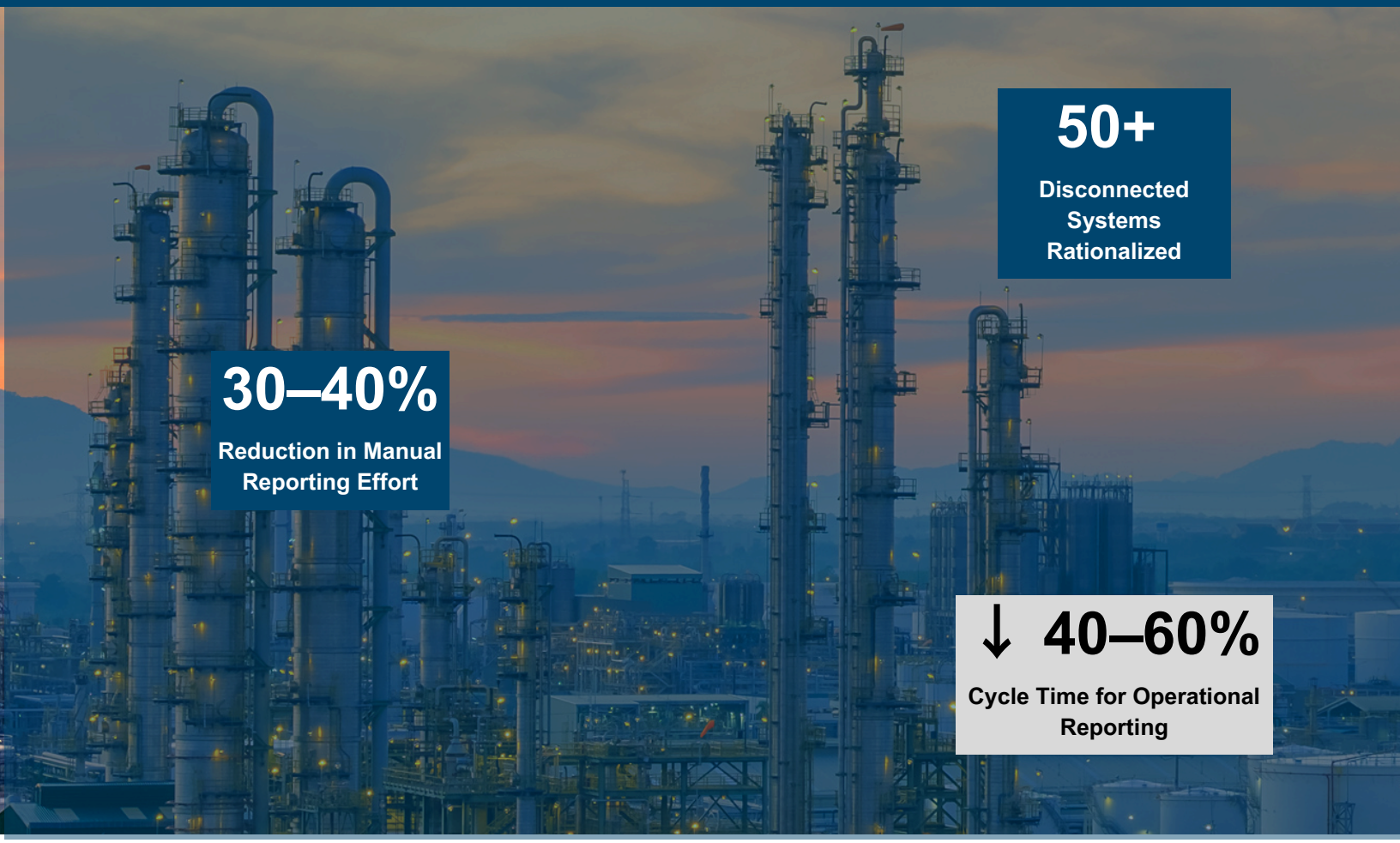
IMPLEMENTATION ENGINEERS®
BEYOND CONSULTING

IX® Case Study

Digital Maturity Assessment & 3-Year Industry 4.0 Roadmap

Enabling Scalable, Connected Operations for a Leading Petrochemical Manufacturer

IX® in Action



Executive Summary

A leading North American petrochemical manufacturer engaged Implementation Engineers to conduct a comprehensive **Digital Maturity Assessment** and develop a **three-year digital roadmap** to advance its Industry 4.0 strategy.

While the organization had already invested in advanced technologies—including historians, quality systems, simulation tools, and predictive maintenance—the digital ecosystem had evolved organically. Systems were fragmented, data was underutilized, and frontline execution relied heavily on manual workarounds.

Implementation Engineers conducted an on-site, end-to-end assessment of the site's **technology stack, operational processes, and digital maturity**, translating findings into a **practical, phased roadmap** focused on foundations first—then culture, analytics, and automation.

The result was a clear, actionable path to move from **reactive, disconnected data usage** to **integrated, scalable digital execution** aligned to operational and business priorities.

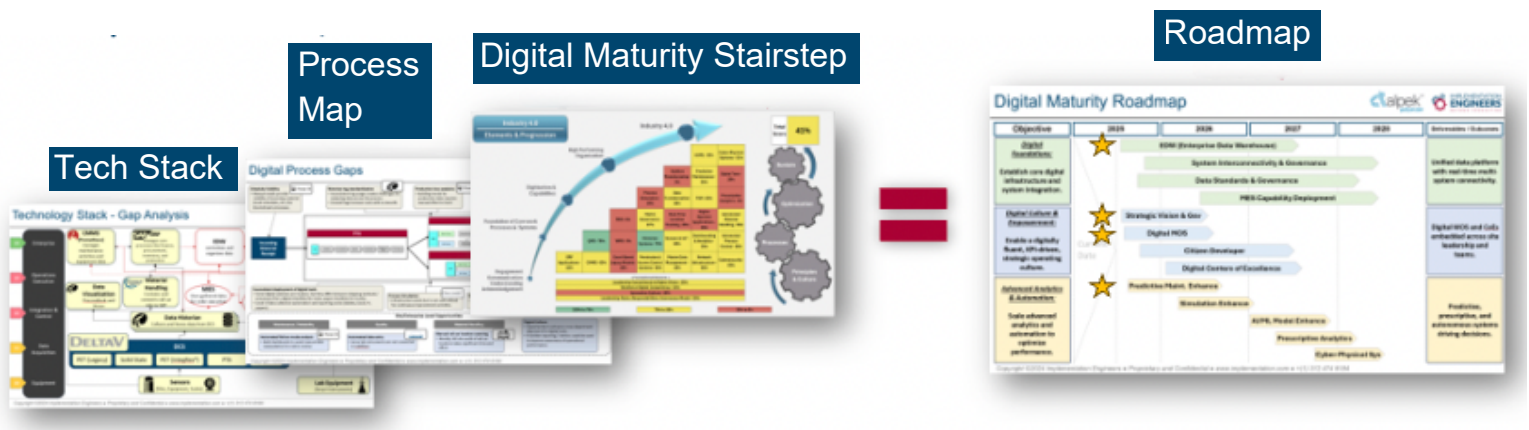
The Challenge

The client's site operated complex petrochemical processes across multiple production units and Distributed Control Systems (DCS). Over time, digital tools were added to solve individual problems—but without an overarching digital architecture or governance model.

Key challenges identified included:

- **Fragmented IT/OT ecosystem** across enterprise, operations, integration, and equipment layers
- **Over 50 digital platforms** in use, including Excel, paper logs, email workflows, custom web apps, and niche point solutions
- **Manual data handling** for production reporting, scheduling visibility, quality tracking, and logistics coordination
- **Limited integration** between production systems, quality systems, CMMS, and ERP
- **Inconsistent deployment of digital tools** across departments and shipping methods
- **High effort, low-value activities**, such as weekly manual railcar audits and redundant data entry

Despite these challenges, the organization had a **digitally capable workforce** and pockets of advanced capability—indicating strong potential if foundational gaps were addressed.



The Approach

Implementation Engineers executed a **two-week, on-site Digital Maturity Assessment**, examining the operation through three integrated lenses:

1 Technology Stack & IT/OT Architecture

- Documented the full **L0–L4 architecture**, from equipment to enterprise systems
- Mapped five distinct DCS environments supporting different process technologies
- Identified system disconnects, custom solutions, and data handoffs
- Assessed gaps between current state and a scalable Industry 4.0 architecture

2 End-to-End Process Mapping

- Mapped physical and digital workflows across manufacturing, maintenance, quality, logistics, and material handling
- Identified where decisions relied on **manual emails, spreadsheets, or paper logs**
- Highlighted broken feedback loops between operations, maintenance, and planning

3 Digital Maturity Scoring Model

- Evaluated digital maturity across **foundational, operational, and advanced elements**
- Scored each dimension on a **1–5 scale**, based on consistency, adoption, and value realization
- Distinguished between **low-priority gaps** and **high-value enablers** required to avoid future digital debt

This structured assessment ensured recommendations were **fit-for-purpose**, grounded in operational reality—not technology for technology's sake.

Key Insights from the Assessment

Strengths Identified

- Workforce Digital Competency: Operators and engineers were comfortable using data and digital tools
- Data Historian (PI): Widely used across functions with reliable, high-quality data
- Quality Management System: Strong reporting discipline and consistent usage

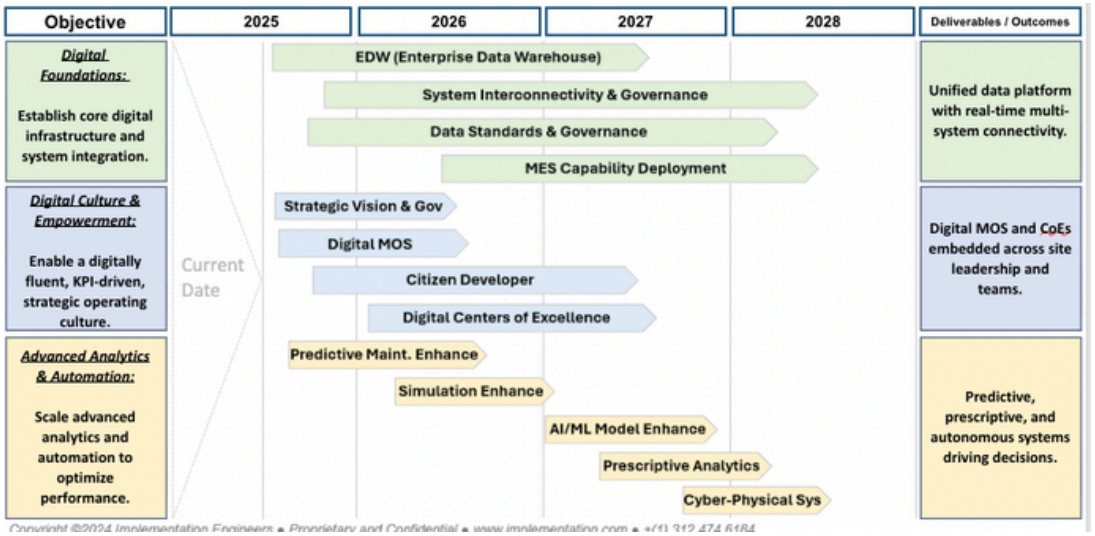
Gaps & Risks Identified

- Disconnected systems limiting enterprise-level insight
- Over-reliance on Excel, paper, and email for execution-critical workflows
- Manual reporting and reconciliation consuming significant engineering and supervisory time
- Inconsistent data standards across assets, tags, and hierarchies
- Risk of accumulating “digital transformation debt” that would limit future AI, analytics, and automation initiatives

The Solution: A 3-Year, Overlapping Digital Roadmap

Rather than a linear transformation, Implementation Engineers designed a **three-year, overlapping roadmap** that allowed the organization to **build digital foundations, enable people and governance, and scale advanced analytics in parallel**.

This approach reduced time-to-value, avoided digital rework, and ensured early initiatives did not become future constraints.



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Foundation Layer (Runs Across All 3 Years)

Enabling scalable, connected digital execution

Foundational initiatives were intentionally **front-loaded and sustained** throughout the roadmap to support all downstream capabilities.

Key focus areas:

- Enterprise data architecture and integration across IT/OT layers
- Standardized asset hierarchies, naming conventions, and master data
- Governance for data quality, cybersecurity, and system ownership
- Evaluation and alignment of MES and execution-layer capabilities

Why it mattered:

Without continuous attention to foundations, advanced analytics and automation would remain isolated pilots rather than scalable capabilities.

Enablement & Digital Culture (Begins Early, Expands Over Time)

Embedding digital into how the site is managed

Digital enablement and cultural adoption began in **parallel with foundational work** and expanded as data availability and system integration improved.

Key focus areas:

- Digital Management Operating System (MOS) powered by integrated data
- Tiered daily management, visual KPIs, and escalation routines
- Leadership governance models for digital decision-making
- Citizen-developer enablement using governed Power BI environments

Why it mattered:

Digital tools only create value when ownership, routines, and accountability are embedded into daily execution—not bolted on after the fact.

Advanced Analytics & Automation (Pilots Early, Scales Later)

Moving from insight to prediction and action

Advanced analytics and automation were **piloted early** in targeted use cases while foundational and cultural elements matured in parallel.

Key focus areas:

- Predictive maintenance integrated with CMMS workflows
- Process simulation for planning, scheduling, and continuous improvement
- Expansion of AI/ML use cases beyond pilots
- Prescriptive analytics embedded directly into MOS routines
- Cyber-physical system readiness integrating SCADA, MES, and analytics

Why it mattered:

Early pilots built momentum and capability, while disciplined scaling avoided technical debt and adoption risk.

The Impact

The Digital Maturity Assessment delivered:

- A **clear, shared understanding** of the current digital state
- Alignment between technology investments and operational priorities
- A r**ealistic, execution-ready roadmap** grounded in how the plant actually runs
- Reduced risk of stalled or fragmented digital initiatives
- A foundation for sustainable Industry 4.0, AI, and automation deployment

Most importantly, the roadmap balanced **technology, process, and people**—ensuring adoption, not shelfware.

Let's Turn Your Vision Into Results

At Implementation Engineers, we don't just execute projects - we transform your vision into operational reality. Our proven 3-phase approach - **Align, Design, Execute** - delivers lasting value, from aligning your team on strategic goals to optimizing operations and driving measurable outcomes. Whether you're aiming to lead your market, boost efficiency, or maximize shareholder value, we're here to make it happen, step-by-step, side-by-side.

Ready to Get Started?

Let's explore how we can bring your vision to life. Contact us today to schedule a conversation. Together, we'll chart the path to your success.

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