



AI OPPORTUNITY AUDIT

Maintenance & Reliability function

Where AI cuts downtime and improves reliability, and where it adds nothing

Client	Group [REDACTED]
Sector	Food processing and manufacturing
Scope	5 sites · 260 critical assets
Function audited	Maintenance & reliability
Date	August 2026
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Confidential document. The group's name and its sites have been masked at the client's request.

Key takeaways

Unplanned downtime costs the group \$3.6M per year. AI can recover part of it, provided we start small, where the data is ready, and only scale up after proof.

\$3.6M cost of unplanned downtime, per year	~\$530K net gain per year, at maturity and conditional	\$1.1M total program cost over 3 years	~32 months to break even
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The three decisions we ask for

- **Launch a pilot on Site A.** The best prepared of the group. Limited investment, first result at month 4.
- **Lay the data foundation now.** Equipment identifiers and failure history: the pilot depends on them.
- **Release the rest only if the pilot succeeds.** Roll-out to the other sites, and its budget, are conditional on results.

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Each heading below is a clickable link. The detail of the calculations and sources is in the appendix.

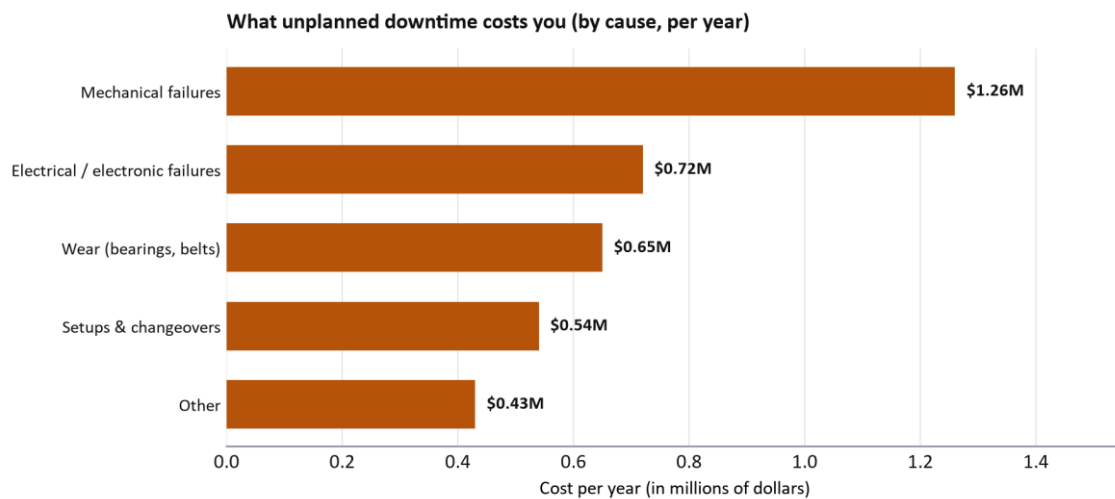
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Downtime costs \$3.6M per year

The group suffers about 12,000 hours of unplanned downtime per year across its 260 critical assets. This total is the sum of the five sites, not a top-down estimate.

Indicator (5 sites)	Today	Target at 18 months
Equipment availability	88%	92%
Average repair time	4.8 h	3.8 h
Share of unplanned failures	55%	40%
Cost of unplanned downtime	\$3.6M / year	to be reduced

Where the money is lost



Three findings

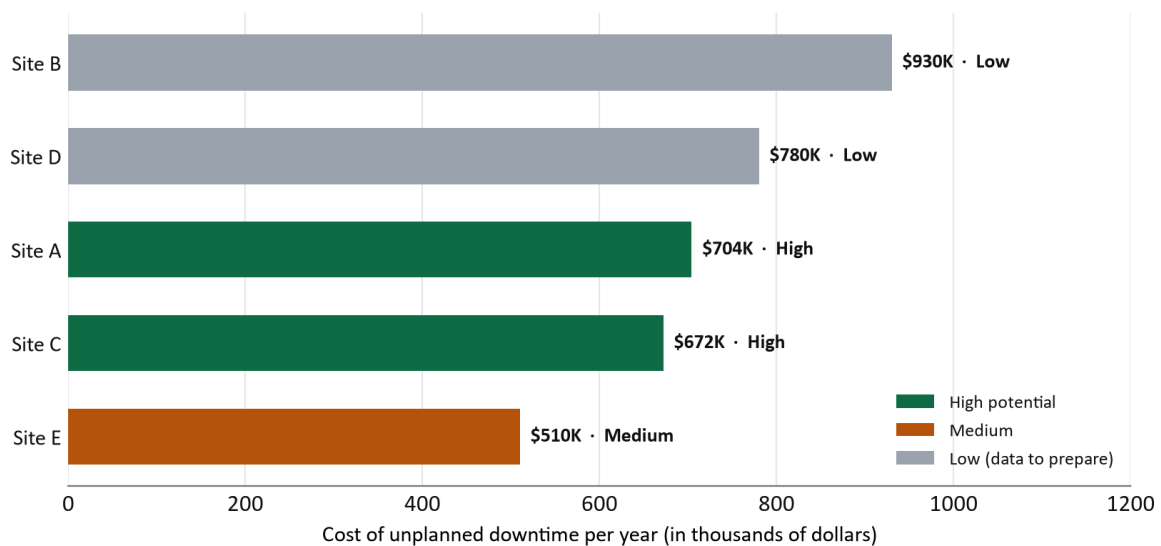
- **Mostly reactive maintenance:** more than half of stoppages are unplanned (55%): maintenance reacts more than it anticipates.
- **Know-how in people's heads:** repair time ranges from 3.2 h to 6.1 h across sites; diagnosis depends on each person's experience.
- **Data present but not connected:** the same asset carries different identifiers in different software, which prevents cross-referencing the data.

Site A is the best starting point

The five sites are not alike. The biggest losses are not where AI is most applicable: the choice of starting point turns on data reliability as much as on losses.

Indicator	Site A	Site B	Site C	Site D	Site E
Availability	91%	86%	90%	84%	89%
Average repair time	3.2 h	5.4 h	3.8 h	6.1 h	4.3 h
Cost of downtime (\$K/yr)	704	930	672	780	510
Data reliable?	Yes	No	Yes	No	Partial
AI potential	High	Low	High	Low	Medium

Where the losses are, and where AI is applicable



Why Site A

- **Usable data.** The best data in the group and 68% of critical assets already instrumented.
- **Real losses to address.** \$704K of downtime per year, mostly on recurring equipment families (pumps, compressors).
- **Replicable next.** The same equipment families exist on Sites C and E, subject to checking their operating conditions.
- **Sites B and D wait.** Their losses are high, but their data is not ready: they go through an upgrade first.

Three opportunities justify an investment

Six options were studied. Three are retained, three are set aside at this stage. Here are the three retained, with the associated decision.

DECISION: PILOT ~\$446K per year Predictive maintenance Detect certain failures before they stop production, on repetitive equipment. Why now: history and sensors already usable on Site A.	DECISION: QUICK WIN ~\$220K per year Diagnostic assistant Help technicians find the cause of a failure faster and restart sooner. Why now: maintenance history and documentation already available.	DECISION: TO PREPARE ~\$40K per year Spare-parts forecasting Reduce parts stock-outs and unnecessary inventory (plus a one-off cash release). Why now: lower value, to add once the data foundation is in place.
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What we set aside, and why

Option set aside	Why	Decision
Production-line digital twin	Data still insufficient, uncertain return.	Defer
Root cause analysis	A conventional method is enough; AI adds nothing at this stage.	Conventional method
Preventive maintenance optimization	A reliability review is safer than an AI model.	Conventional method

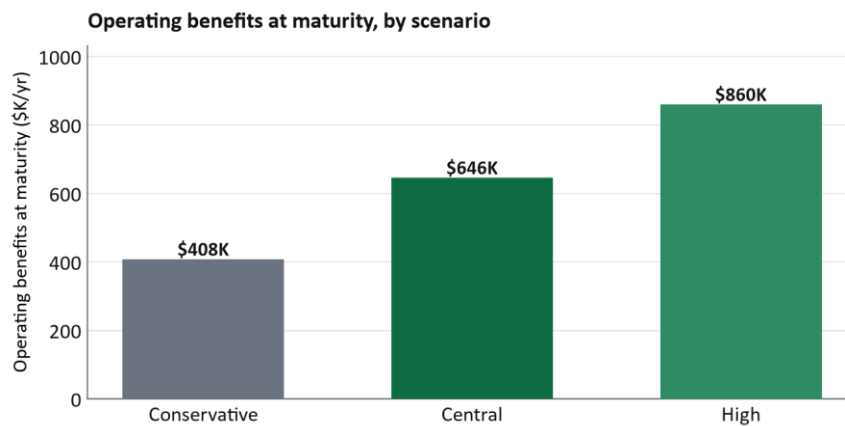
Setting these aside is not giving up the value: root causes and preventive work will be handled, but with a safer, cheaper method than AI at this stage.

The program pays back in ~32 months

The reasoning fits in five lines. The investment is a total cost over three years; the benefits are those of the estate at maturity, once all eligible sites are equipped.

Item	Amount
Investment (total cost over 3 years)	\$1.1M
Operating benefits at maturity	\$646K / year
Less recurring operating costs	-\$120K / year
Net gain at maturity	~\$530K / year
Payback	~32 months

Three scenarios (operating benefits at maturity)



A figure at maturity, not an immediate promise

- The pilot (Site A) first demonstrates ~\$90K/year on a limited scope. That modest, verifiable figure is what is committed now.
- The ~\$530K/year gain assumes successful replication to the other sites. The budget for later waves is released only after confirmation at month 4.
- Benefits are not added up naively: overlaps between levers are removed. The detail is in the appendix.

Four prerequisites determine success

Success does not depend on technology but on preparation. Four workstreams must be started before, or during, the pilot.

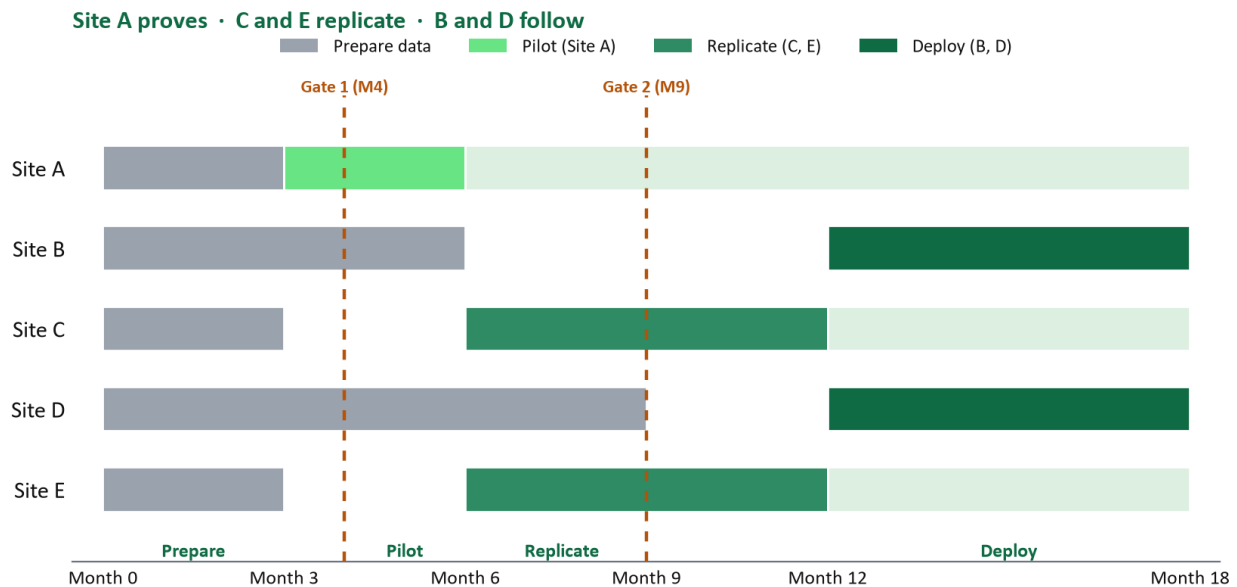
Prerequisite	What to do	Effort
Unify equipment identifiers	A single reference linking each asset across the software (today it has three different names).	4 to 6 wks
Make failure history reliable	Record causes with standardized codes, not free text.	Ongoing
Add the necessary sensors	Instrument the targeted critical equipment where sensors are missing.	Per site
Secure the industrial connections	Have each connection validated by security before connecting sensors.	Before connecting

The biggest blocker: a single asset identifier

- The same asset carries three identifiers depending on the software (management, measurements, sensor). Result: 31% of events require manual matching before any analysis.
- **Without this single reference, predictive maintenance is impossible.** It is the first workstream to start, owned by maintenance, industrial IT and the IT department.

A roll-out in four waves over 18 months

The five sites do not start together. Site A proves, Sites C and E replicate, Sites B and D fix their data first. Two decision points (month 4 and month 9) gate the rest.



Wave	Sites involved	Expected result	Decision point
Prepare (M0-M3)	All 5 sites	Reliable data, unified identifiers	-
Pilot (M3-M6)	Site A	First failures anticipated, faster repairs	Decision at month 4
Verify and replicate (M6-M12)	Sites C then E	Value confirmed, replication cost validated	Decision at month 9
Deploy (M12-M18)	Sites B and D	Scale-up to eligible equipment	-

A wave is triggered only if the previous one met its targets. Sites B and D receive AI only after their data is upgraded. The detail (costs, owners, gate criteria) is in the appendix.

Five risks, and what we do about them

A program of this size carries risks. The first three must be handled before the pilot. Each has a mitigation and an owner; the detailed rating is in the appendix.

Risk	Level	What we do
Insufficient failure history	Critical	Make the data reliable before the pilot.
Equipment identifiers not aligned	Critical	Build a single reference.
Cybersecurity of industrial systems	High	Have each connection validated before hook-up.
Incorrect AI alerts	High	Keep the decision with the human; conservative thresholds.
Adoption by technicians	High	Co-design with the teams, train, pilot small.

The other risks (vendor dependence, replication cost, loss of model performance over time) are tracked with the same method: see the risk appendix.

The decision we ask for

Three decisions are enough to launch the program. They are deliberately sequenced: the significant value is committed only once proof is established.

1. Approve the pilot on Site A

- Pump and compressor families, with a limited scope. First measurable result at month 4.

2. Lay the data foundation now

- Single reference of identifiers and reliable history: these workstreams gate everything else and do not wait for the pilot.

3. Release the rest only after proof

- Roll-out to the other sites, and its budget, are committed only if the pilot meets its targets at month 4.

Every recommendation in this report ties back to an audit finding and a reconstructible calculation. The detail (method, sources, assumptions, per-site data, risk rating) is in the appendices that follow.

Appendices

The main report fits in ten pages. The appendices gather the method, the sources and the detail of the calculations, so your teams can reproduce every figure.

A. Method and sources

Every figure in this report is reconstructible. The table below shows where each data point comes from and its evidence level.

Item	Source and method	Evidence
Scope	5 sites, 260 critical assets (motors, pumps, compressors, conveyors, packaging).	Measured
Downtime hours	Extraction from the maintenance software over 36 months, unplanned stoppages, annualized average per site.	Measured
Cost of one hour of downtime	Lost margin net of recovery, validated with the finance team (\$280 to \$320/hr).	Calculated
Availability and repair time	Weighted averages (by planned hours and by number of interventions), not simple averages.	Calculated
Expected gains	Addressable base by cause of stoppage, cut by a conservative rate, after detectability (appendix C).	Assumption
Targets (92%, 3.8h, 40%)	Derived from the best site, the gains model and a sector reference (appendix C).	Calculated

Evidence levels - Measured: direct extraction. Calculated: derived by a formula. Declared: interview not cross-checked. Assumption: model parameter bounded by a scenario. Benchmark: external reference.

Economic cost of one hour of downtime

\$280 to \$320/hr depending on the site, validated with the finance team. The lost margin is net of recoverable production (buffer stock, overtime); it is therefore not the gross hourly margin.

B. Per-site detail and scoring rules

Indicator	Site A	Site B	Site C	Site D	Site E
Availability	91%	86%	90%	84%	89%
Average repair time	3.2 h	5.4 h	3.8 h	6.1 h	4.3 h
Corrective interventions / yr	210	340	190	300	150
Data quality (/5)	4/5	2/5	3/5	1/5	3/5
Sensor coverage	68%	25%	55%	15%	45%
Cost of downtime (\$K/yr)	704	930	672	780	510
Data readiness (/100)	75	34	58	18	54

AI-potential rule. Data readiness = $60\% \times (\text{CMMS data quality} / 5) + 40\% \times (\text{sensor coverage})$. Potential 'High' if readiness $\geq 55/100$ AND losses $\geq \$600K$; 'Low' if readiness < 40 ; 'Medium' otherwise. The score thus combines value (addressable losses) and feasibility (available data).

Data-quality scoring (/5) - weighting: Completeness of logged interventions 30% · Standardized fault coding 25% · Quality of equipment identifiers 20% · Depth of history 15% · Timestamp consistency 10%. Levels: 1 Unusable · 2 Weak · 3 Partly usable · 4 Usable with limited fixes · 5 Ready for industrialization.

C. How the gains are calculated

Not every mechanical or electrical failure can be detected in advance. We go one level down: cause, then failure mode, then available signal, then truly addressable base.

Failure mode	Cost \$K	Usable signal	Predictable?	Addressable base \$K
Bearings & housings	520	Vibration, temperature	Yes	520
Pumps & seals	430	Vibration, pressure	Yes	430
Gearboxes & gearing	310	Vibration	Yes	310
Electric motors	400	Current, thermography	Partial	240
Belts & drives	240	Vibration, current	Partial	120
Miscellaneous wear (slides, cylinders)	410	Mixed	Partial	164
Sudden electrical faults	320	Insufficient signal	No	0
Total	2,630			1,784

Of \$2.63M of unplanned failures, \$1,784K (~\$1.78M) are truly addressable. Conservative reduction of 25% -> \$446K/year at group maturity.

The base depends on how much of the scope is data-ready (pilot to group)

Scope	Addressable base (\$K)	Predictive gain (\$K/yr)
Pilot (Site A)	263	66
A + C (data ready)	513	128
Group at maturity (after B/D/E upgrade)	1,784	446

Diagnostic assistant detail

Item	Value	Basis
Complex interventions / year	~ 476	40% of the group's corrective interventions
Diagnosis time saved	~ 5.3 h	per complex intervention, via the assistant
Technician hours freed	~ 2,500 h	476 x 5.3 h
Loaded hourly technician cost	\$60/hr	finance team
Technician time gain	\$150K/year	2,500 h x \$60/hr
Recovered production (earlier restart)	~ 230 h	faster diagnosis on critical stoppages
Hourly value of production	\$300/hr	economic hourly margin
Production gain	\$70K/year	230 h x \$300/hr
Total diagnostic assistant	\$220K/year	150 + 70

Spare-parts forecasting detail

Item	Value	Basis
Spare-parts inventory tied up	~\$1.5M	CMMS inventory
Stock-outs / rush orders avoided	\$40K/year	recurring P&L: waiting for parts and procurement surcharges

Item	Value	Basis
Reduction of dormant stock	~\$60K	working capital: one-off cash release, outside the run-rate

Where the targets come from

Indicator	Today	Target	How the target is set
Equipment availability	88%	92%	Benchmark = best site of the group (Site A, 91%) raised to 92% by cutting unplanned failures. Food-industry reference: 90 to 93% (top quartile).
Average repair time	4.8 h	3.8 h	Current weighted repair time 4.8 h, cut 20% by the diagnostic assistant ($4.8 \times 0.8 = 3.8$ h).
Share of unplanned failures	55%	40%	Predictive maintenance converts a quarter of unplanned failures into planned ones ($55\% \times 0.75 \sim 40\%$).

D. Detailed business case

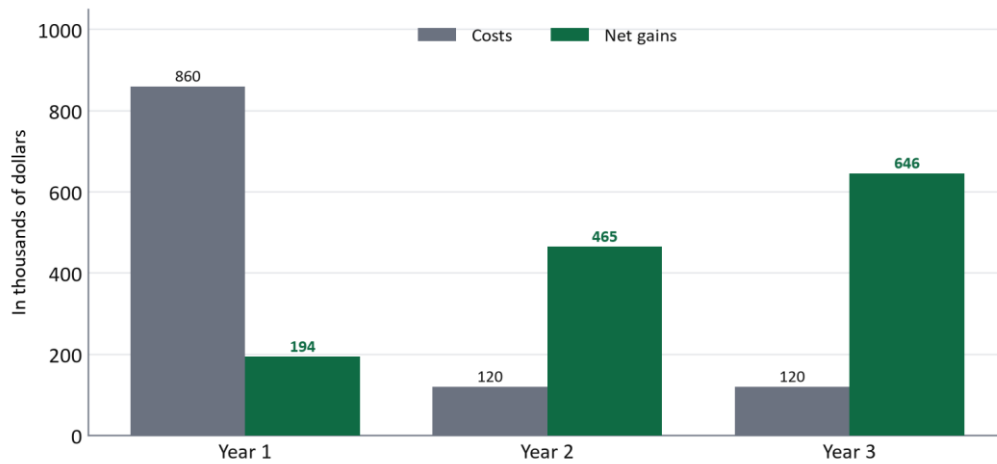
Cost item	Amount (\$K)	Nature
Sensors & instrumentation	220	Upfront (equipment)
Platform & licenses (3 years)	210	Recurring
CMMS / Historian integration & data preparation	180	Upfront
Pilot development (integrator)	160	Upfront
Model maintenance & support (3 years)	150	Recurring
Edge processing & infrastructure	90	Upfront (equipment)
Change management & training	90	Upfront
Total cost over 3 years	1,100	

Upfront costs (implementation): 740 \$K · recurring costs (3 years): 360 \$K · 18-month roll-out budget: 920 \$K · annual recurring costs after deployment: 120 \$K. Upfront / Recurring classification, to be confirmed with Finance for accounting treatment (capitalization or expense). Physical equipment (sensors, edge) represents ~310 \$K; the rest is integration, development and operations.

Scenario assumptions

Variable	Conservative	Central	High
Reduction of unplanned failures (predictive)	18%	25%	32%
Reduction of repair time (assistant)	12%	20%	25%
Adoption by technicians	65%	80%	90%

Result (operating benefits at maturity): conservative \$408K · central \$646K · high \$860K. Trajectory over 3 years: benefit/cost ratio 1.2 x, payback ~32 months.



E. How priority is calculated

Criterion (weight)	Predictive maint.	Assistant	Spare parts
Economic value (25%)	5/5	3/5	2/5
Data readiness (15%)	3/5	5/5	4/5
Technical feasibility (15%)	4/5	5/5	4/5
Time to first results (15%)	2/5	5/5	4/5
Ease of implementation (10%)	2/5	4/5	4/5
Multi-site replicability (10%)	5/5	5/5	4/5
Risk control (10%)	3/5	4/5	4/5
Final score (/100)	72	86	70

Score = weighted average of the seven criteria, each rated 1 to 5 (higher = better), rescaled to 100. The roll-out order also factors in dependencies: the assistant goes first because it has no heavy prerequisite, predictive waits for the data foundation.

F. Detailed risks (before and after mitigation)

Criticality = Probability x Impact (each 1 to 5). 1 to 4 low - 5 to 9 moderate - 10 to 14 high - 15 to 25 critical.

Risk	Before	Mitigation	After	Owner
Incomplete or free-text failure history	16 (Critical)	Data clean-up and standardized fault codes (Phase 0)	8 (Moderate)	Maintenance + Data
Equipment identifiers not reconciled (ERP / Historian / sensors)	16 (Critical)	Single equipment reference (asset master)	6 (Moderate)	OT + IT
False positives or false negatives in alerts	12 (High)	Conservative thresholds, human supervision, gradual ramp-up	6 (Moderate)	Reliability lead
Model drift over time	9 (Moderate)	Performance monitoring and scheduled retraining	4 (Low)	Model ops
Cybersecurity of industrial systems (OT)	12 (High)	Network segmentation, IEC 62443 standard, review before connection	6 (Moderate)	IT security / OT
Insufficient sensor coverage on some sites	12 (High)	Targeted instrumentation of critical equipment	6 (Moderate)	Maintenance
Adoption by technicians	12 (High)	Co-design, limited pilot, training	6 (Moderate)	Site manager
Dependence on the integrator or vendor	6 (Moderate)	Open standards, reversibility, internal skill-building	4 (Low)	IT

Risk	Before	Mitigation	After	Owner
Replication cost underestimated	9 (Moderate)	Per-site cost model validated at the pilot	4 (Low)	Sponsor
Staying stuck at the pilot stage (no scale-up)	12 (High)	Go/No-Go gates, budget tied to results	6 (Moderate)	Sponsor

G. Detailed roadmap

Wave	Cost	Expected gain	Owner	Gate criterion	Decision
Prepare (M0-M3)	~\$250K	Prerequisite (no direct gain)	OT + Data	Data quality > 90%, identifiers reconciled	-
Pilot (Site A) (M3-M6)	~\$300K	~\$90K/year (pilot)	Reliability lead	Repair time -15%, reliable alerts > 80%	Gate 1 (M4)
Replicate (C then E) (M6-M12)	~\$300K	~\$300K/year cumulative	Reliability lead	Per-site replication cost confirmed	Gate 2 (M9)
Deploy (B and D) (M12-M18)	~\$250K	~\$530K/year net recurring at maturity	Sponsor	Scale-up to eligible families	-

Gate 1 - Month 4 (End of the Site A pilot): >= 95% of pilot-scope equipment identifiers reconciled · >= 90% of pilot data usable (fault codes, timestamps) · Alert accuracy > 80% and false-alert rate < 15% · Pilot business case confirmed on the pump / compressor families.

Gate 2 - Month 9 (Site A industrialized, Site C prepared): Site A repair time cut by at least 15% · Adoption: > 70% of interventions go through the assistant · Per-site replication cost confirmed (model validated at the pilot) · Site C at the required data level to start.

H. Scope and limitations of the audit

Point	Detail
Sites visited	3 of 5 (A, C, E). Sites B and D analysed remotely from records and extractions.
Interviews	9 interviews: 5 maintenance managers, 2 methods / reliability, 1 IT / OT, 1 finance.
Data used	36 months of CMMS history; Historian on instrumented sites; ERP spare-parts inventory.
Missing data	Sensor history < 12 months on B and D; partial fault codes on D.
Based on declaration	Site B availability (partial readings); Site A team's willingness (management interview).
Out of scope	Machine safety, product regulatory compliance, energy optimization, production planning.

I. Glossary

Term	Definition
CMMS	Computerized Maintenance Management System: the software that logs interventions and failures and manages the equipment register.
Historian	Database that archives production-sensor measurements over time.
MTTR	Mean Time To Repair: average time to fix a failure.
Unplanned failure	An unplanned stoppage (breakdown), as opposed to a planned stoppage (preventive maintenance).
Predictive maintenance	Anticipating failures from sensor signals, before the breakdown occurs.
RCM	Reliability-Centered Maintenance: a reliability method that optimizes preventive work without a statistical model.
OT	Operational Technology: industrial IT systems (controllers, sensors, plant networks).

Term	Definition
IT / IT security	Information systems department / information-systems security officer.
Edge	Processing data locally, close to the machines, rather than in the cloud.
Model drift	Loss of model accuracy when conditions change; requires retraining.
Asset master	A single table linking the identifiers of one piece of equipment across systems.
Go/No-Go gate	A decision point where criteria are checked before releasing the next budget tranche.
IEC 62443	International standard for the cybersecurity of industrial systems.
TCO	Total Cost of Ownership: full cost over time (implementation + operations).
Working capital	Cash tied up, here in the spare-parts inventory.