AI **AI OPPORTUNITY BRIEF**

AI-GENERATED PRELIMINARY ASSESSMENT

AI OPPORTUNITY ASSESSMENT

Automated Visual Inspection for Weld Defect Detection

Prepared for **Fictional MetalWorks GmbH – industrial equipment manufacturing**

Business area **Quality Management – robotic welding line** Assessment date **27/07/2026**

68
out of 100

RECOMMENDATION

✓

Conditional PoC candidate

The use case meets the score and gate criteria for a PoC. Final consultant approval is still required.

APPROVAL PENDING

READINESS SCORE

68/100

Conditional PoC candidate

POC PREREQUISITES

6/6

passed

REVIEW SIGNALS

1

Final consultant approval required

!

DECISION STATUS

Additional validation required

These signals must be reviewed by the responsible consultant before approval.

Model and system recommendations conflict

AI recommendation: Discovery workshop recommended **Rules-based decision:** PoC candidate

01

DECISION BASIS

Executive summary

Fictional MetalWorks GmbH's robotic welding line currently relies on manual sampling, resulting in an escaped-defect rate of 1.8% and 11 customer complaints over six months. The Plant Director wishes to evaluate whether an AI-driven visual inspection system can detect at least 90% of visually identifiable weld defects and lower the escaped-defect rate to ≤0.8% without slowing the line. A ten-week offline PoC with a budget of EUR a source-validated value a source-validated value is approved, but data quality (lighting inconsistencies, label verification) and technical feasibility (model performance, resource needs) remain unresolved, suggesting a discovery phase before committing to the PoC.

What supports the case

✓ **Business value**

Current escaped-defect rate is 1.8% and the plant recorded 11 customer complaints related to weld quality in the last six months.

✓ **Organisational readiness**

Executive sponsor: Plant Director (IDENTIFIED).

✓ **Governance readiness**

The image data contains components only and no employee or customer information.

What needs attention

! **Strategic fit**

No documented corporate strategy, portfolio priority, or mandatory commitment linking this use case to strategic objectives.

! **Data readiness**

Inconsistent lighting in approximately 8% of images may affect model training and inference.

! **Technical feasibility**

Model performance (detection rate, false-reject rate) on the available data has not been demonstrated.

02

READINESS SCORE

Readiness at a glance

Six dimensions weighted into a total score of 100.

STRONG

Business value

4/5

Weight 25% | Contribution 20 pts | MEDIUM

Evidence and gaps

EVIDENCE

- Current escaped-defect rate is 1.8% and the plant recorded 11 customer complaints related to weld quality in the last six months.
- Target KPI defines success: detect at least 90% of visually identifiable weld defects, reduce escaped-defect rate from 1.8% to no more than 0.8%, keep false-reject rate below 5%, maintain current production cycle time.

Source fields: problem, target_kpi, target_kpi_status

GAPS

- Validated link between reduced escaped-defect rate and business outcomes such as warranty cost reduction or customer satisfaction.
- Clear ownership of the quantified business value (who will track and realize benefits).
- Baseline detection rate of the current manual process to measure improvement.

DEVELOPING

Data readiness

3/5

Weight 20% | Contribution 12 pts | MEDIUM

Evidence and gaps

EVIDENCE

- Fourteen months of camera images are available, covering approximately 24,000 welded components.
- Quality records identify 1,900 confirmed defect examples across porosity, undercut and incomplete-fusion categories.
- Images are linked to component IDs and inspection outcomes.
- Data owner: Quality Data Product Owner (IDENTIFIED).
- Systems and integrations: Images stored in on-premises quality server and linked to production records in the MES. A PoC can use exported image batches and CSV metadata. The production camera supplier has confirmed that a read-only image stream can be made available for offline testing.

Source fields: available_data, data_owner, data_owner_status, systems_and_integrations, risk_context

GAPS

- Inconsistent lighting in approximately 8% of images may affect model training and inference.
- Label quality and consistency of the 1,900 confirmed defect examples have not been validated.
- Representativeness of the data across all production shifts, equipment variations, and defect types is not confirmed.

DEVELOPING

Technical feasibility

3/5

Weight 20% | Contribution 12 pts | MEDIUM

Evidence and gaps

EVIDENCE

- Images are stored in an on-premises quality server and linked to production records in the MES. A PoC can use exported image batches and CSV metadata.
- The production camera supplier has confirmed that a read-only image stream can be made available for offline testing.
- During the PoC, the AI will provide defect recommendations but will not automatically reject components or modify welding parameters. Qualified inspectors remain responsible for every release decision.

Source fields: systems_and_integrations, risk_context, available_data

GAPS

- Model performance (detection rate, false-reject rate) on the available data has not been demonstrated.
- Impact of lighting inconsistencies on model accuracy is unknown.
- Required computational resources (hardware, software) for training and inference within the ten-week PoC have not been specified.
- Integration path to the live welding line (latency, throughput) has not been tested.

STRONG

Organisational readiness

4/5

Weight 15% | Contribution 12 pts | MEDIUM

Evidence and gaps

EVIDENCE

- Executive sponsor: Plant Director (IDENTIFIED).
- Process owner: Quality Manager (IDENTIFIED).
- Data owner: Quality Data Product Owner (IDENTIFIED).
- Budget status: APPROVED; timeline status: APPROVED for a ten-week offline PoC with EUR 75,000 budget.
- Stakeholders (quality inspectors, welding engineers, production supervisors, MES administrators, OT cybersecurity, camera supplier, works council) have nominated representatives for the PoC.

Source fields: executive_sponsor, executive_sponsor_status, process_owner, process_owner_status, data_owner, data_owner_status, timeline_and_budget, budget_status, timeline_status, stakeholders

GAPS

- Delivery capacity (availability of data science/ML expertise) for the PoC team is not explicitly confirmed.
- Change readiness – how inspectors will adopt AI recommendations and any required training – has not been validated.
- Decision-making authority for go/no-go after the PoC is not explicitly documented.

ATTENTION

Strategic fit

2/5

Weight 10% | Contribution 4 pts | LOW

Evidence and gaps

×

EVIDENCE

- The Plant Director wants to determine whether automated visual inspection can improve quality without slowing the welding line (management interest).

Source fields: why_now

GAPS

- No documented corporate strategy, portfolio priority, or mandatory commitment linking this use case to strategic objectives.
- No evidence that the initiative is part of a defined quality-improvement program or digital-transformation roadmap.

STRONG

Governance readiness

4/5

Weight 10% | Contribution 8 pts | MEDIUM

Evidence and gaps

×

EVIDENCE

- The image data contains components only and no employee or customer information.
- During the PoC, the AI will provide defect recommendations but will not automatically reject components or modify welding parameters. Qualified inspectors remain responsible for every release decision.
- OT cybersecurity has approved the offline test environment.
- A PoC decision review is scheduled immediately after the ten-week test.

Source fields: risk_context, stakeholders, timeline_and_budget

GAPS

- Formal data-governance policies (usage, retention, access) for the image data have not been specified.
- Monitoring plan to track AI performance (detection/false-reject rates) during the PoC is not defined.
- Incident-response process for handling AI errors or disputes has not been established.

03

RECOMMENDATION

Recommended next steps

Concrete actions that reduce the most important decision uncertainties.

01

Conduct data quality audit focusing on lighting consistency and label accuracy.

Owner: Data Owner (Quality Data Product Owner) **Timing:** Before PoC

Acceptance criterion: Audit report completed with recommendations for lighting normalization and label verification process.

02

Validate a sample of defect labels with senior weld inspectors to establish ground truth.

Owner: Process Owner (Quality Manager) **Timing:** Before PoC

Acceptance criterion: Label validation results showing strong concordance with expert review.

03

Secure ML expertise and allocate computational environment (hardware/software) for model development.

Owner: Executive Sponsor (Plant Director) or designated PoC Lead **Timing:** Before PoC

Acceptance criterion: Project plan signed off with assigned data scientist and access to required GPU/CPU resources.

04

Define PoC success criteria and decision-making protocol (go/no-go thresholds).

Owner: Process Owner (Quality Manager) **Timing:** Before PoC

Acceptance criterion: Documented PoC success criteria signed off by sponsor and stakeholders.

05

Engage works council and OT cybersecurity to review data usage and privacy safeguards.

Owner: Data Owner (Quality Data Product Owner) **Timing:** Before PoC

Acceptance criterion: Written confirmation from works council and OT cybersecurity that no employee data is involved and security controls are adequate.

Conditions for the next approval

- Data quality assessment confirms that lighting inconsistencies can be mitigated via preprocessing or augmentation.
- Label validation of a random sample shows strong agreement with expert adjudication.
- ML expertise and computational resources (hardware/software) are committed for the ten-week PoC.
- Stakeholder alignment on PoC success criteria and go/no-go decision process is achieved.

04

POC PREREQUISITES

Structured PoC prerequisites

These statuses come from required selections and are not inferred from free-text wording.

✓ EXECUTIVE SPONSOR

Identified

✓ PROCESS OWNER

Identified

✓ DATA OWNERSHIP

Identified

✓ KPI MATURITY

Baseline and measurable target defined

✓ BUDGET

Approved

✓ TIMELINE

Approved

✓ All structured PoC prerequisites are satisfied.

05

OPPORTUNITY CONTEXT

Opportunity context

Problem statement

Manual sampling inspections allow some weld defects to escape detection. The current escaped-defect rate is 1.8%, and the plant recorded 11 customer complaints related to weld quality during the last six months.

Business objective

Reduce the escaped-defect rate from 1.8% to no more than 0.8% while maintaining the current production cycle time and keeping the false-reject rate below 5%.

AI solution hypothesis

The PoC will test whether a deep learning model trained on the available labeled weld images can achieve at least 90% detection of visually identifiable weld defects with a false-reject rate below 5% when applied to offline image batches.

Strongest non-AI alternative

Increase manual sampling frequency and improve inspector training, or implement deterministic rule-based image processing (e.g., thresholding and edge detection) to flag potential weld defects for inspector review.

06

SUCCESS AND DELIVERY

Success and delivery

Success measures

- Detect at least 90% of visually identifiable weld defects
- Reduce escaped-defect rate from 1.8% to no more than 0.8%
- Keep false-reject rate below 5%
- Maintain current production cycle time

Required data

- Camera images of welded components (approx 24,000) from the on-premises quality server
- Linked quality records identifying defect type (porosity, undercut, incomplete fusion) and component ID
- Exported image batches and CSV metadata for offline testing
- Read-only image stream from the production camera for offline testing

Stakeholders

- Quality inspectors
- Welding engineers
- Production supervisors
- MES administrators
- OT cybersecurity
- Camera supplier
- Works council

Assumptions

- The 1,900 labeled defect examples are representative of the defect types occurring in production.
- Inconsistent lighting in approximately 8% of the images can be mitigated through preprocessing or data augmentation without losing critical defect features.
- The offline test environment (image resolution, frame rate, lighting) replicates the online imaging conditions sufficiently to validate model performance.
- Qualified inspectors will correctly follow AI recommendations while retaining final release authority.
- The PoC team will have access to sufficient ML expertise and computational resources to develop and evaluate a model within the ten-week window.

Business-case maturity

Quantification status: Not yet quantified
Value hypothesis: Reducing the escaped-defect rate from 1.8% to 0.8% is expected to lower warranty costs, rework, and customer complaints, thereby improving profit margin.

AVAILABLE EVIDENCE

- Current escaped-defect rate is 1.8%.
- Plant recorded 11 customer complaints related to weld quality in the last six months.

EVIDENCE STILL REQUIRED

- Baseline cost per escaped defect (warranty, rework, liability).
- Projected cost savings from reducing escaped-defect rate to 0.8%.

07

OPEN QUESTIONS

Open questions

- What preprocessing or augmentation techniques are needed to handle the images with inconsistent lighting while preserving defect detectability?
- What is the label accuracy of the existing defect examples, and how much additional labeling effort is required to achieve a reliable ground truth?
- What computational resources are necessary to train and evaluate a candidate model within the ten-week PoC timeline?
- How will the AI recommendations be integrated into the existing inspection workflow without affecting line speed?
- What specific go/no-go thresholds will be used to decide PoC success?
- What are the expected operational impacts of running the AI model inline?
- How will model performance be monitored and maintained after deployment to address drift or new defect types?
- What training or change-management activities are required for inspectors to trust and effectively use AI assistance?

08

KEY RISKS AND MITIGATIONS

Key risks and mitigations

01

Model performance may fall short of detection and false-reject targets due to data quality issues (lighting variability, label noise).

IMPACT

PoC fails to meet success criteria, leading to no go-ahead for scale-up.

MITIGATION

Perform data preprocessing (e.g., histogram equalization, augmentation) and iterative label verification; evaluate multiple model architectures.

02

Inspectors may disregard or mistrust AI recommendations, resulting in no actual reduction in escaped defects.

IMPACT

Expected quality improvement not realized despite technical success.

MITIGATION

Involve inspectors in model development, provide training on AI output interpretation, keep human-in-the-loop with final decision authority.

03

Offline PoC environment may not capture real-time production variations (e.g., vibration, exposure time), limiting transferability of results.

IMPACT

Findings may not translate to inline deployment, causing unexpected performance loss.

MITIGATION

Validate with a subset of inline images captured during the PoC; simulate production conditions in the test set.

04

Works council or data-privacy concerns could arise if images are perceived to contain employee information or enable monitoring.

IMPACT

Delay or resistance to adoption, potential regulatory scrutiny.

MITIGATION

Confirm that images contain only components; share transparency documentation with works council; obtain OT cybersecurity sign-off on data usage and access controls.

METHODOLOGY AND TRACEABILITY

General AI Opportunity Screening Model

Each contribution is calculated as rating ÷ 5 × dimension weight. The score is a screening indicator, not a probability of success. The weighting should be calibrated to the client’s strategy, risk profile and historical project outcomes.

Weighting version	**1.1.0**
Scoring	**3.2.0**
Routing	**2.2.0**
Report design	**1.1.0**