Implement a Design Authority Across Utility IT and OT to Drive Alignment

Published 10 November 2021 - ID G00760032 - 13 min read
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Initiatives: Energy and Utilities Technology Optimization and Modernization

Aging infrastructure and legacy technology drive maintenance backlogs and technology debt. Using standards and managing compliance will reduce friction and improve operations and network resilience. CIOs can leverage this research to coordinate shared responsibilities to unlock latent asset value.

Overview

Key Findings

- The convergence of information technology (IT), operational technology (OT) and engineering technology (ET) disrupted by the Internet of Things (IoT) around a physical asset raises the requirements for business knowledge, data applications and intelligence-led operational capabilities.

- Digital asset technologies and ecosystems bring benefits but also introduce new data acquisition, configuration management complexities and cybersecurity risks.

- Existing utility data and analytics environments, particularly equipment data historian systems, are poorly prepared for, and are cost-inefficient in, modernized event-driven architectures. Adding to the data tsunami are 5G networks and industrial IoT systems that are creating higher volumes of time-series data.

- Knowledge required for aligned and converged technical operations and security management is segmented across experts, sequestered in outmoded business processes and isolated in arcane organizational business structures. Gaps in knowledge create risk, constrain performance and limit resilience.

Recommendations

CIOs in energy and utilities tasked with technology optimization and modernization should implement a design authority to:
Strategic Planning Assumption

Through 2023, predictive maintenance and other asset performance management (APM)-related functions will continue to be delivered outside of the EAM product, but increasingly by the same vendor as your EAM.

Introduction

The pressures of an aging utility infrastructure as well as legacy maintenance, asset and work practices drive an expanding work backlog that misses key business goals, triggering “catch-up” of outsourced refurbishment projects. This not only results in nonstandard projects delivered against time and budget criteria, but can also produce part and component variations that are not maintainable.

Many utilities’ mission statements articulate an ambition of superlative asset management. However, utility budget expenditure and cost control evidence point to a gap between asset management life cycle intentions and operational results. This gap highlights that utilities lack the requisite control needed over cradle-to-grave asset management capabilities. Continuing budget shortfalls and delayed maintenance create an accumulating work backlog, resulting in a declining asset health score that drives up systemic risks.

- Drive cross-functional capability, management of standards and compliance by working across IT/OT/ET people, processes and organizational silos to encapsulate complexity and manage risk across the asset life cycle.

- Deliver a reference architecture and standardization patterns that are open and flexible, enabling the organization to rapidly progress from proof of concept to production. Do this by integrating diverse views of risk and capability to set appropriate standards.

- Foster the right integrated IT/OT/ET asset management culture by focusing on data and the velocity of data across business processes. Do this particularly where the design authority will oversee changes, including in operations and maintenance, finance, strategic planning, human resources, and corporate risk teams.

- Extend asset design authority acceptance by getting buy-in from stakeholders around intent and governance. Demonstrate, through objective examples and performance metrics, why oversight of asset management measurements, tools, artificial intelligence and supporting software reduces asset risk.
This trend of declining asset health means that the risk of asset failure is rising, resulting in business discontinuity, customer outages and safety hazards. It could even trigger environmental impacts, such as fires, and their consequential reputational damage and legal exposure. CIOs must recognize and address the unmanaged friction between asset life cycle and work life cycle as a source of operational and business risk (see Figure 1).

Figure 1: Events Disrupt Asset and Work Life Cycle Trade-Offs, Triggering Additional Risk

The continued megatrends of decarbonization, digitalization, decentralization and democratization are disrupting traditional utility asset-centric business models. These forces combine to accelerate the energy transition and are driving the electrification of end use. Conventional reactive, time-triggered asset maintenance approaches are inadequate in the face of tightening environmental and regulatory policies.

Therefore, CIOs need to engineer condition-based, predictive and reliability-focused strategies into the plan from the outset of asset acquisition. Responding to the megatrends requires a predictable, reliable asset base able to support the energy transition. Utilities that build for intelligent operations are creating agility in the asset base that enables the utility to perform, while transforming, to accommodate new energy business models enabled by a composable architecture.
Digital technologies such as IoT linked to APM can improve performance by automating and replacing some of the labor-intensive asset inspection and monitoring processes, and consequently reduce operational risk. The core business capabilities will pivot to “sense, decide and act” in real time. Those capabilities are becoming critical for continued operational and business performance improvement; they are already finding their way into legacy solutions such as EAM and APM. Leading utilities will sense, decide and act across these silos. Transformation occurs when digital technologies, such as Industrial Internet of Things (IIoT) and artificial intelligence (AI), are combined with digital capability frameworks, such as intelligent operations (IO).

_The collision of culture, ill preparedness to face and mitigate asset-based risk events, and a lack of alignment and convergence in utility capabilities combine to create a critical risk exposure._

Regulators do not accept the assumption that utilities are already achieving full value from their existing assets. Extensive regulatory reporting requirements on asset age profiles, performance incentives and risk penalties show this. The challenge for utilities is to reenvision and establish a sustainable, affordable asset base. Utilities need to demonstrate that assets are maintainable and improving operational effectiveness, revenue and customer satisfaction, while at the same time reducing capital, operating and maintenance support costs. In their relentless pursuit of immediate customer value (such as lower prices), regulators are challenging investment proposals. Regulators will become assertive and exert pressure to adopt the International Organization for Standardization (ISO) 55000 series of asset management standards.

An “always on” system could be designed, built and maintained, but only at an enormous cost, which is not an acceptable regulatory outcome. But affordable, accessible, acceptable energy is the social objective.

**Analysis**
Drive Alignment Across the Asset Life Cycle

To realize the full economic value of an asset, a utility will need to implement and execute a strategic asset management plan that, in turn, will leverage software to meet performance objectives. A design authority would create a plan to assure compliance with regulations and leverage voluntary standards across organizational silos to support asset decisions across the time-independent asset life cycle (see Figure 2). Utility assets can last decades, in contrast with organizational units that have a limited decision horizon (such as the next quarter's results). This long time period triggers tension between competing business domain objectives. This means that the maintain phase (see Figure 2) dominates and determines the useful asset life. Assets built against unmanaged standards risk early obsolescence due to parts availability, legacy technology and technical obsolescence.

Figure 2: Asset Life Cycle

Laws, regulations and standards need to be integrated into operational business processes and day-to-day decisions that impact the asset. Aligning decision boundaries of day-to-day actions in an adaptive governance framework changes the way assets are operated, managed and maintained. It will also improve the return on investment, while supporting the long-term asset value across the useful economic life and remaining within the utility's risk appetite.

The asset design authority requires a number of competencies. The initial focus has to be on a consistent asset valuation approach across the asset life cycle, which is a trade-off across cost dimensions such as operating safely, securing supplies and ensuring delivery within an acceptable risk envelope.
This minimizes the environmental impact, meeting the designed uptime/performance and meeting the expected life, while remaining within an acceptable performance total cost (capex + opex).

A disjointed asset management approach with unmanaged standards results in growing inventories of obsolete parts and spares. Standards that are managed can be explicitly linked to compatible units that drive alignment across finance, maintenance, project and design systems. Managing standards into retirement and linking to superseding standards help manage inventories down and prevent supply chain issues that, when not addressed, could drive early refurbishment projects. The outcome is an increase in the cost base and working capital.

**Adopt Standards to Reduce Risk Across the Asset Life Cycle**

Utilities are infrastructure experts, with very common infrastructure projects and asset life cycles that are remarkably similar, as illustrated in Figure 3, where the primary life cycle and its variations are straightforwardly captured over time. Published standards exist such as ISO 55000, derived from PAS 55, itself derived from National Grid's efforts in this area.

The same asset life cycle is found in the ISO 55000 suite of standards that sets out asset management and asset management systems in three parts:

- ISO 55000 sets out the fundamentals from maintenance to value creation.
- ISO 55001 sets out the asset management systems with a series of compliance statements.
- ISO 55002 sets out general guidance.

Implementing ISO 55000 typically requires changes in utilities’ existing policy, work and business processes and people. Significant business and technology leadership involvement is required to challenge the utility status quo toward rethinking and developing scalable approaches to manage assets over the long term, in a risk-aware manner. Trade-offs could include interruptions and outages; refurbishment delays; and operational risk, customer, reputational and environmental impacts. The objective is to manage total life cycle costs in a transparent manner (see Financially Optimized Maintenance Planning Using Asset Performance Management).
In reality, Gartner often finds that the valuation of an asset is linked to short-term organizational unit KPIs enforced by limited organizational decision boundaries (see Figure 3).

**Figure 3: Suboptimal Value Trade-Offs From Siloed Mandates**

<table>
<thead>
<tr>
<th>Engineering Analysis</th>
<th>Projects</th>
<th>Operations</th>
<th>Refurbish</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plan</strong></td>
<td><strong>Design</strong></td>
<td><strong>Procure</strong></td>
<td><strong>Build</strong></td>
</tr>
<tr>
<td>Estimate Capex</td>
<td>Constrain Capex Meet Timeline Trade Scope and Quality</td>
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<tr>
<td><strong>Retire/Replace</strong></td>
<td><strong>Operate</strong></td>
<td><strong>Maintain</strong></td>
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<tr>
<td></td>
<td>Reduce Opex</td>
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<td>Reduce Remediation</td>
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**Foster an Integrated Asset Management Culture to Accelerate Data Velocity and Reuse**

A design authority that is an adaptive governance model can inform the management life cycle of assets. The design authority coordinates the asset management system, the definition of asset policy, the applicability of the policy to asset classes, and the asset standards and specifications, which is a best-in-class ambition. The aim is to ensure that the planning, design and procure/build processes are aligned with the operate-maintain stages. Even though engineers are involved across the life cycle, they are pursuing different objectives. Implementing a design authority will require strong leadership and resources to deliver an extensive operating model and business process shift that exploits timely data to trigger business events.

Asset specifications are no longer just physical but include digital interfaces, protocols and data exchange within the context of the organization. Specifications need to be updated through the life cycle so that the asset specification is managed from inception to retirement and linked to emerging, succeeding specifications. Managed asset specifications enable the use of asset specification codes across IT systems, simplifying procurement; reducing inventory; simplifying contracting construction and commissioning; and standardizing maintenance planning, work scheduling and costing.
The scope of an efficient asset design authority will vary by organization and charter. Utility CIOs should evaluate the design authority role with regard to both organization and asset perspectives and needs (see Table 1). The organization perspective focuses on improving organization performance and decision making, while the asset perspective is centered on improving the performance of assets. The design authority should address both perspectives and needs.

**Table 1: Utility Asset Design Authority Scope**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Asset</th>
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<td>Improve organization performance and decision making.</td>
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<td>■ Reliability-centered maintenance planning</td>
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<td>■ Capability assessment and improvement programs</td>
<td>■ Condition-based maintenance planning and execution</td>
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<td>■ Business transformation design, change and culture development</td>
<td>■ Physical asset modeling and digital twins</td>
</tr>
<tr>
<td>■ Standards assessment and certification</td>
<td>■ Geospatial modeling</td>
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<td>■ Technology solution planning, architecture, strategy and integration</td>
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<td>■ Data analytics and operational intelligence</td>
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<td>■ Performance metrics and service-level indicators</td>
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<td>■ Competence assessment and development, including asset management training</td>
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Source: Adapted from Asset Management: Planning for Rehabilitation, Renewal and Replacement, American Water Works Association.
Focus on Reducing Asset Risk

Utilities own extensive asset networks that are exposed to risks from environmental and human interference, poorly judged maintenance investments, and control and objective conflicts. The risk profile of external events is rising, driven by a number of factors, including statistical long-tail events, such as surging urbanization and climate change. Natural disasters and adverse weather events are particularly challenging, creating a cascade of asset management setbacks:

- Storms, for example, can trigger break-fix emergency activity, consuming the available budget and overwhelming planned operations and maintenance activities.
- Subsequently, as a result of overtaxed operations and budget lag, asset management governance and stewardship slip down the priority list to a base level, while the storm event is slowly absorbed operationally and economically, but not structurally.
- This sets up the next spiraling cycle of break-fix activities to overwhelm the resources and capabilities of the organization.

Storms and adverse events combine to deprioritize asset resilience maintenance and management practices. Basically, the organization falls into fire-fighting mode. This behavior triggers accelerated aging of an already stressed infrastructure, driving deterioration in asset condition and increasing asset failure risks, which in turn trigger the need for early asset replacement. Refurbishment introduces new asset types that include OEM-embedded IoT. These emerging assets have designs and configurations that span both physical electromechanical and digital considerations that create new cyber risks and will coexist alongside legacy assets on the grid, creating observability and control discontinuities.

Cross-functional disciplines spanning OT, IT and ET need to manage and maintain the emerging software-defined asset classes. While this change is slowly gaining momentum within a conservative utility culture, an aging workforce can resist it.
“One of the biggest challenges in asset management is the injection of long-term thinking (strategic goals and sustainability) while under pressure to deliver short-term results.”

— John Woodhouse, TWPL

Understanding the asset valuation approach allows a utility to make informed choices based on asset-class life cycle costs that impact decisions on specific assets applied in a consistent and ideally standardized manner across the asset life cycle (see Optimize Utility Capital Expenditures With Asset Investment Planning Solutions). This approach to management by asset class (see Figure 4) creates a flexible asset management choice. It can safeguard and balance the demands of the asset manager against the available field resources and budget constraints within an active risk management portfolio.

**Figure 4: Traceable Trade-Off Decisions That Balance Work and Asset Life Cycles**
Recommended Next Steps for Asset-Centric Utility CIOs

- Be intentional about adaptive governance.
- Make the design authority and the definition of asset management system requirements the responsibility of a single C-level executive who has overall technical design oversight accountability — typically, the COO/VP of engineering.
- Carefully consider moving toward ISO 55000 as an enterprise objective.
- Be inclusive about membership in the design authority by seeking members drawn from across the enterprise, which will also assist in cultivating good change management practices.
- Specify the detailed design rights and operation of the design authority and how it will mandate the selection and prioritization of key asset classes based on business risk. ¹
- Defer to the design authority for prioritization of asset management activities, such as continuous intelligence, data quality rules and asset specifications codes. Manage these priorities and their alignment across systems such as work, asset, analytics and AI.
- Enforce the use of compatible units across the asset life cycle, from planning to design to project costing and procurement.
- Execute IoT initiatives on behalf of the design authority, prioritizing initiatives that focus on targeted active risk management of asset classes.
- Assess the legacy technical debt across IT systems that serve the asset life cycle. Where appropriate, invest in, renew or refresh your EAM and APM capabilities.

Evidence

¹ CIGRE Technical Bulletin 787

² World Economic Forum Global Risk Report 2020

Document Revision History

Implement a Design Authority to Deliver Improved Asset Value Supported by an Asset Management System - 6 April 2020
Recommended by the Authors

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