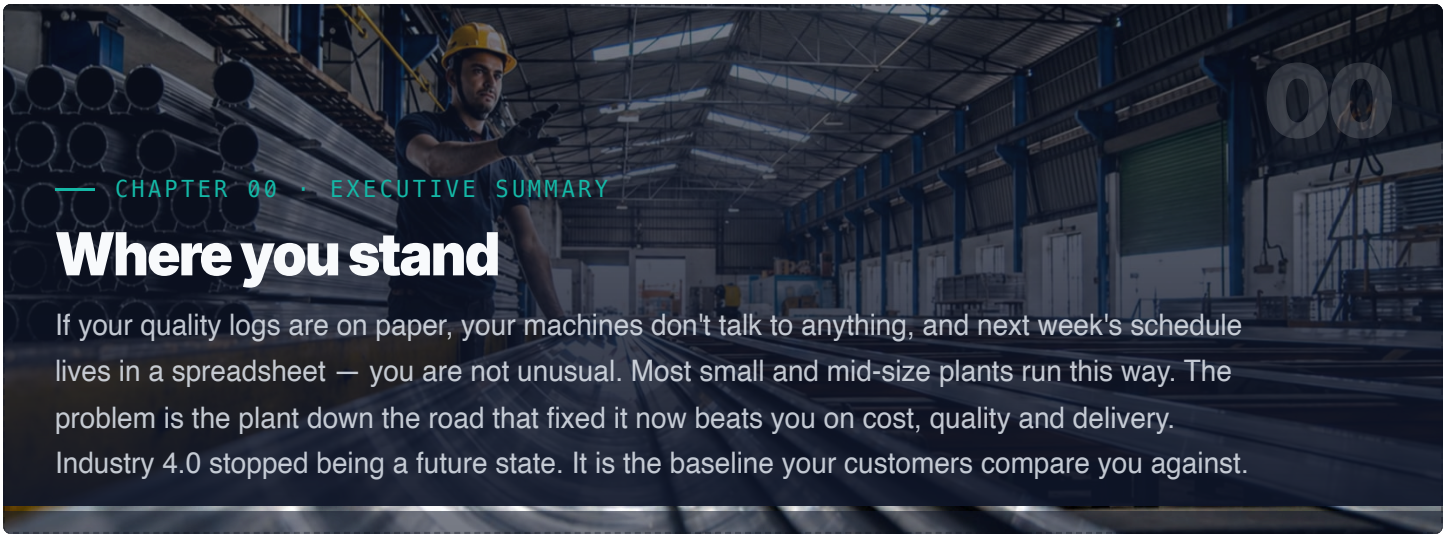
WHO THIS IS FOR

Production supervisors and plant managers running one plant, one to three shifts, 30 to 500 people, tight capex, no IT department to speak of. You own the OEE number. You sign off on the scrap report. You get the call at 2 a.m. when Line 3 is down.

Every chapter has the same shape: what the system does, who it fits, what it costs, one number to remember, and a checklist you can run this week. Read the chapter for the problem on your board right now. Skip the rest until it matters.

Enterprise vendors are listed too — so you know the ceiling, not because you should buy them.

CONTENTS



— CHAPTER 00 · EXECUTIVE SUMMARY

Where you stand

If your quality logs are on paper, your machines don't talk to anything, and next week's schedule lives in a spreadsheet — you are not unusual. Most small and mid-size plants run this way. The problem is the plant down the road that fixed it now beats you on cost, quality and delivery. Industry 4.0 stopped being a future state. It is the baseline your customers compare you against.

→ The pressure rolls downhill. 95% of Fortune 500 manufacturers are investing in smart factory tech. MES adoption is up 34% year over year. Real-time quality is standard in automotive and electronics. Their suppliers get audited against it — that means you.

→ A full stack is 8–12 systems. ERP, MES, QMS, WMS, CMMS, PLM, planning, workforce. Nobody in a 120-person plant buys all of them at once. But every system you own has to share data with the others, or you get data islands and no honest OEE number, no lot traceability, no real schedule.

→ The payoff is measurable. Plants that get this right report 20–35% higher OEE, 40–60% lower quality cost, 25–40% less inventory, 30–50% faster engineering changes, and 15–25% better MTBF/MTTR.

15–30%

Reduction in unplanned downtime from predictive maintenance alone. That is the single most common first win in a small plant — and it needs sensors and a CMMS, not a new ERP.

INVESTMENT LANDSCAPE BY CATEGORY

CATEGORY	MARKET SIZE	GROWTH	AVG. INVESTMENT (YOU'LL BE AT THE LOW END)
ERP systems	$18B	9% CAGR	$800K–$5M
MES & production	$12B	15% CAGR	$400K–$2.5M
Quality management	$6B	12% CAGR	$150K–$1M
Supply chain planning	$8B	14% CAGR	$500K–$3M

CHECKLIST · NEXT 30 / 90 / 180 DAYS

- [ ] 30 days: list every system you run, and every place someone re-types data from one into another. Those are your data silos.
- [ ] 30 days: write down your real OEE and quality cost, line by line, and compare against your industry.
- [ ] 60–90 days: shortlist 3–5 vendors in the one category that hurts most. Visit a reference plant your size with your production model.
- [ ] 6 months: Phase 1 live — core system of record plus real-time quality visibility. Measure OEE against your baseline.

Old plant vs. connected plant

The old model was one ERP that did everything, badly, and a lot of clipboards. That is still how most small plants run. A connected plant is different: specialized systems, each good at one job, passing data to each other without a human in between. Machines, material, quality events and labor all show up in one picture — live.

TRADITIONAL PLANT (2015)	CONNECTED PLANT (2026)
Disconnected systems. ERP, QMS, WMS and machines run on their own.	**Integrated ecosystem.** Real-time data flow between systems via APIs and message queues.
Manual quality logging. Inspectors write defects in logs or spreadsheets — 30 min delay.	**Real-time quality vision.** Automated visual inspection, AI anomaly detection, instant alerts.
Reactive maintenance. It breaks, you fix it. MTTR 24–48 hours.	**Predictive maintenance.** ML models flag failures 1–2 weeks out. MTTR down to 4–6 hours.
Static schedules. Plan made weekly. No adjustment when a machine goes down.	**Finite capacity scheduling.** MRP/APS sees real machine status and re-plans.
Manual lot traceability. Serials on paper or a basic database.	**Automated lot traceability.** Every component tracked by barcode/RFID through the whole chain.
Workforce on paper. Printed work orders. Labor tracking scattered.	**Digital workforce.** Mobile work instructions, live labor tracking, skill-based task allocation.

THE 10 STACK CATEGORIES

01
ERP
BOM, MRP, costing, financials, multi-plant

02
MES & production
Live WIP, machine data, downtime, OEE

03
Quality management
NCR, SPC, CAPA, audit trails, documents

04
Supply chain & planning
Demand sensing, supplier collaboration, risk

05
Inventory & WMS
Stock position, cycle counts, FIFO, barcodes

06
Maintenance / CMMS
PM/PdM scheduling, assets, spare parts

07
PLM & engineering
BOM, ECO workflows, versions, drawings

08
Finance & accounting
Job costing, variance, GL, consolidation

09
Safety & EHS
Incidents, audits, hazards, compliance docs

10
Workforce & training
Digital work instructions, skills, compliance

CHECKLIST · WALK THE FLOOR WITH THIS

- [ ] Which column does each of your six rows sit in — 2015 or 2026? Be honest.
- [ ] Of the 10 categories, which do you cover with software, which with a spreadsheet, which with nothing?
- [ ] How long from a defect on the line to someone with authority knowing about it? Minutes, hours, or next shift?

CATEGORY 1 OF 10 · ERP

ERP. The system of record.

02

ERP holds the BOM, runs MRP, tracks inventory and cost, and feeds the books. Whatever you pick here decides what everything else has to plug into — so pick for your production model (job shop, batch, repetitive, process), not for the demo. Modern manufacturing ERPs are cloud, real-time, and API-first.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
Epicor Kinetic	Mid-market discrete: job shop, batch, repetitive. Manufacturing-first, strong MRP, multi-plant.	$1,000–$8,000/mo + implementation	500+ integrations, REST API-first.
NetSuite	Growing manufacturers with global ops ($100M–$5B). GL, supply chain, WMS in one box.	$5,000–$20,000/mo + $500K–$2M impl.	Higher TCO; one ecosystem means fewer custom integrations.
SAP S/4HANA	Large enterprise: automotive, aerospace, electronics. Finite capacity scheduling.	$50K–$200K/mo + $500K–$10M+ impl.	Fortune 500 leader. Your customer runs it. You don't need to.
Infor CloudSuite	Mid-market to enterprise, regulated: automotive, food & beverage, pharma.	$3,000–$15,000/mo + implementation	Industry templates. Strong for pharma and aerospace compliance.
Acumatica	Mid-market wanting modern UX and flexibility. Cloud-native, strong project accounting.	$1,500–$6,000/mo + implementation	Fast implementations: 8–16 weeks vs. 6 months.
SYSPRO	Job shop and batch. Exceptional BOM flexibility, accurate job costing.	$800–$5,000/mo + implementation	50+ years in discrete manufacturing.

PLATFORM	FIT	BOM/MRP	GLOBAL	INTEGRATION	COST	TIME-TO-VALUE
Epicor Kinetic	Mid-market	★★★★★	★★★★☆	★★★★★	$$	4–6 months
NetSuite	Enterprise	★★★★☆	★★★★★	★★★★★	$$$	6–9 months
SAP S/4HANA	Fortune 500	★★★★★	★★★★★	★★★★★	$$$$	12–18 months
Infor CloudSuite	Regulated	★★★★☆	★★★★☆	★★★★☆	$$$	6–9 months
Acumatica	Mid-market	★★★★☆	★★★★☆	★★★★☆	$$	3–5 months
SYSPRO	Job shop	★★★★★	★★★☆☆	★★★★☆	$$	4–7 months

SMALL-PLANT READ

Shortlist Acumatica, SYSPRO, Epicor Kinetic. NetSuite if you already have — or will have — more than one legal entity. SAP and Infor are the ceiling: a single plant under $100M does not need them and cannot staff them.

3–5 mo

Time-to-value for a mid-market cloud ERP like Acumatica. An enterprise ERP takes 12–18 months. In a small plant, the long project is the one that never finishes.

Before you sign for an ERP.

All six sign-off checks from the ERP chapter - together on one page.

CHECK 01

- [ ] Multi-level BOM with revisions, out of the box - you saw it in the demo with your own part numbers.

CHECK 02

- [ ] MRP that respects your real lead times and machine capacity, not infinite capacity.

CHECK 03

- [ ] Job costing matches how you actually quote (job / standard / process costing).

CHECK 04

- [ ] REST API documented and open - ask to see the docs, not a slide about them.

CHECK 05

- [ ] A reference plant your size, your production model, that you can call without the vendor on the line.

CHECK 06

- [ ] Implementation fee capped in writing. Open-ended hours kill the ROI.

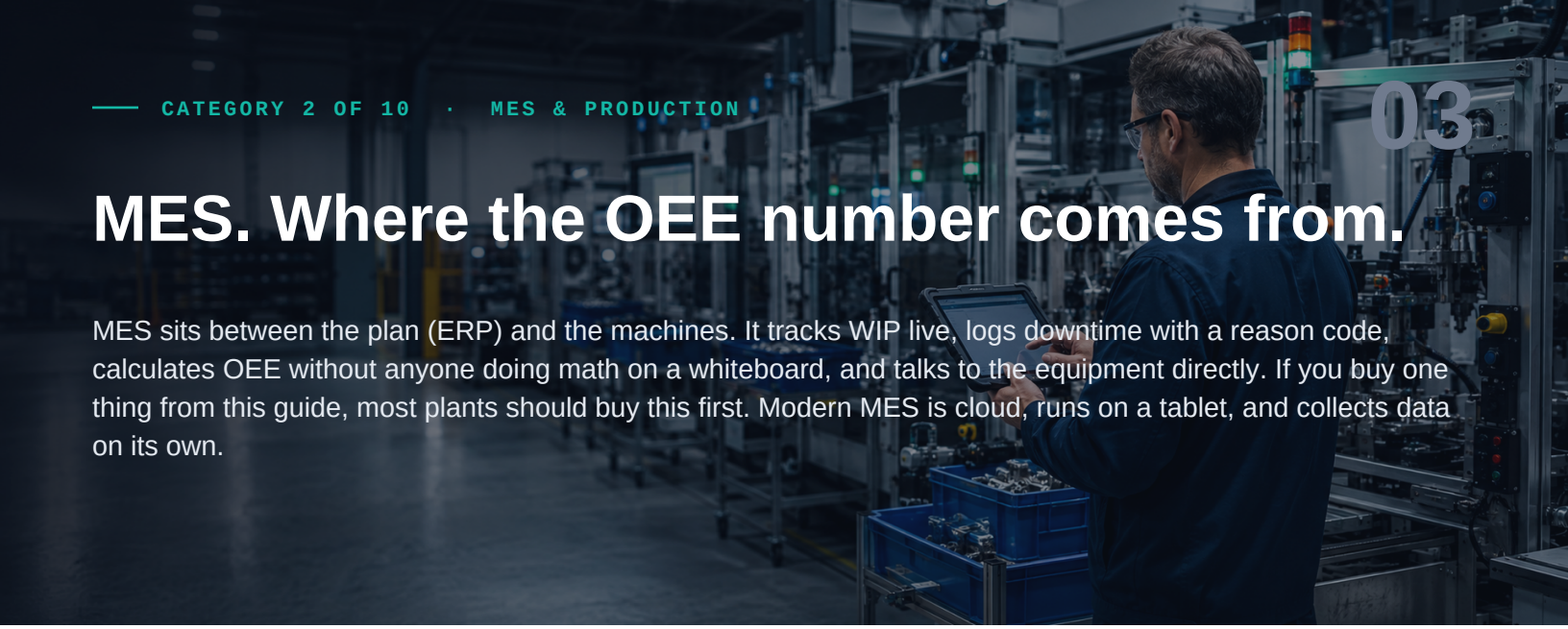
Decision record

VENDOR / PRODUCT

REFERENCE PLANT CONTACT

INTERNAL OWNER

TARGET DECISION DATE



CATEGORY 2 OF 10 · MES & PRODUCTION

03

MES. Where the OEE number comes from.

MES sits between the plan (ERP) and the machines. It tracks WIP live, logs downtime with a reason code, calculates OEE without anyone doing math on a whiteboard, and talks to the equipment directly. If you buy one thing from this guide, most plants should buy this first. Modern MES is cloud, runs on a tablet, and collects data on its own.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
Plex Systems	Mid-to-large ($50M–$5B). Cloud-native MES, real-time SPC, autonomous OEE, excellent mobile UX.	$3,000–$12,000/mo + implementation	Fastest-growing MES vendor. 8+ years of perfect uptime SLA.
Tulip	High-mix, job shops, contract manufacturers. No-code shop-floor apps, real-time analytics.	$2,000–$8,000/mo + implementation	Built to digitize manual work instructions at the station.
MachineMetrics	Retrofit connectivity on existing machines. Autonomous OEE, predictive maintenance signals, no integration project.	$500–$2,000 per machine/mo	Plug-and-play sensors work on legacy CNC and older equipment.
Siemens Opcenter	Large, automated plants: automotive, electronics, pharma. Finite capacity scheduling, advanced analytics.	$10K–$50K/mo custom enterprise	Native to the Siemens automation stack.
42Q	Job shops and contract manufacturers with messy scheduling. Finite capacity, demand sensing, live WIP.	$2,000–$6,000/mo + implementation	Good fit if you run the plant from Excel today.

SMALL-PLANT READ

Old CNCs and no budget for an integration project: MachineMetrics, per machine, start with the five that hurt most. High-mix and lots of manual steps: Tulip. Living in Excel: 42Q. Plex once you pass $50M. Opcenter is not for you.

45–60% → 65–80%

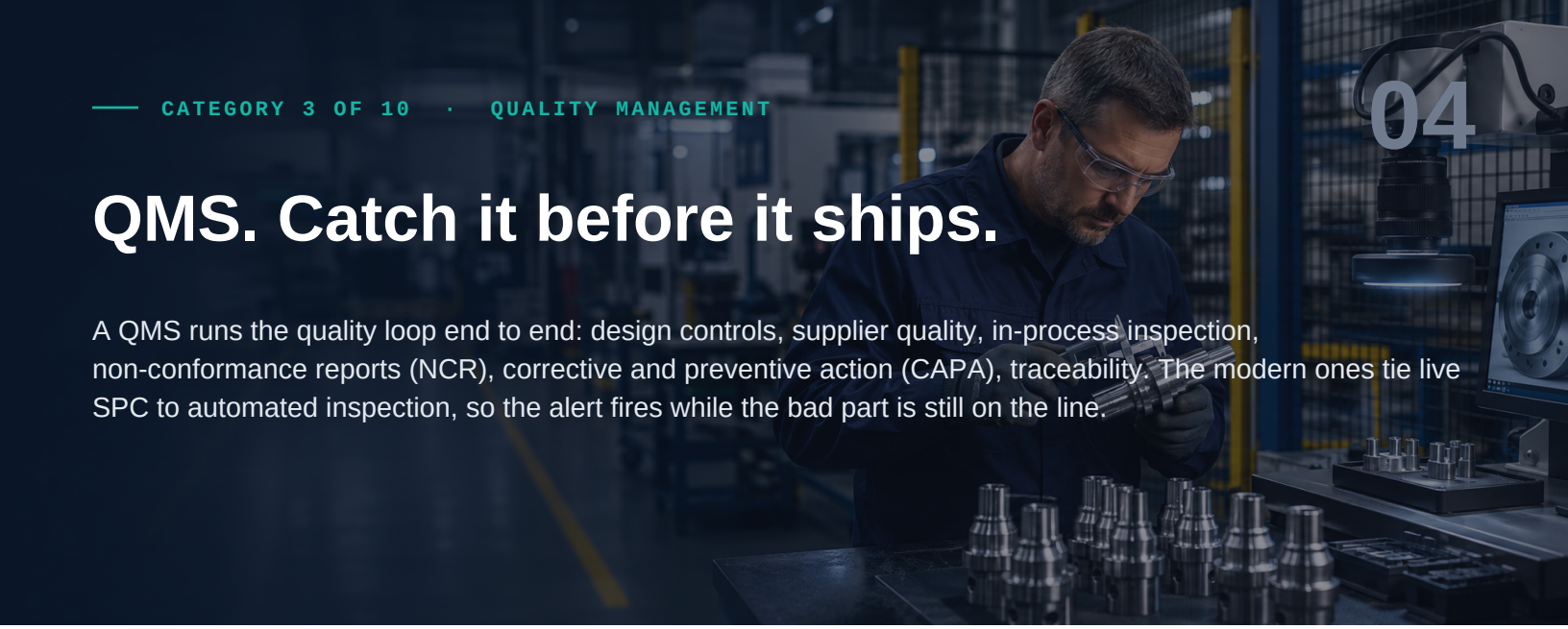
Typical OEE before and after real-time MES, within 12 months. Each OEE point is worth roughly $50K–$150K a year on a $10M+ line. Typical ROI: 18–24 months from scrap reduction and throughput.

CHECKLIST · BEFORE YOU SIGN FOR AN MES

- [ ] It captures 100% of downtime automatically. Manual logging catches 60–70% at best.
- [ ] The operator types nothing except a reason code. If it adds work at the station, it dies in week three.
- [ ] It connects to your oldest machine — ask the vendor to name the interface, not "we support legacy".
- [ ] OEE shows on a screen at the line, not in a report the plant manager reads on Friday.
- [ ] Pilot on one line for 90 days before you roll out. Write down baseline OEE the day before you switch it on.

04

QMS. Catch it before it ships.



A QMS runs the quality loop end to end: design controls, supplier quality, in-process inspection, non-conformance reports (NCR), corrective and preventive action (CAPA), traceability. The modern ones tie live SPC to automated inspection, so the alert fires while the bad part is still on the line.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
MasterControl	Regulated: pharma, medical devices, food. FDA 21 CFR Part 11, audit trails, batch genealogy.	$5,000–$20,000/mo + implementation	Market leader in life sciences QMS.
ETQ Reliance	Aerospace and defense: ITAR, AS9100. NCR, supplier quality, design FMEA, audit scheduling.	$3,000–$15,000/mo + implementation	A&D regulation built in.
Qualio	Mid-market wanting a modern QMS. Mobile-first, real-time NCR alerts, collaboration.	$1,500–$6,000/mo + implementation	Easier adoption than legacy QMS; faster time-to-insight.
InfinityQS	Process manufacturers: chemicals, food, beverage. Real-time SPC, predictive quality, adjustment alerts.	$2,000–$10,000/mo by sensor integration	Specialty: process control and continuous improvement.
Greenlight Guru	Medical device (Class II/III). Design controls, risk management, 21 CFR Part 11.	$3,000–$12,000/mo + implementation	Fastest-growing QMS in med-device.

SMALL-PLANT READ

No regulator on your back: Qualio. Process plant with SPC on the wall: InfinityQS. FDA: MasterControl or Greenlight Guru — the auditor will ask. AS9100 or ITAR: ETQ. Whichever you pick, the NCR must be raised from a phone on the floor, not from a desk.

40–60%

Quality cost reduction with real-time QMS. The reference math: a $100M plant with 3% quality cost ($3M) — prevention $300K, appraisal $600K, internal failures $1.2M, external failures $900K. Shift $500K from detection to prevention, save $1.2M–$1.8M a year against a $150K–$300K platform. Net $900K–$1.5M. The percentages hold at your size; scale the dollars to your revenue.

CHECKLIST · BEFORE YOU SIGN FOR A QMS

- [ ] You know your cost of quality today, split into prevention / appraisal / internal / external failure.
- [ ] An operator can raise an NCR with a photo in under 60 seconds.
- [ ] CAPA has owners, due dates, and automatic follow-up — no more "open since March".
- [ ] It matches the certification your customers actually audit you against (ISO 9001, AS9100, IATF, FDA).
- [ ] SPC data comes from the gauge or the machine, not re-typed from a clipboard.

Planning. Stop guessing what to build next week.

05

Advanced planning systems (APS) pull demand signals, supply constraints and your real capacity into one plan. The good ones use ML to forecast, run what-if scenarios, and tell you what to do to hold service levels with less inventory. Honest warning: this is the most enterprise-heavy category in the guide.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
Kinaxis RapidResponse	Complex multi-tier chains: automotive, electronics. Rapid scenario modeling, supply/demand balancing, supplier collaboration.	$50K–$150K/yr + $200K–$1M+ impl.	Market leader in scenario planning.
o9 Solutions	Enterprise with AI-driven forecasting needs. ML demand forecasting, network optimization, integrated planning.	$500K–$3M+ impl. custom licensing	Graph-based planning engine for complex networks.
Blue Yonder	Large manufacturers and 3PLs. Demand sensing, supply optimization, logistics planning.	$300K–$2M+/yr enterprise custom	Market leader post-JDA merger; 50+ year lineage.
Coupa	Procurement and supplier collaboration tied to planning. Supplier portal, risk, contracts.	$200K–$1.5M+/yr by transaction volume	Strong integration with SAP, Oracle, NetSuite.
Logility	Mid-market wanting a modern APS without the mega-budget. Demand planning, S&OP, inventory optimization, scenarios.	$100K–$400K/yr + implementation	Faster to implement than Kinaxis or Blue Yonder.

SMALL-PLANT READ

Kinaxis, o9 and Blue Yonder are for your customer, not for you. Logility is the realistic entry point. Coupa only if supplier chaos is your top pain. For most plants under $50M the right move is: make MRP inside your ERP actually work first — clean lead times, clean BOMs, clean on-hand.

$75M

Cash released for a $500M manufacturer moving from 6 to 8 inventory turns ($250M → $175M on hand). At 6% cost of capital that is $4.5M a year, plus 15–25% less expedited freight. Same ratio applies to you: roughly 15% of revenue back in the bank.

CHECKLIST · BEFORE YOU BUY PLANNING SOFTWARE

- [ ] You know your inventory turns and your forecast accuracy today. If not, fix that with a spreadsheet first.
- [ ] Your ERP MRP runs nightly and people actually trust the output. If they override it every morning, the APS will inherit the same garbage.
- [ ] Expedited freight last 12 months is on paper. That number is the business case.
- [ ] Your top 5 suppliers will actually log into a portal. Ask them before you buy one.

FIELD NOTES PAGE 08

WMS. Know what you have and where it is.

06

A WMS gives you a live stock position by location, lot rotation (FIFO/LIFO), cycle counting, and guided pick/pack. Modern platforms run on barcode or RFID scanners, optimize putaway, and handle cross-docking. For a small plant the first win is simple: the count in the system matches the count on the shelf.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
Fishbowl	Job shops and contract manufacturers. QuickBooks/Xero integration, strong lot traceability, multi-location.	$500–$2,500/mo by modules + impl.	Best-in-class SMB WMS. 40+ year track record.
Manhattan Associates	Large 3PL and distribution (500K+ SKUs). Automation support, labor optimization, RF picking.	$100K–$500K+/yr + $500K–$3M+ impl.	Enterprise WMS leader; Gartner Magic Quadrant leader.
Cin7	Growing ecommerce and D2C brands. Multi-channel sync, real-time automation, API-first.	$250–$1,500/mo + implementation	500+ integrations with ecommerce platforms, marketplaces, ERPs.
Finale Inventory	Product companies (manufacturing + ecommerce), 1,000–100K SKUs. Barcode scanning, multi-location, forecasting.	$300–$1,200/mo + implementation	Sweet spot between Fishbowl simplicity and Manhattan complexity.
NetSuite WMS	Already on NetSuite. Native GL integration, real-time cost adjustments, lot genealogy.	Included in NetSuite ($5K–$20K/mo)	One system of record for inventory, finance and WMS.

SMALL-PLANT READ

On QuickBooks: Fishbowl. Selling online too: Cin7 or Finale. On NetSuite: switch on NetSuite WMS and stop looking. Manhattan is a distribution-center product — not a plant product.

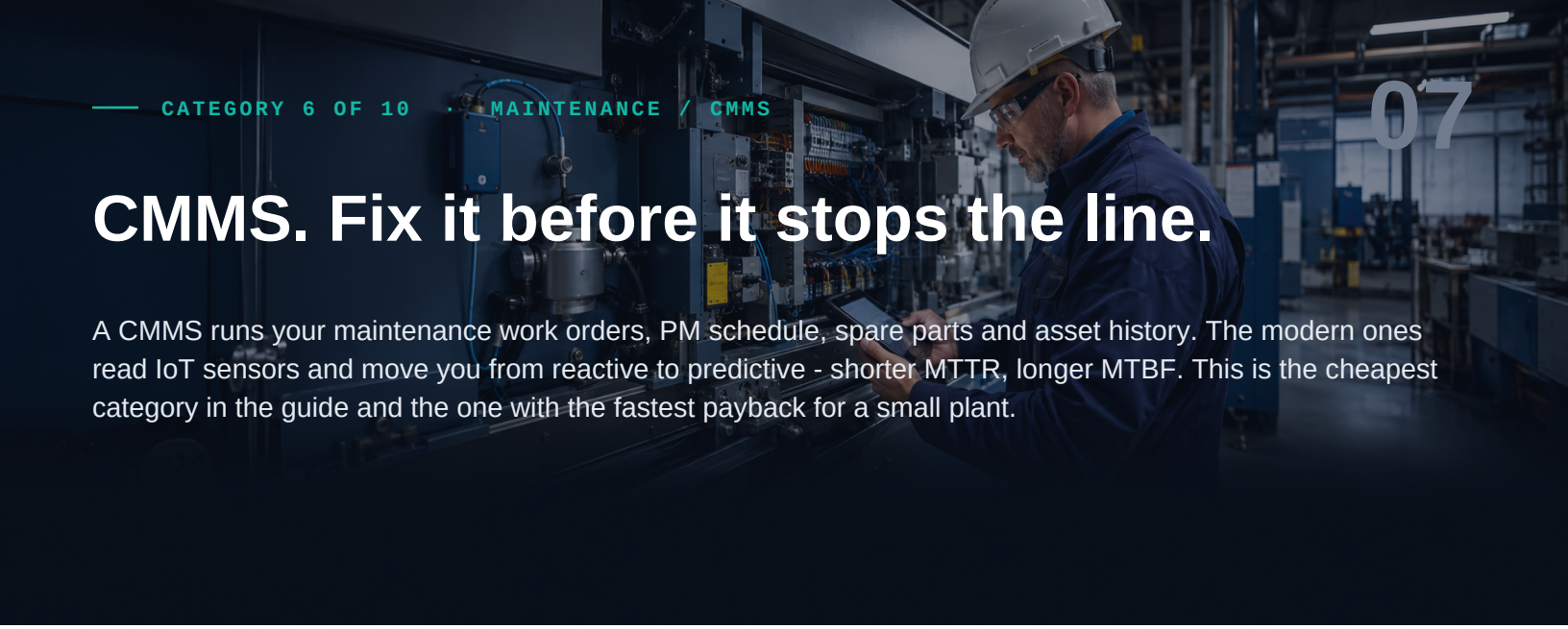
48 h → 2–4 h

Time to isolate a recall with barcode/RFID lot tracking. Inventory accuracy goes 85–90% → 99%+. Defect lots get flagged by the WMS instead of found by a customer. Warranty cost falls 20–35% from faster, narrower recalls.

CHECKLIST · BEFORE YOU SIGN FOR A WMS

- [ ] Run a 50-SKU cycle count this week. Write down your real accuracy. That is your baseline.
- [ ] Every location has a label and every label has a scan. No "the blue rack by the door".
- [ ] Lot number follows the part from receiving to shipping without a human re-keying it.
- [ ] It posts to your accounting system natively — a CSV export at month-end is not integration.

FIELD NOTES PAGE 09



CATEGORY 6 OF 10 · MAINTENANCE / CMMS

07

CMMS. Fix it before it stops the line.

A CMMS runs your maintenance work orders, PM schedule, spare parts and asset history. The modern ones read IoT sensors and move you from reactive to predictive - shorter MTTR, longer MTBF. This is the cheapest category in the guide and the one with the fastest payback for a small plant.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
UpKeep	Plants wanting mobile-first maintenance. Mobile work orders, asset tracking, predictive alerts, IoT sensors.	$500–$3,000/mo by equipment count	Fastest-growing CMMS in discrete manufacturing.
Fiix	Preventive-focused facilities and plant maintenance. PM scheduling, asset lifecycle, mobile technicians.	$400–$2,500/mo by asset count	Strong facilities and ERP integration.
Limble CMMS	Mid-market with 50–500 assets. PM automation, work order templates, spare parts.	$600–$2,000/mo + implementation	Easier than legacy CMMS.
IBM Maximo	Large plants with mission-critical equipment. Advanced asset management, IoT, predictive analytics.	$50K–$500K+/yr + $200K–$2M impl.	Enterprise leader for predictive maintenance at scale.
MaintainX	Discrete plants wanting a lean, modern mobile CMMS. Mobile work orders, team chat, live spare-parts inventory.	$200–$1,500/mo by user count	Purpose-built for floor teams.

SMALL-PLANT READ

MaintainX, Limble, UpKeep, Fiix — all four fit a small plant and all four run on the technician's phone. Pick on price model (per user vs. per asset) and on whether your team will actually use the app. Maximo is for refineries.

15 → 2–3

Unplanned downtime events per month, reactive vs. predictive, for a discrete plant with $50M of installed equipment. MTBF 2,000 → 4,000+ hours. MTTR 8 → 2 hours. 20–30% less unplanned downtime is worth $100K–$300K a month in throughput.

CHECKLIST · BEFORE YOU SIGN FOR A CMMS

- [ ] You know last month's MTBF, MTTR and number of unplanned stops per line. If not, count them from the shift log.
- [ ] Every asset has a tag and a QR code. A technician scans it and sees the history.
- [ ] Operators can raise a work request from the line in under a minute.
- [ ] Start sensors on the 3–5 machines that stop the whole plant when they fail. Not on everything.

PLM. One BOM, one revision, no surprises.

PLM holds the product definition: BOMs, drawings, engineering change orders (ECO), artwork, supplier docs. It is the golden record that ERP, MES and purchasing should read from. In a small plant the symptom you are fixing is simple — the floor builds rev C while the drawing on the tablet says rev B.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
Arena (PTC)	Mid-market wanting cloud-native PLM. BOM management, collaborative design, ECO workflows, quality integration.	$3,000–$15,000/mo + implementation	Fastest-growing cloud PLM; Gartner leader.
Teamcenter (Siemens)	Large automotive and aerospace. Program management, EBOM/MBOM/SBOM, compliance.	$50K–$500K/yr + $100K–$1M+ impl.	Market leader for large enterprises.
Onshape	Engineers wanting browser-based CAD. Cloud CAD, real-time collaboration, version control, mobile.	$100–$500/user/mo + workspace licensing	First true cloud CAD. No local files.
Windchill (PTC)	Large enterprises with global teams. Enterprise PLM, supply chain integration, lifecycle management.	$100K–$1M+/yr + $200K–$3M+ impl.	Industry standard for mid-market PLM.
OpenBOM	Growing manufacturers and hardware startups. Simple BOM collaboration, supplier integration, change tracking.	$200–$2,000/mo by users + items	Lower cost, easier to implement than traditional PLM.

SMALL-PLANT READ

Start with OpenBOM. Move to Arena when ECO volume passes 20 a month or a customer demands formal change control. Onshape if your engineers want cloud CAD. Teamcenter and Windchill are for the OEM you supply.

2–4 wk → 3–5 d

Time per ECO, traditional vs. cloud PLM with concurrent approvals, for a mid-market electronics plant running 20–30 ECOs a month. Design changes hit production 30% faster. BOM errors drop 50–70% from version control and automatic sync to ERP/MES.

CHECKLIST · BEFORE YOU SIGN FOR PLM

- [ ] Count last quarter's ECOs and how many days each took. Count the scrap caused by wrong revisions.
- [ ] One BOM syncs to ERP automatically. Nobody maintains a second copy in Excel.
- [ ] The tablet at the station always shows the released revision — and only that one.
- [ ] Suppliers get the drawing from the system, not from an email attachment.

FIELD NOTES PAGE 11

09

Job costing. Know which jobs make money.

Manufacturing finance has to handle job costing (custom / job shop), standard costing (repetitive) and process costing (continuous), and then show you the variance between what a job should have cost and what it did. That variance is where the floor and the office finally talk about the same number.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
NetSuite	Integrated GL + job costing + WMS. Native job costing, variance analysis, multi-entity consolidation.	$5,000–$20,000/mo + $500K–$2M impl.	One system, no reconciliation between systems.
Prophix	Manufacturing-specific FP&A. Cost accounting, variance analysis, plant dashboards.	$100K–$500K/yr by data volume	Works with SAP, Oracle, NetSuite, Infor.
FloQast	Faster close and consolidation. Close management, workpapers, CFO dashboards, variance tracking.	$50K–$200K/yr	Works with SAP, Oracle, NetSuite, Sage Intacct.
BlackLine	Large manufacturers. Reconciliation automation, intercompany, audit readiness.	$300K–$2M+/yr by account count	Gartner leader in financial close automation.
Bill.com	Mid-market with high-volume supplier payments. AP automation, 3-way match, fraud detection.	$15–$200/mo + $0.50–$1.50/transaction	3–6 month ROI from AP efficiency.

SMALL-PLANT READ

Bill.com this quarter — cheap, fast, nobody argues. Job costing should live in your ERP, not in a separate tool. Prophix or FloQast once your finance team is bigger than three people. BlackLine is for a multi-entity CFO.

10–15% → 2–3%

Job cost variance to actuals for a contract manufacturer with 500+ active jobs — manual timesheets and spreadsheet allocation vs. MES-fed labor and material. Better cost visibility translates to 8–12% margin improvement through pricing accuracy.

CHECKLIST · BEFORE YOU TOUCH FINANCE TOOLS

- [ ] Pull your 10 biggest jobs from last quarter. Compare quoted cost to actual. Write down the spread.
- [ ] Labor hours come from a clock-in at the job, not from a timesheet filled in on Friday.
- [ ] Material issued to a job is scanned, not estimated from the BOM.
- [ ] The supervisor sees job variance the week the job closes, not at quarter-end.

FIELD NOTES PAGE 12

10

EHS. Everyone goes home with ten fingers.

EHS platforms track incidents and near misses, run hazard assessments and audits, hold your regulatory paperwork and training records. The modern ones push real-time alerts to phones and model risk before it becomes an OSHA log entry.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
Intelex	Enterprise with complex global compliance. Incident management, audit scheduling, compliance docs, audit trail.	$100K–$500K+/yr by employees and sites	70% of Fortune 500 use it.
VelocityEHS	Mid-market needing EHS plus process safety. PSM, hazard assessment, compliance tracking, training.	$50K–$300K+/yr	Strong for building a plant safety culture.
SafetyCulture	Mobile-first inspections. Real-time notifications, audit scheduling, corrective actions.	$1,000–$10,000/mo by user count	AI photo analysis for hazard identification.
Cority	Large multi-site. Incident/illness management, regulatory compliance, environmental.	$200K–$1M+/yr enterprise custom	Heavy industry: steel, chemical, oil & gas.
Enablon	Enterprise, compliance-heavy. Compliance management, audit management, regulatory reporting.	$150K–$750K+/yr	Wolters Kluwer. Leader for compliance-heavy industries.

SMALL-PLANT READ

SafetyCulture. Supervisors run the daily walk from their phone, photos attached, corrective action assigned on the spot. VelocityEHS if you have process safety (chemicals, pressure, combustible dust). Intelex, Cority, Enablon are corporate EHS-department tools.

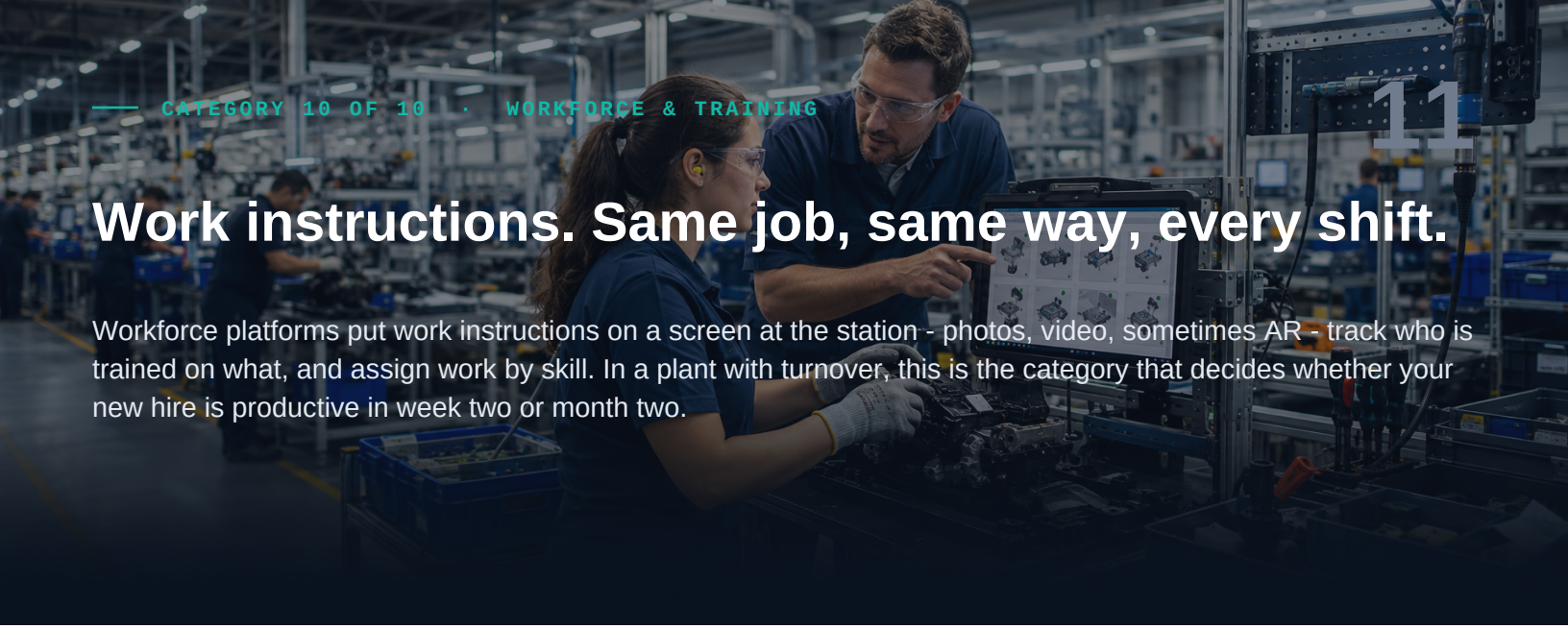
TRIR 3–5 → 1–2

Recordable incidents per 200K hours with a real-time EHS program. Incident investigation 1 week → 1 day. Corrective actions close 60% faster with automatic follow-up. Insurance premiums drop 10–20% on demonstrated improvement.

CHECKLIST · BEFORE YOU SIGN FOR EHS

- [ ] You know your TRIR and your near-miss count. If near misses are zero, nobody is reporting them.
- [ ] Any employee can report a hazard with a photo in under a minute, from the floor, anonymously if they want.
- [ ] Corrective actions have an owner and a date, and the system chases them — not the safety coordinator.
- [ ] Ask your insurer what a documented program is worth on the premium. Put that number in the business case.

FIELD NOTES PAGE 13



CATEGORY 10 OF 10 · WORKFORCE & TRAINING

11

Work instructions. Same job, same way, every shift.

Workforce platforms put work instructions on a screen at the station - photos, video, sometimes AR - track who is trained on what, and assign work by skill. In a plant with turnover, this is the category that decides whether your new hire is productive in week two or month two.

VENDOR	GOOD FOR	PRICE	FLOOR NOTE
Dozuki	Discrete manufacturers wanting visual work instructions. Photo/video capture, training compliance, A3 problem solving.	$2,000–$8,000/mo by employee count	Leader in visual manufacturing knowledge.
Poka	AI-assisted guidance. Real-time work guidance, error detection, quality feedback, performance metrics.	$3,000–$10,000/mo + implementation	Step guidance adapts to worker performance.
Augmentir	Complex assembly, new product launches. AR guidance, remote expert support, hands-free.	$2,000–$6,000/mo + implementation	Best value on high-complexity assembly.
Redzone	Food and beverage. Food safety training, compliance documentation, audit readiness, mobile learning.	$500–$2,000/mo by employee count	Regulatory expertise for food manufacturing.
SwipeGuide	Mid-market with high turnover. Mobile instructions, training, competency tracking, multi-language.	$1,500–$5,000/mo + implementation	Operators create and update instructions — no IT.

SMALL-PLANT READ

SwipeGuide or Dozuki — let your best operator write the instruction with a phone camera. Multi-language matters more than AI on most floors. Redzone if you make food. Poka and Augmentir when you have complex assembly and the budget to match.

4 wk → 1.5 wk

New-hire ramp to full productivity with digital instructions, for a 500-person discrete plant. Process variance 20–30% → 5–10%. Defects from improper execution 8–12% → 2–3%. Training cost per employee $2,000 → $500 a year.

CHECKLIST · BEFORE YOU SIGN FOR WORK INSTRUCTIONS

- [ ] You know how many weeks a new hire takes to hit rate, and your turnover rate. Multiply. That is the cost.
- [ ] A team lead can update an instruction in 10 minutes without calling anyone.
- [ ] It shows the languages your floor actually speaks.
- [ ] The skills matrix is in the system, and the supervisor can see who is certified for which station before assigning the shift.

12

AI on the floor. Four uses that pay. Everything else is a demo.

The AI that earns money in a plant is narrow and trained on plant data: cameras that spot defects, models that predict a bad batch, a failing bearing, or next month's demand. Not a chatbot. If a vendor leads with "generative AI", ask what it does to your OEE.

Computer vision & automated inspection

Highest immediate impact of any AI use. 95–99% accuracy vs. 85–90% human consistency. Real-time detection vs. 30-min manual delay. Frees 2–3 full-time inspectors for better work. Typical plant: $150K–$300K a year in labor plus 20–40% fewer escaped defects.

Predictive quality & root cause

Flags batches likely to fail before the run ends, instead of 48 hours after. Suggests the likely cause: material, machine, operator, setting. False positives 5–10%. CAPA cycle 2–3 weeks → 4–5 days.

Demand sensing & inventory

Forecast accuracy 70% → 85–90%. Inventory down 15–30% at the same service level. Bullwhip effect down 20–40%. Expedited freight down 25–35%.

Predictive maintenance

MTBF up 20–40%. 1–4 weeks warning before a likely failure. MTTR down 40–60% because the part and the tech are ready. Unplanned downtime down 30–50% = $100K–$500K+ a year in recovered production.

95–99%

Automated visual inspection accuracy. A tired human at hour seven of a shift lands at 85–90%. The camera does not get tired, and it does not wait 30 minutes to write it down.

CHECKLIST · BEFORE YOU BUY ANYTHING WITH "AI" ON IT

- [ ] You have 6+ months of clean machine, quality or downtime data. No data, no model. Do Phase 1 first.
- [ ] Start with vision on your single worst defect, on one line. Prove it. Then expand.
- [ ] The vendor names the metric it moves — OEE, escapes, MTBF, forecast accuracy — and the baseline it needs from you.
- [ ] The false-positive rate is in the contract. Above 10% the operators will switch it off.

FIELD NOTES PAGE 15

CHAPTER 13 · IMPLEMENTATION ROADMAP

18 months. Three phases. One line at a time.

Nobody swaps every system at once and survives. Phase it. Each phase has to pay for itself before the next one starts — that is how you keep the owner's signature on the next purchase order.

PHASE 1 · MONTHS 1–4 **Foundation & visibility**	Shop-floor data collection: machines, WIP, downtime. Real-time defect tracking and an SPC screen. Baselines for OEE, quality, inventory accuracy, MTTR/MTBF.	Expect: OEE +8–12 points from visibility alone. Defect detection instant vs. 24–48 h lag. Downtime capture 100% vs. 60–70% manual.
PHASE 2 · MONTHS 5–10 **Optimization & planning**	Cloud ERP with real-time capability, if the old one can't. Demand sensing plus WMS with lot traceability. Sensor-based predictive maintenance on critical equipment.	Expect: OEE +12–18 points. Inventory turns +15–25%. MTTR –30–50% from predictive alerts.
PHASE 3 · MONTHS 11–18 **Integration & intelligence**	Cloud PLM with ECO automation. Vision inspection, demand forecasting, quality prediction models. Digital work instructions and skills-based assignment.	Expect: OEE +20–35 points total. Quality cost –40–60%. Engineering changes to production 30–50% faster.

WHAT KILLS THESE PROJECTS

- → **No owner.** The plant manager or VP Ops owns it personally. If IT owns it, the floor ignores it. Ownership alignment is non-negotiable.
- → **Dirty data.** Clean BOMs, routings and reason codes before go-live. Garbage in any system is garbage insight.
- → **No training time.** Production teams need 4–8 weeks on the new workflow. Budget the hours or budget the failure.
- → **Integration as an afterthought.** Reserve 15–20% of implementation cost for APIs, ETL and data sync.
- → **No early win.** Show a measurable OEE or quality gain inside 6 months or the momentum dies.

CHECKLIST · BEFORE PHASE 1 KICKS OFF

- [ ] One named owner from operations, with time carved out of their week.
- [ ] One pilot line chosen — the one with the worst OEE and the most cooperative team lead.
- [ ] Baselines written down and dated: OEE, defects, downtime events, inventory accuracy, MTTR/MTBF.
- [ ] A 6-month win defined in one sentence the owner would repeat to the bank.

Picking a vendor without getting played.

Score every finalist on the same six criteria, weighted. Do it in a room with the supervisor who will live with the system, not just the person who signs the check.

CRITERION	WEIGHT	ASK	RED FLAG / GREEN SIGNAL
OEE impact	25%	Will it raise OEE, cut downtime, or improve quality — by how much, for a plant like mine?	Red: vague improvement claims. Green: specific benchmarks for your production type.
Integration	20%	Does it connect to my ERP, MES, QMS and the rest — today?	Red: needs expensive custom development. Green: pre-built connectors exist.
Manufacturing expertise	15%	Do they know discrete from process from job shop?	Red: generic "bolt-on" for manufacturing. Green: built for your production model.
Total cost	15%	Software + implementation + training + 3 years of support — one number.	Red: hidden fees, surprise costs. Green: transparent pricing model.
References	15%	3–5 manufacturers my size I can call?	Red: only enterprise or only tiny customers. Green: several in your size and industry.
Timeline	10%	How long to go-live, and what do you need from my people?	Red: 6+ months with no milestones. Green: 4–5 months with clear milestones.

BUY ORDER BY PRODUCTION TYPE

Discrete job shop

Month 1: MES + quality (live WIP, defect tracking).
Month 4: PLM + ERP BOM management.
Month 8: demand sensing, supplier collaboration, CMMS.

Repetitive / batch

Month 1: MES + finite capacity scheduling + quality.
Month 4: supply chain planning (demand sensing).
Month 8: predictive maintenance + digital workforce.

Process (chemicals, food)

Month 1: quality (SPC, batch genealogy, compliance).
Month 4: MES (process control, lot traceability).
Month 8: supply chain (demand sensing for raw materials).

CHECKLIST · BEFORE YOU SIGN THE CONTRACT

- [ ] **Benchmarked 2–3 competitors.** Vendors vary 50%+ in price for the same scope.
- [ ] **Multi-year priced.** A 3-year commitment typically gets 20–30% off annual.
- [ ] **Implementation capped.** Fixed cap on hours and fees. Open-ended T&M kills ROI.
- [ ] **99.5% uptime SLA** with automatic service credits.
- [ ] **Data portability.** Full export in CSV/JSON, no restrictions, in writing.
- [ ] **Integration owner named.** Vendor or SI handles ERP/MES integration — and the cost is in the quote.

FIELD NOTES PAGE 17

The whole guide on one page.

60%+ of automotive, electronics and aerospace plants already run real-time MES. The ones that haven't moved are losing share on cost, quality and delivery. The question is when, not whether.

+20-35	-40-60%	-25-40%	-30-50%
OEE POINTS	QUALITY COST	INVENTORY	UNPLANNED DOWNTIME

DAYS 1-30

Assess & build the case

Baseline OEE, quality cost, inventory turns, MTTR/MTBF per line. Name the top 3 pains, put a dollar figure on each. Build a 3-year ROI for ops and finance.

DAYS 31-60

Evaluate & visit

RFP for the top-priority category - usually MES or ERP. Demos with 3-5 finalists. Visit 2-3 reference plants your size. Negotiate and sign.

DAYS 61-90

Launch & win early

Steering group: plant manager, finance, ops, IT. Define 90-day quick-win metrics - OEE, defects. Pilot Phase 1 on one line before you roll out.

BUY ORDER FOR A SMALL PLANT

1. Machine data + downtime capture (MES)
2. Real-time quality (QMS, SPC on the line)
3. Mobile CMMS on critical equipment
4. ERP that fits your model + WMS with lot tracking
5. PLM + digital work instructions
6. AI: vision on your worst defect, then predictive maintenance

SIX CONTRACT RULES

-> Benchmark 2-3 competitors - 50%+ price variance

-> 3-year term = 20-30% off

-> Fixed cap on implementation fees

-> 99.5% uptime SLA with service credits

-> Full data export, CSV/JSON, no restrictions

-> Integration owner and cost named in the quote

MEET THE AUTHOR · FOUNDER, LEANMARK.AI

Want a second pair of eyes on your stack before you sign?

Mark Dabrowski - 15 years of real Lean on real floors, now with AI tools that work at the station. No fluff. No frameworks. No consulting speak. One problem. One principle. One thing to do Monday.

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