

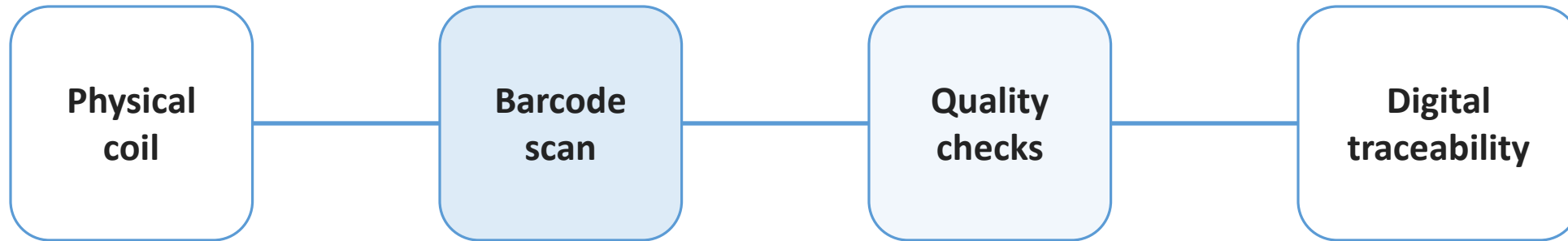
Mobile Barcode Scanning System for Coil Traceability

Industrial Based Research ACCA6029

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Research context

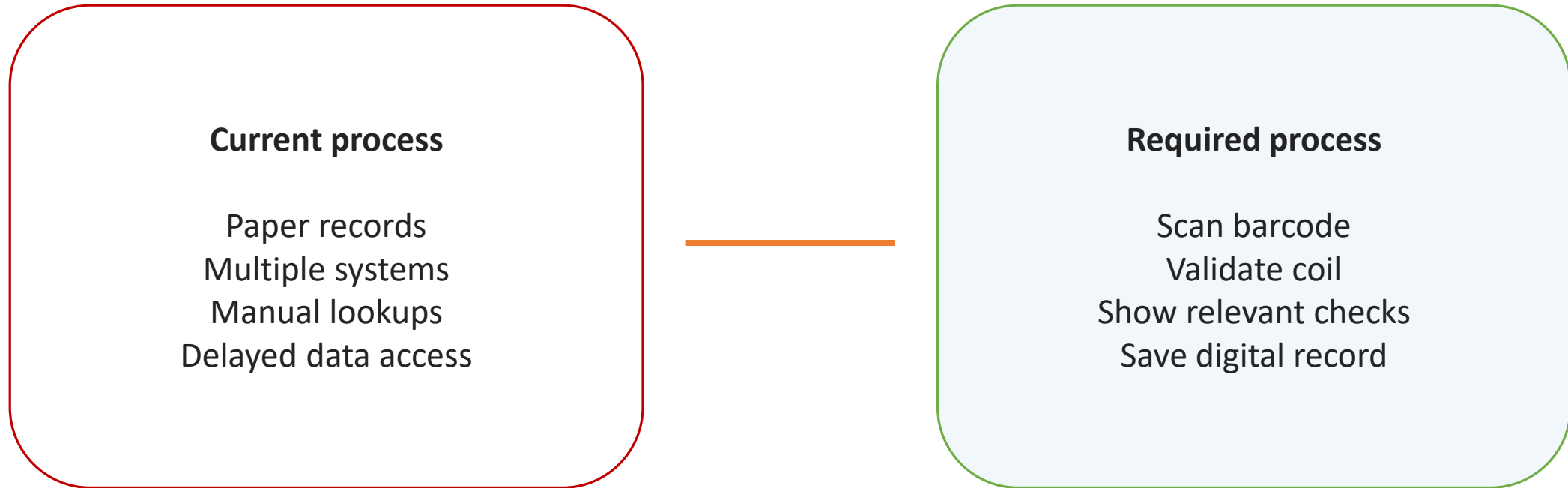
Tata Steel coils move through multiple production stages where accurate identification and quality information are essential.



- Pit crew members identify coils and check quality before material moves forward.
- Current work relies on paper records and separate systems.
- The project proposes a mobile scanner that links barcode, coil data, quality checks, coil loading and LPAs.

Research problem

The issue is not only capturing data — it is capturing the right data, at the right time, against the correct coil.



Research gap: a tool that improves traceability without adding unnecessary work for operators.

Research aim & objectives

Aim

Create and test a user-friendly mobile barcode scanning system that improves workflow efficiency, quality data collection and material traceability at Tata Steel.

1. Understand

Analyse coil identification, quality checks, coil loading and LPAs.
Gather requirements from pit crew and stakeholders.

2. Build

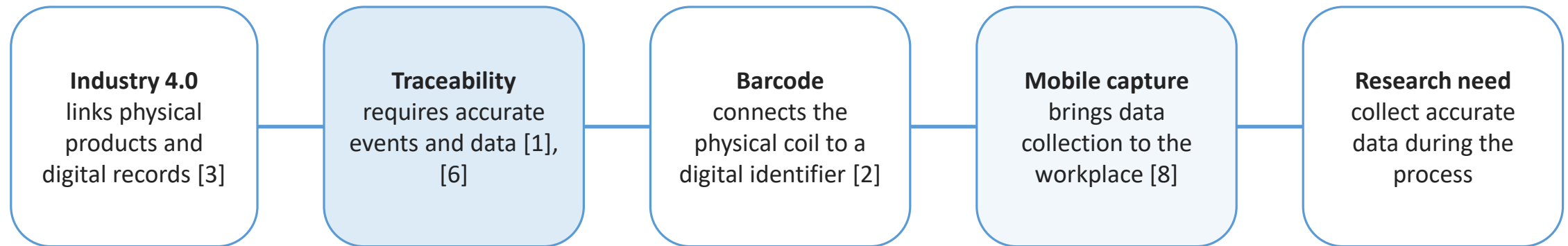
Design the mobile scanner workflow.
Integrate with existing Tata Steel data sources.
Add quality checks and LPAs.

3. Evaluate

Test reliability, response time and validation.
Measure task completion time.
Collect usable feedback.

Success means the system is reliable, accurate and accepted by the pit crew — not just technically functional.

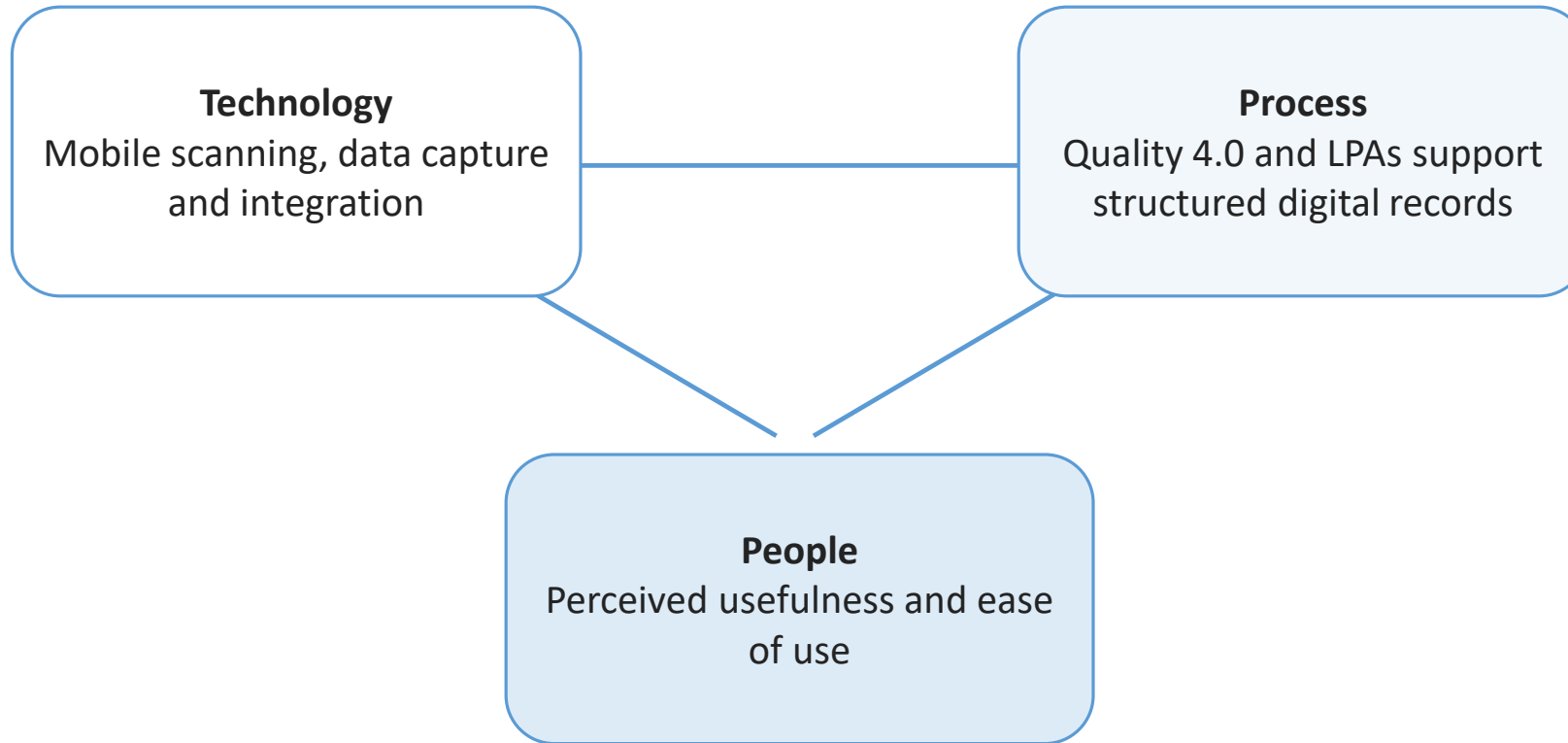
Literature review: traceability and data capture



- Traceability systems must interact with manufacturing information systems, not sit separately.
- More data alone is not enough: it must be accurate, relevant and collected at the correct point in production.
- Barcodes remain a practical automatic identification method for linking material to records.

Literature review: quality, LPAs and usability

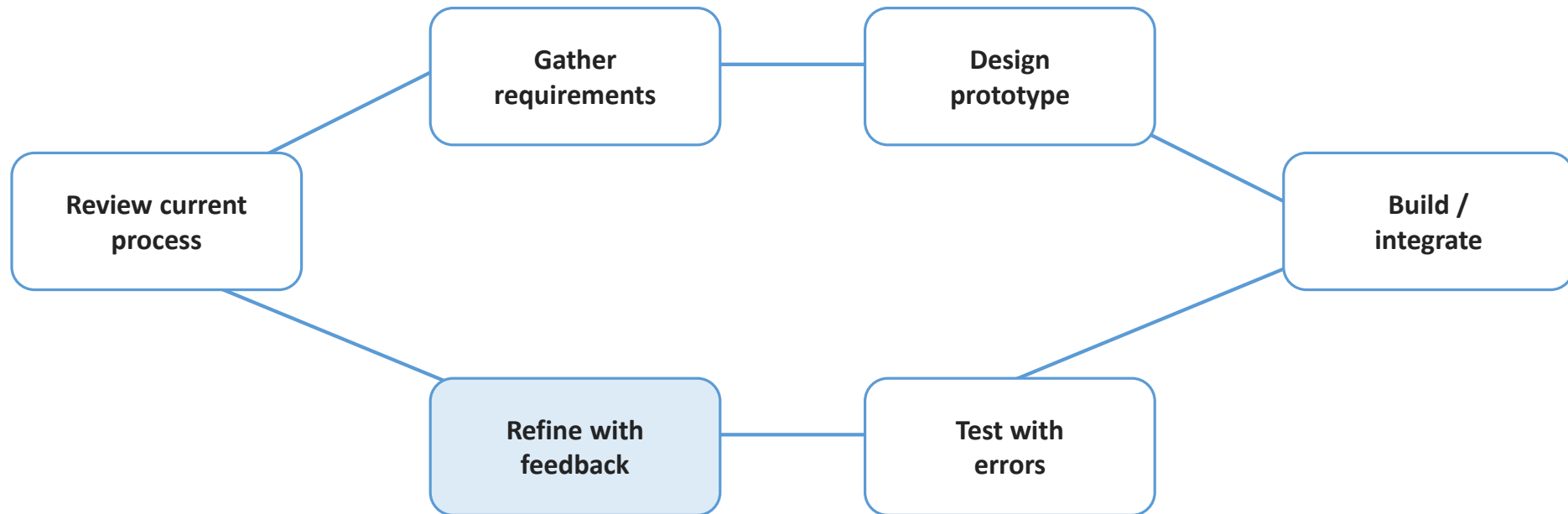
The literature leads to one main design principle: technology, process and people must fit together.



Therefore, the scanner must be quick, simple and useful during normal pit crew tasks.

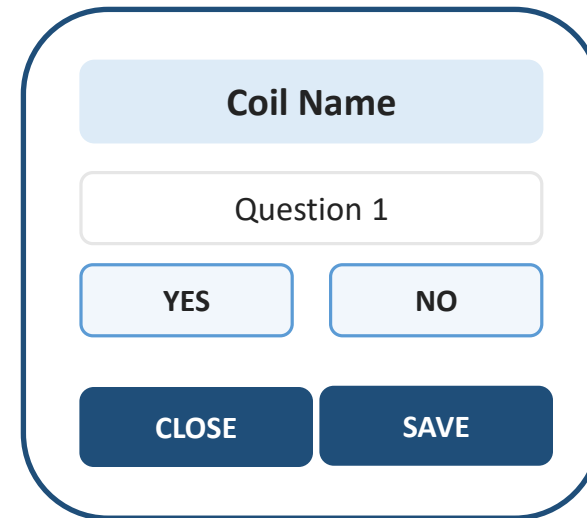
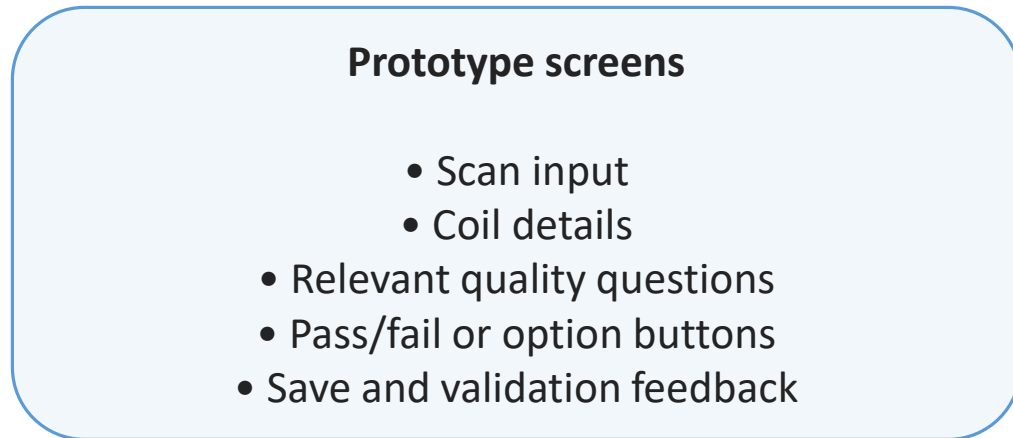
Research/development methodologies

An iterative development approach will be used so that technical work and operator feedback improve together.



- Functional requirements: scan barcode, validate coil, display questions, record responses.
- Non-functional requirements: usability, speed, reliability and suitability for the shop floor.
- User feedback will be gathered throughout development to identify workflow issues early.

Project design: workflow and prototype



Design focus: fewer screens, clear validation, and minimum manual entry.

Data collection and analysis

The evaluation will combine measured workflow performance with an operator's feedback.

Quantitative data

- Scan submit time
- Scan success rate
 - Response time
- Incomplete submissions
 - Error frequency

Qualitative feedback

- Interface clarity
- Ease of completing tasks
 - Perceived speed
- Problems encountered
- Suggested improvements

Analysis method

- Mean / median time
 - Completion rate
 - Error patterns
- Percentage change
- Feedback themes

Resources & materials

The project is designed to use existing Tata Steel infrastructure where possible, keeping additional cost low.

Existing resources

- Databases and servers
- Network infrastructure
 - Development tools
- Internal technical support

People

- Project developer
- Pit crew members
 - Technical staff

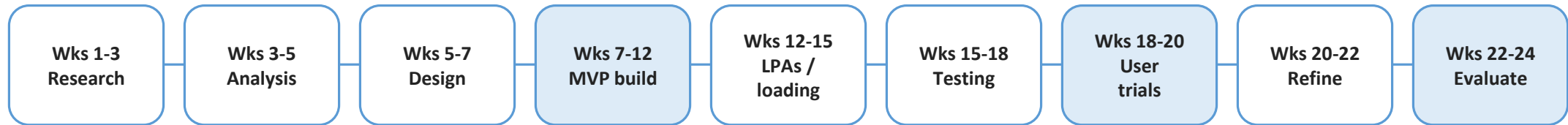
Main cost risk

- Mobile scanner/device hardware
- Number of devices needed
- Maintenance/support if rolled out wider

Estimated additional cost depends mainly on required scanning hardware. Most software and infrastructure are existing resources.

Project plan

Proposed delivery is split into research, design, build, testing, trial and evaluation phases.



Key milestones

Requirements defined • Design approved • MVP operational • Technical testing completed • User feedback collected
• Final system and evaluation completed

Project impact and limitations

Potential impact

- More efficient workflow
- Improved material traceability
- Quality data recorded directly against coils
- Reduced paper and separate systems

Limitations

- Depends on source data quality
 - Depends on network and barcode readability
- Trial size and duration may limit findings
- Short tests may not prove long-term adoption

Further development

- Roll out to more production units
 - Reporting and trend dashboards
 - Failed-check alerts
- Offline use where connectivity is poor

Final judgement: whether the system improves traceability and efficiency without increasing operator workload.

References

- [1] GS1 Global Traceability Standard.
- [2] GS1 Barcodes.
- [3] Schuitemaker & Xu, Product traceability in manufacturing.
- [4] Factors influencing acceptance of Industry 4.0 technologies.
- [5] Reinhardt et al., Efficient data acquisition for traceability and analytics.
- [6] GS1 Critical Tracking Events and Key Data Elements.
- [8] Bottani et al., mobile and mixed-reality tools in manufacturing.
- [9] Ranjith Kumar et al., Quality 4.0 framework.
- [10] AIAG CQI-8 Layered Process Audit Guideline.
- [11] System Usability Scale (SUS).
- [12] Davis, Technology Acceptance Model.
- [13] Schlemitz & Mezhuiev, smart manufacturing data collection.
- [14] Filz, Bosse & Herrmann, digital quality-management platform.
- [15] Raja, Syafrina & Tarigan, LPA effectiveness.