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Smart operations in Energy and Chemicals

Maximizing the value from IT/OT convergence

Introduction

The energy and chemicals sectors are beset with complexity—meeting the world's growing and diversifying energy and chemicals demands while addressing the ever-shifting investor, regulatory, and public relations landscapes. Companies are making difficult choices today about how they can simultaneously optimize operations in maturing assets and drive future production growth through prudent investments and operational improvements. These forces have given rise to five key challenges facing the industry:

- Transitioning assets into operations and becoming "operations ready" from day one
- Driving safe and reliable operations at lowest unit cost
- Delivering on decarbonization and sustainability commitments through operations
- Enabling enterprise-level decision-making across the value chain
- Attracting and retaining operations talent to rethink the nature of work, now and into the future

To be successful in today's economic climate, many energy and chemicals companies are looking to address these issues by investing in operational capabilities that can give them the ability to be resilient, agile, and competitive amidst changing market conditions.

Developing a winning investment strategy

To gain competitive advantage, many companies are considering how to operate their facilities as integrated assets; enable new ways of working via smart, interconnected, digitally-enabled capabilities; and optimally leverage data for insights in areas such as:

- Operational strategy, planning, and execution
- Cost, productivity, and production optimization
- Maintenance and reliability
- Turnaround/overhaul programs and tools
- Engineering, asset management, and master data management (MDM)
- Strategic workforce management

Some are making sizable investments into integrated solutions that produce faster and more repeatable decisions in their operations, while others are taking a targeted approach to improve functional capabilities such as reliability and maintenance. In either case, understanding which assets and what investments may lead to desired business outcomes can be challenging for several reasons.

Many energy and chemicals companies operate a vast set of maturing assets across upstream, midstream, and downstream business segments. In determining where to invest, it is often difficult to do "like for like" comparisons across the entire portfolio of diverse

assets since business segments or assets within a portfolio may have different maturity levels in how they work and operate.

In addition, it is not uncommon for business units to try to get ahead of the curve by piloting or initiating proof of concepts (POCs) on their own. If approached in an unstructured way, these pilots may end up competing with similar use cases already being trialed at the same company—not to mention these "random acts of digital" may not fully consider the requirements needed to scale the solution across the asset, let alone the entire enterprise.

A structured approach to connected operations

While many business functions are siloed, digital technologies may not be. An investment in a single digital upgrade can impact workers, business processes, and other technologies within a facility—and often across the enterprise. For example, a seemingly straightforward investment in drone surveillance to inspect equipment, as opposed to using on-site, manned crews, can have many implications. Consider the following:

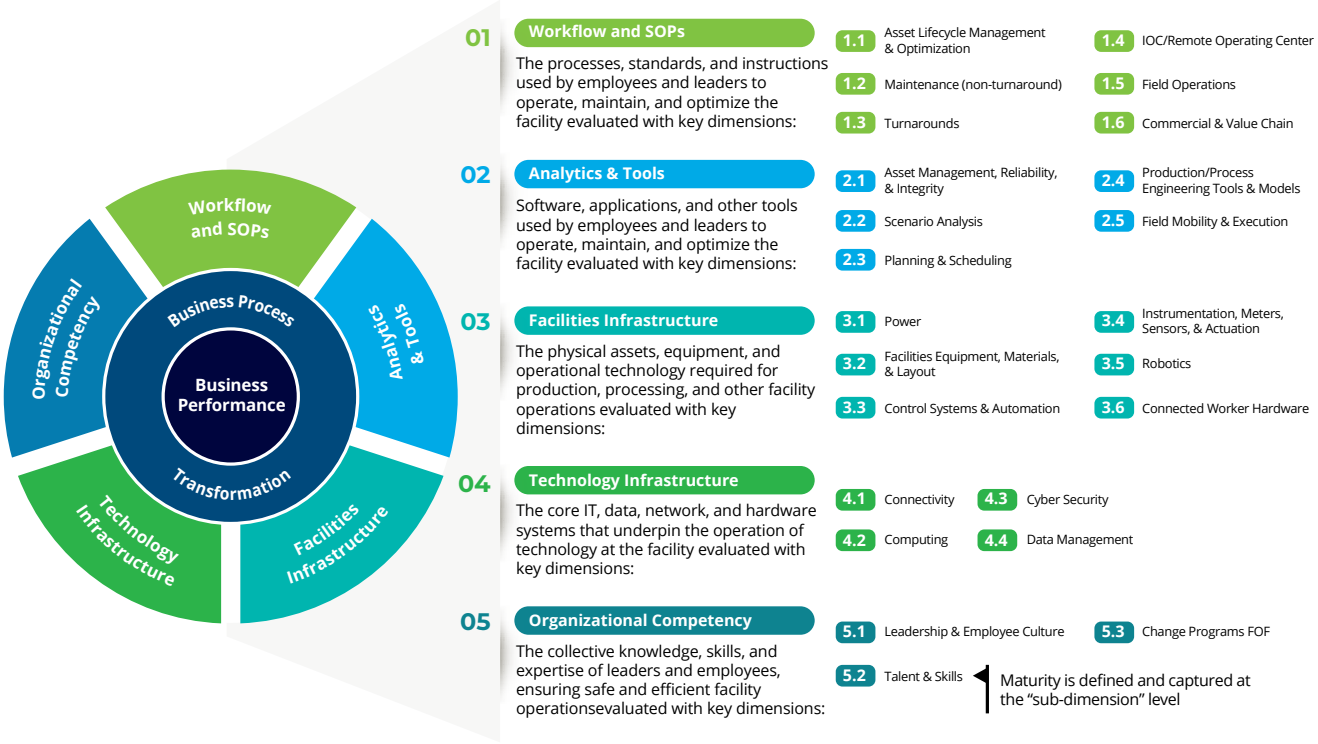
- Do manual inspections drive unit operating and maintenance costs in a significant way?
- Will eliminating manual inspections significantly improve the performance of the asset?
- Are digital and robotics technologies integrated with maintenance workflows to support employees in making effective decisions and taking the right actions concerning corrective and predictive maintenance?
- Does the organization have the core IT, data, network, and hardware systems to support the surveillance program and to keep it safe from a cybersecurity perspective?
- Is the organization equipped to consume, manage, and analyze the data produced by the advanced robotics system?
- Do employees have the competency to operate these digitally enabled systems?
- Are there facility and/or enterprise processes, standards, and instructions in place to operate the system in a safe, sound, and compliant manner?

Whether the business objective is broad or targeted, achieving it will likely require process modifications and workforce considerations, along with a foundation of computing, connectivity, data management, and cybersecurity. In the world of integrated assets and smart operations, the investments needed to build this foundation, and ultimately to scale the operational technology and analytics that sit on top of it, will likely transcend business units and functional silos—and because of that, companies need a structured way to think about them.

A key theme within the sector is the convergence of information technology and operational technology (IT/OT). The integration of these traditionally separate domains is important for energy and chemicals companies because it can lead to enhanced operational efficiency, improved decision-making, and increased competitiveness. Bringing IT and OT together can enable real-time data sharing and analytics, which can optimize processes, reduce downtime, and improve safety and compliance. As much as we may think IT/OT convergence is all about technology, it is much more; it may also require transformation across each aspect of the technology organization and the technology delivery value chain ranging from vision and strategy to deployment, security, operations, and support and maintenance after go live.

To expedite this transformation, Deloitte has developed the Facility of the future (FoF) framework (see Figure 1), a standardized tool for assessing current-state technologies, workflows, and organizational maturity levels. The framework also exposes current limitations and presents options for addressing them. This helps enable business leaders to understand trade-offs and key considerations when determining how, when and where to invest in IT/OT. Moreover, the structured approach afforded by the framework enables the exercise to be repeated across the portfolio of diverse assets (e.g., upstream, midstream, and downstream), allowing for robust investment strategies to emerge across the enterprise.

Figure 1: Facility of the future assessment framework: Integrating five core dimensions of smart operations to enable performance



Source: Deloitte Analysis

Charting a course to value: Next steps on the smart operations journey

In an integrated organization, one thing often leads to another. The compounding benefits of high-potential use cases, such as equipment failure prediction using AI/machine learning, advanced robotics inspections and surveillance, condition-based maintenance programs, and closed-loop equipment optimization (i.e., self-diagnostic and self-healing) can have great allure. However, IT/OT convergence raises many considerations that need to be addressed systematically—step-by-step—if leaders are to make informed investment decisions that achieve the desired business outcomes such as reduced operating costs, increased production efficiency, decreased at-risk man hours, and lower carbon intensity.

For energy and chemical companies aiming to invest in smart operations via IT/OT convergence, return on investment (ROI) often hinges on blending cutting-edge technology with practical execution. Here are five key considerations for mitigating risk in the leap into the future:

1. **Build a unified foundation**
   Start with a robust framework that merges IT and OT seamlessly. This means investing in interoperable systems—think industrial IoT platforms or middleware—that can talk to both legacy equipment and modern cloud platforms. Prioritize standardized protocols, such as Open Platform Communications Unified Architecture (OPC UA), to o help enable longevity of future-proof the setup. The goal? A single, real-time view of operations, from equipment performance to supply chain data, without the clunky handoffs. It's less about replacing old systems and more about making new and old systems work well together.

2. **Embed cybersecurity from the ground up**
   Security isn't an add-on; it's the bedrock. Facilities of the future strive to be hyper-connected, so apply zero-trust architecture—verify everything, assume nothing—across networks, devices, and users. Segment OT systems from IT where possible, use air-gapped backups for critical controls, and lean on AI-driven threat detection to catch anomalies fast. Regular stress-testing and compliance with standards like NIST 800-82 can help keep risks in check.

3. **Leverage data with purpose**
   Turn the flood of sensor and process data into a strategic asset. Deploy edge computing to process time-sensitive information on-site while funneling bigger trends to the cloud for advanced analytics and AI-enabled modeling, like predictive maintenance or yield optimization. Focus on use cases with clear wins: reducing energy waste, minimizing downtime, or boosting safety. The key is to avoid data overload—curate what matters and remove the unnecessary data.

4. **Empower the workforce**
   People can make or break this shift. Invest in training programs that bridge the IT/OT divide—teach operators to use digital dashboards, and give IT personnel a crash course in plant processes and technologies. Digital twins or augmented reality tools can ease the transition, letting workers simulate scenarios or troubleshoot hands-on. Culture matters too: champion early adopters, reward innovation, and hire hybrid talent who get both worlds.

5. **Plan for scalable, sustainable growth**
   Design with the long game in mind. Start small. Pilot a smart system at one site, but architect it to scale across the portfolio without reinventing the wheel each time. Balance capital expenditures with phased rollouts to help keep costs manageable, and track return on investment to justify each step.

Smart operations in action: Roadmap to reduce at-risk man hours

A multinational energy company engaged Deloitte US to analyze operations on a high priority offshore production platform and provide recommendations for moving towards minimally manned operations. The asset in-scope was a platform preparing for late-life base production operations and cashflow optimization. Deloitte was asked to deliver a pathway towards 50% reduction in at-risk man hours and 25% reduction in unit operating expenses. The operator was seeking a prioritized set of strategic and tactical opportunities with a clear business case that could be integrated into an actionable roadmap with dependencies and milestones outlined.

Opportunities identified

The team analyzed platform operations considering major activities/schedules, equipment, and personas/skills across operations, maintenance, and supporting functions on the platform. It worked closely with operations and maintenance and technology stakeholders to validate opportunities. Value levers identified included onshoring non-production/safety-critical staff, cross-skilling and re-skilling core platform staff, optimizing activity and roster schedules, and implementing technology and automation solutions.

Value quantified

The team provided a timeline of recommended milestones along with detailed business cases, requirements, and other impacts to the platform. Overall, it identified opportunities exceeding the organization's operational improvement goals, detailing a path to ~70% reduction in man-hours and ~25% (US$40 million/yr) decrease in annual operating expenses.

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