How Utility CIOs Can Deliver Business Value With Digital Twins

Published 24 July 2020 - ID G00731258 - 26 min read

By Analysts Nicole Foust, Alfonso Velosa

Initiatives: Energy and Utilities Technology Optimization and Modernization

Utilities are increasingly evaluating digital twins to improve operational awareness and efficiency, but in-production examples remain few and immature. CIOs can use Gartner’s best practices to ensure that this complex and still-misunderstood concept delivers the desired business outcomes.

Overview

Key Challenges

- Although industry interest in digital twins is increasing, they are not yet widely deployed in the utilities industry. The primary reason is market confusion driven by complexity, broad and unclear definitions, and unsubstantiated vendor claims.

- Utilities often face challenges determining where to start, identifying suitable processes, and establishing delivery requirements mapped to appropriate digital twin initiatives that are linked to clear business goals and supported by governance frameworks.

- Managing data, keeping it synchronized and aligning it with expected business outcomes are critical functions of digital twins. The greatest digital twin challenges are determining which data best supports the desired outcome, finding it, establishing ownership, and ensuring its quality and consistency.

Recommendations

CIOs in utilities focused on digital transformation and innovation:

- Establish a roadmap by mapping your digital twin journey to high-impact use cases, success criteria, and technology and service partners, in alignment with specific business outcomes.

- Integrate digital twins with enterprise utility processes and culture by aligning them with enterprise key performance indicators (KPIs), getting buy-in from all stakeholders and ensuring executive leadership commitment. This introduces business process management and a governance process to ensure business relevance.

- Identify and avoid potential obstacles by engaging stakeholders in addressing data requirements to include quality, synchronization and ownership issues before beginning a digital
Strategic Planning Assumptions

By year-end 2024, 25% of utility digital twins will fail and be mothballed due to improperly defined governance, lack of updates and resource constraints.

By year-end 2023, 25% of utility digital twin projects will go significantly over budget or schedule due to lack of standards and required customization efforts.

Introduction

Utilities are increasingly evaluating digital twins to enable greater operational awareness and optimize performance. Many utilities are making significant investments in the technology to support these initiatives. But deriving business value and achieving return on investment (ROI) from digital twins is proving to not be a simple task.

The digital twins concept is still relatively new. Digital twin definitions and capabilities are still not consistently accepted or understood, and standards and best practices are still not widely available. In addition, the market lacks a digital twin integration environment that brings together drag-and-drop third-party multivendor digital twins. This definitely contributes to the complexity of composite digital twins of multiple aggregated assets. Recently, some collaborative standardization efforts have begun. One example is the Digital Twin Consortium from the Object Management Group. These efforts should not be viewed as a short-term fix, and they will continue to expand and evolve over time to deliver long-term success with digital twin deployments. Utility use cases and realized ROI examples are immature and limited. Nonetheless, deployments in other industries, and some utility sector deployments marketed by vendors, show that digital twins hold the promise to offer real value to utilities if implemented with clear goals and understanding of their complexities and their far-reaching implications. (See “Demystifying the Digital Twin in Oil and Gas: Define Its Purpose to Achieve Results.”)

A digital twin deployment is a highly complex, time- and labor-intensive undertaking, and it requires capabilities that a utility may not currently have in place. (See Figure 1.) Depending on the desired digital twin initiative, it may include a broad range of technologies and data sources across energy technology (ET), operational technology (OT) and IT systems, and will increasingly include consumer technology (CT). For all these reasons, CIOs need to develop a comprehensive understanding of digital twin technologies, resource demands and the impacts on the overall operations of the utility before beginning a digital twin journey. For example, if a utility has hundreds or even thousands of assets and each has a digital twin, management and scalability can quickly become a challenge. This could overwhelm the IT department with life cycle management requirements of keeping all the digital twins up to date (for example, software updates and recalibration due to drift from the real-world assets' behavior). Utilities will need varying degrees of technology and service provider partners, depending on the complexity of their digital twin initiatives.
Utilities’ interest in digital twins continues to rise, with expectations that they will provide significant benefits in operational efficiencies, improve reliability and advance digital transformation. However, delivering on the desired business outcomes and achieving ROI — for example, reductions in capital and operating expenditure, increased machine health or extended asset life — isn’t easy. Utility CIOs should develop a comprehensive understanding of digital twins’ complex underlying technologies and their far-reaching impact on existing systems and business processes.

**What Is a Digital Twin?**

A digital twin is a virtual representation — an encapsulated software model — of a physical object, person, or process. It relies on data from Internet of Things (IoT) sensors and other operational and IT sources to report on an object’s (including processes and people) current state. It analyzes this data against business objectives — often by integration with an asset performance management system (APMS) — to enable situational awareness and maintain a unique correspondence to the object. Digital twins include a combination of models, data, unique identities and monitoring.

CIOs will need to leverage technology and service provider partners to integrate both business- and system-centric thinking to create models of how these disparate technologies and processes will work together to achieve a well-designed and composed digital business capability. (See Figure 2.) For example, the design process in the engineering technology system of a geospatial information system (GIS) will document an infrastructure network design. When the GIS is deployed, the OT that’s implemented will work in concert with the real-time operations of the network. Then, IT — for example, an asset performance management system — can be combined with supervisory control and data acquisition (SCADA) or an advanced distribution management system (ADMS) to...
dynamically respond to the network's real-time operational or economic requirements. The data from the network can then be made available to IT for use in systems such as enterprise asset management (EAM) and asset investment planning (AIP) for planning and business management. The result is that network and infrastructure design and operations are much more closely connected to business value, and a more dynamic grid is capable of addressing energy transition challenges.

**Figure 2. Emerging Utility Digital Twins**

Next-generation grid digital twins hold particular promise, because they can go beyond simply tracking distributed energy resource (DER) connectivity and offer real-time dynamic grid modeling. This will enable them to integrate and orchestrate DERs to achieve needed flexibility in operation and commodity management processes (see “Market Guide for Distributed Energy Resource Management Systems”).

One enabler of digital twin technology’s full potential — one that is not yet fully in place — is 5G connectivity, because it reduces cost and latency to obtain real-time data from remote assets.
Current (4G) connectivity and access technologies are largely inadequate to deal with the explosive growth in IoT and other data inputs (see “How to Pace and Progress 5G in Energy and Water Utilities”). However, 5G is better placed to handle high-velocity, latency-critical time series data streams, and if combined with edge technology, may have notable impacts. A 5G platform will better position energy and water utilities to use digital twins to improve their mission-critical operations through advances in asset maintenance and infrastructure system management. (See “How to Pace and Progress 5G in Energy and Water Utilities” and “6 Critical Changes That Affect the Future of Asset Maintenance.”)

Although IoT-enabled digital twins are still emerging, utilities have been running similar solutions that provide real-time representation of their system for many years. For example, similar solutions have been used in distribution utilities for network management with ADMSs, and in transmission utilities with energy management systems (EMSs) based on SCADA measurements. But these solutions are built to address a specific function, are based on proprietary legacy technologies and are a digital representation of a complex system, rather than a representation of an individual asset. Utilities are now integrating and layering these systems with others, including applications that deliver IoT inputs, geospatial information systems and asset data systems, to create composite digital twins. This makes it possible to answer more complex questions, such as how to increase operational efficiency in an increasingly decarbonized and decentralized energy system. These solutions offer utilities much-needed insight into current operating conditions and allow them to explore the impact of different contingencies.

Digital twins are becoming a central monitoring and simulation feature of IoT-based architectures in many industries, and in asset-centric and utilities in particular. Digital twin initiatives in utilities are driven by potential business benefits, such as improving dynamic stability of the transmission system or optimizing output of a power plant. A digital twin initiative may start in one area but expand to others. For example, an initiative may begin with a focus on equipment, plant and enterprise in generation, and eventually move toward the grid. These initiatives are driven by the recognition that digital twins can offer real benefits.

Utilities are looking toward digital twins to:

- Predict the performance of assets and operations
- Evaluate different scenarios
- Understand trade-offs
- Enhance efficiency
- Improve operational awareness
- Optimize decisions associated with the changing state
Instrument and model complex things, from critical assets like transformers to operations or even entire networks

- Reduce operational risks
- Lower capital expenditure (capex) by improving asset utilization
- Lower operating expenditure (opex) through event avoidance
- Extend asset life

IoT-enabled digital twins can provide more enhanced capabilities, enabling more effective and efficient operations at a more expansive and granular level (see Figure 3). To help navigate through digital twin initiatives, Gartner has developed a set of best practices designed to help CIOs in utilities realize the real-world benefits of digital twins.

**Figure 3. Representative View of Water Utility Digital Twin**

**Representative View of Water Utility Digital Twin**

- **Model:** A model of the “thing”
- **Data:** Example — identity, status, context, ...
- **Uniqueness:** Each twin has a 1-to-1 correspondence to an asset
- **Monitor:** Query state, obtain notifications

Source: Gartner 731258_C
Establish a Roadmap by Mapping Your Digital Twin Journey

Digital twin deployments are highly complex undertakings that require precision orchestration and shouldn't be considered plug-and-play solutions. The digital twin concept represents an enterprise software design pattern with specific characteristics — required and optional — that can and should change dynamically as business, operational and other conditions change. A digital twin may, for example, need to respond to the movement of equipment parts, such as a part taken out of one asset, refurbished and placed in another. Extreme environmental events, such as storms, wildfires and other natural disasters or simply changes in wind direction or water flow, will also need to be taken into account. Also, digital twins will need to be able to respond to operational interruptions or limitations due to factors such as technology outages or personnel shortages.

Another highly significant contributor to the complexity of digital twins deployments is data, and especially the increasing amount of data coming from IoT sensorized endpoints that need cleansing. Utilities typically face challenges in ensuring that they have good-quality, consistent datasets and access to necessary historical data. (A detailed discussion of data issues appears below.)

Due to these challenges and more, utility company CIOs and other stakeholders often find that implementing a digital twin takes longer and costs more than initially anticipated.

To minimize this, CIOs in utilities must:

- Identify and complete digital twin prerequisites before starting on their digital twin journey.
- Evaluate and select appropriate and realistic use cases.
- Establish technology and service provider partners to include the number of resources and the respective roles and capabilities that will be dedicated to the digital twin to understand and manage risk. This will support the achievement of predefined goals.
- Determine success criteria, including specific metrics beyond simply delivering the digital twins.

Table 1 provides a list of considerations utility CIOs can leverage when establishing a framework of prerequisites.

<table>
<thead>
<tr>
<th>Do</th>
<th>Don't</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand that you will need a partner ecosystem to develop and manage digital twins.</td>
<td>Get too ambitious and implement digital twin projects that fail to align with your enterprise maturity and to your business unit co-sponsor’s short-term metrics.</td>
</tr>
</tbody>
</table>

Table 1: The Do’s and Don’ts of Digital Twin Implementation Prerequisites
Understand that digital twins are meant to answer business questions, such as “How do I prioritize my maintenance calls?” or “How can I push my operations to take advantage of arbitrage markets?”

Implement digital twins as a technology project.

Understand that digital twins are a concept and not a single technology. Multiple systems, technologies and data sources will need to be integrated with precise orchestration.

Implement digital twins as a technology project. Understand that digital twins are a concept and not a single technology. Multiple systems, technologies and data sources will need to be integrated with precise orchestration.

View digital twins as a plug-and-play solution. It is too early in their development stage.

Recognize that digital twins will be customized solutions.

Expect a digital twin initiative to be delivered as a one-vendor solution. Many projects require a blend of business and technical capabilities.

Evaluate in-production use cases, including one from other industries, to understand how they may be relevant to your organization.

Forget that digital digital twins are dynamic and must be updated as your assets and processes change.

Identify use cases with the highest impact by targeting specific business goals and mapping out how to achieve them. This will define the scope and ensure that each digital twin is manageable.

Create a digital twin for everything. Doing so adds unnecessary complexities for assets that might have been better served by traditional models.

Establish internal standards for integrating data from disparate systems and vendors.

Assume that there are appropriate standards available. Investments in integration capabilities, both for legacy assets and for assets from multiple vendors, will be needed. Adopt industry standards for data exchange between IT domains and data ingestion from real-time systems.

Determine how digital twins that are specific to particular use cases could work with other digital twins in enterprisewide initiatives, allowing capabilities from both a bottom-up and top-down approach.

Switch between IT and OT business units during different phases, because problems may result from possible differences in, or lack of understanding of, technologies, products or methodologies.

Create the same outward-facing APIs with an internal translation of systems/assets.

Enable your suppliers to develop and own the digital twin of your power plant or fleet of plants.
Identify and Select Use Cases

Identify use cases with the highest impact by targeting specific business goals and mapping out how to achieve them. This will define the scope and ensure that each digital twin is manageable. Digital twins can help utility company CIOs address a number of operational pain points by:

- Enhancing or extending operational, safety, and commercial risk analyses and scenario planning
- Lowering maintenance and spare parts inventory carrying costs
- Increasing uptime and reliability
- Understanding customer energy consumption
- Modeling the impacts of DERs or the performance of distribution or transmission
- Understanding the impact of distributed energy resource management systems (DERMSs) and how to create the operational model for the applications that manage DERs
- Overcoming a limited or siloed view of assets or operations
- Improving insufficient operating and planning models
- Adhering to regulations and compliance-reporting requirements
- Reducing fuel consumption
- Managing influence in arbitrage markets (see “The Energy Transition Question: Do We Need the Grid?”)
- Comparing similar assets (or even entire power plants in the fleet)
- Modeling weather patterns to track assets and personnel in the path of weather events, and simulating historic and current weather patterns and climate change impacts to understand how assets may be degraded over time

- Enhancing and optimizing workforce management to improve productivity and efficiency

- Simulating process flows (for example, water cycle management)

- Modeling operations process redesign

- Understanding shutdown planning opportunities

- Creating models of customers to help facilitate energy reduction promotions

There are a variety of use-case examples across utility domains and subsectors (see Table 2). However, to ensure that any digital twin journey supports and achieves specific business objectives, utility company CIOs must work with business unit leaders and partners to clearly define the digital twin's success criteria framework.

<table>
<thead>
<tr>
<th>Utility Domain</th>
<th>Subsector</th>
<th>Use-Case Examples</th>
<th>Use-Case Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Generation</td>
<td>Fossil Generation</td>
<td>Modeling data of entire plant</td>
<td>Accelerate the utilities reaction to market scarcity pricing opportunities</td>
</tr>
<tr>
<td>Power Generation</td>
<td>Nuclear</td>
<td>OT asset data streams</td>
<td>Improve performance</td>
</tr>
<tr>
<td>Power Generation</td>
<td>Hydro</td>
<td>Turbine models</td>
<td>Optimize maintenance and output</td>
</tr>
<tr>
<td>Power Generation</td>
<td>Renewables</td>
<td>DER connectivity with real-time network modeling</td>
<td>Improve understanding of the energy flow and optimize grid asset utilization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assets connected to large-scale transmission networks (e.g., wind farms)</td>
<td></td>
</tr>
</tbody>
</table>
Before embarking on a digital twin journey, CIOs should determine where there are critical gaps in their utilities’ digitalization roadmaps that could delay the DT or limit its success. Depending on the specific type and scale of the digital twin journey, utilities will need varying degrees of digitalization completeness.

In some power plants, many monitoring and control systems are electromechanical, not digital. Many of these electromechanical systems are not at all integrated with one another — not across asset types, and sometimes not even across individual assets. In generation assemblies and units, for example, the electromechanical controls for motors are not integrated with those for hydraulics.

Another factor to consider is that API intermediation requires a digitization mechanism. Only now are some standards emerging for which models best represent different electromechanical topologies. Determining digitalization gaps provides valuable insights that utilities can leverage in the course of their digitalization journeys, outlining critical digitalization areas that need attention prior to the introduction of a digital twin.

Establish Partners
Digital twins are not a one-vendor solution, and they require detailed integrations and orchestration. Due to digital twins’ complexity, utilities will need to leverage varying degrees of both technology and service provider partners tailored to the organization’s specific digital twin initiatives. Considerations such as the organization’s needs for an integration environment for third-party multivendor DTs, or resources for managing the life cycle of each digital twin, which require regular updates, should be included in establishing the organization’s requirements for DT success.

The majority of current utility digital twins in production are those developed by the original equipment manufacturers (OEMs) of their assets. These may include wind turbine manufacturers, like Envision, GE and Goldwind Americas; power plant equipment manufacturers, like ABB, GE and Siemens; and grid operation solution providers, like CGI and third-party consultants. This makes OEMs critical partners in the digital twin initiative, and this makes a governance framework and clear definitions of who owns and maintains the digital twin and its data essentials. These partners should be evaluated on the basis of their asset, industry and process expertise, as well as their knowledge of the utility’s products ecosystem, which will provide the data for the digital twin. Utilities need to evaluate partners’ off-the-shelf options versus custom capabilities and templates, and consider how partner delivery options align with their current and future requirements.

**Determine a Success Criteria**

Given the immaturity of digital twins, realized ROI and in-production use cases are few. Utilities may find it difficult to create a baseline for business metrics, because most digital twins are in the experimental or, at least, very early stages. As with many technology initiatives, initial costs are typically outlined upfront, and the benefits are often not realized until long after implementation. The benefits can be distributed, or even become more socialized, outside the utility’s hard-quantified metrics.

Creating a baseline for business metrics is further complicated by regulatory requirements and the potential for regulators to challenge utility investment proposals that raise the threshold of the rate of return allowed by regulation. Regulators may also question if the utility is working beyond its chartered scope. Utility CIOs must develop digital twin success criteria by establishing clear business outcomes aligned with measurable goals. Doing this will provide further clarity and make the business case for investing in digital twins more effective (see “Digital Business KPIs: Defining and Measuring Success”)

Digital twins shouldn’t be viewed as all-or-nothing or plug-and-play projects that, at some point, will be finished. Digital twin implementations should instead be understood as a journey, not a destination. They are, in fact, ongoing processes that will require continuous, ongoing attention. For this reason, utility CIOs should use an iterative process to develop and maintain digital twin success criteria over the digital twin’s life cycle. The place to start is identifying the use cases with the highest impact. This can be done by targeting specific business goals and mapping out how to achieve them. After gaining experience and traction, expand to further the digitalization journey (see “Four Steps Utility CIOs Can Take to Move Past Proof of Concept”).

Gartner, Inc. | 731258
Recommendations for CIOs in Utilities:

- Determine a specific business goal to be achieved with a digital twin, and map out which systems will need to be leveraged and which types of data are needed.

- Identify business leaders who will benefit from the digital twin output, and who will champion their use in operations.

- Recognize that there will not be a one-vendor solution: Determine which vendors provide digital twins themselves, which support digital twins and which integrate the multiple components. Then, establish partners for the delivery and ongoing management of the digital twins.

- Identify where digital-twin-based simulation and predictive maintenance could deliver value by working with business leaders. Determine where improvements in product performance, operation or maintenance could drive down costs, create new revenue or improve a process.

- Build measurable goals for digital twin success in the near term.

Avoid Potentially Crippling Data Issues by Engaging Stakeholders Early

Data, one of the four required elements for a digital twin, is one of the biggest challenges utilities face in the digital twin journey. In addition to data that comes from the physical object (e.g., identity, time series, event, class-instance, sensor, status and event data), digital twins also generate relevant information about the object. Examples include weather data, maintenance logs, supply chain and inventory data.

Digital twins are only as accurate, effective and expansive as the data that models are built upon to include the real-time and historical data that illustrate operating conditions. This makes data issues one of the most challenging aspects of any digital twin strategy. CIOs must consider what types of data are needed, how to get it, the quality and consistency of it, who owns the data, how it should be managed and shared, and how it will be synchronized. Although a digital twin has a unique one-to-one relationship with an asset, many constituencies have access to the digital twin and its data. This leads to the need for access control with a tailored view, capabilities for users and access to digital twins.

CIOs in utilities must incorporate strong data management into their digital twin journey, focusing on four critical factors: data quality and ownership, and data synchronization and governance.

Data Quality and Ownership

Any digital twin will only be as accurate as its model or template and the related source data. CIOs can resolve data deficiencies by upgrading relevant systems or through a data cleansing, using internal resources or external vendors. No matter which method is used, the most important takeaway is that data quality is not a one-time project, but rather a continuous process. Any data cleansing should include updating processes to ensure that data quality is constant.
As data monetization becomes a competitive differentiator for many stakeholders in the market, including digital twin technology vendors and utility companies that operate digital twins, data ownership is an increasingly significant issue. In addition, datasets have different values and meanings to different stakeholders. For example, OEMs’ digital twins will contain their own property. Most OEMs won’t share this data — unless there’s a contractual arrangement in place to do so for a fee. Therefore utility organizations will need clarity around what is IP, ownership and access.

When addressing data ownership, consider the following (see “Data Ownership of IoT-Connected Equipment Poses New Challenges for CIOs”):

- Who “owns” or needs access to the data and for what purpose? Owners may include equipment manufacturers, financing entities, regulators, engineers who collect data and utility customers.
- How much data does each entity own, and how do they want to use it?
- In what form and in what time period will this occur?
- Will the data be actual, summarized, correlated or derived?

Whether directly related to a digital twin or external market forces, utilities must be able to determine (and potentially monetize) the data and intellectual property collected from their machines, production facilities and even customers. At the same time, they must build in an appropriate level of confidentiality. With all this complexity and activity, data ownership should be a top priority for utility CIOs implementing digital twins. The key stakeholders the CIO will want to engage include — at minimum — the chief operating officer, the chief counsel and the procurement team.

**Data Synchronization and Governance**

Utilities increasingly encounter challenges in digital twin data taxonomy such as static data used to determine parameters of the object and real-time data used to determine current operating conditions of the asset. Some data may be derived from GIS, computer-aided design, EAM or other enterprise systems, while other data may be temporal, coming from real-time acquisition systems (SCADA or IoT). These are very different and require different processing, validation and storage. A fusion of these two models through algorithms such as state estimation creates a digital representation of the asset or system and requires purposeful orchestration.

Complex digital twins pose data synchronization challenges. Complex digital twins include those with many different components that may themselves have digital twins, or those running larger-scale digital twins, like a grid or power plant digital twin. Data coming from multiple components, vendors and other systems such as SCADA may not be in the same format or language. In addition, in OT real-time systems, a utility will traditionally need to consider time skew, the measurement used to calculate the state of the system. This measurement may not have been
taken at the same time or cadence and can create an inaccurate representation of the system (or asset).

Utilities must find a way to integrate all of this disparate data and build a composite digital twin associated with various discrete assets. One way is via a direct feed into a data historian or data lake with sensor data. Another is through an enterprise system that has the data, such as an enterprise asset management process, industrial data platform or industrial control system (ICS). To make this approach work, utilities must dedicate operational teams to help identify key business outcomes and develop a composite digital twin using a technical solution, such as an IoT platform or analytics tool.

The lack of global standards further complicates the synchronization challenge. As a result, utilities have increasingly looked to a patchwork approach using standards IEC 61850 (an international standard defining communication protocols for intelligent electronic devices at electrical substations) and IEEE 2030.5, ICCP.

All these factors point to the urgent need for sound data governance for digital twin initiatives to deliver four key elements:

- **Accountability** — Establishing that clear roles and responsibilities are in place, especially for key management decisions, throughout the digital twin life cycle
- **Participation** — Engaging the appropriate stakeholders, and only the appropriate stakeholders, in decision making
- **Predictability** — Delivering the information, reports and actions needed to ensure sound decision making and good governance
- **Transparency** — Recording and sharing digital twin activities, decisions and results, as appropriate and needed, to ensure stakeholder confidence in actions taken and enable ongoing improvements

It’s essential that utility CIOs recognize that none of these mission-critical data management and governance objectives can be achieved in isolation. They require complete, proactive, ongoing collaboration with and commitment from all the stakeholders impacted by the utility's data issues. There are three key players in these efforts: the executive sponsor (most often from the business unit), the program lead (most often from IT), and the data owner (who may be a frontline worker). For more detail, see “Strengthen 4 Elements for Successful Management and Governance of Digital Twins.”

**Recommendations for CIOs in Utilities:**

- Ensure that you have oversight into and responsibility for setting up governance and stewardship rules around all data.
- Engage with the business units to jointly allocate budget and personnel to support long lifetime digital twins.

- Establish an environment for data synchronization by identifying any existing standards that apply to your specific use cases and establishing internal standards where there are gaps.

- Experiment with your enterprise’s requirements by establishing a digital twin integration framework that enables you to update the digital twin models.

- Build a digital twin architecture roadmap that enables you to progressively address more complex scenarios and deal with the complexities of data ownership and integration.

Evidence

Centre for Digital Built Britain

The Centre for Digital Built Britain (CDBB) has established the Digital Twin Hub (DT Hub), a community for those developing digital twins within the built environment.

Other Research Sources

The analysis and advice provided in this research are derived from constant scanning of utility-specific and digital twin use cases. They are also provided from the aggregation of analysts’ experience and ongoing interactions with end users, technology and service providers. We used a range of sources to feed our perspective on the topics discussed in this research. They included Gartner customer inquiry, discussions between Gartner analysts with expertise in key technologies and business models, engagement with representative vendors and their associated materials, and ongoing digital twin research.

1 Digital Twin Consortium is an open membership organization created by the Object Management Group, which includes founding members Ansys, Dell, Lendlease and Microsoft. The consortium is intended to develop and apply best practices and create consistent vocabulary, architecture, security and interoperability for digital twin technologies across a broad range of industries.

Recommended by the Authors

Market Guide for Asset Performance Management Software

Market Guide for Advanced Distribution Management Systems

Implement a Design Authority to Deliver Improved Asset Value Supported by an Asset Management System

Exploiting Digital Twins to Drive Ecosystem Strategies

Innovation Insight for Digital Twins — Driving Better IoT-Fueled Decisions
2018 CIO Agenda: A Utility Perspective

Top 10 Trends in 2018 Driving the Utility Industry Toward a Decarbonized, Distributed, Digital and Democratized Future

Show the Value of OT and IT Alignment, and Realize Digital Business Results

What to Expect When You’re Expecting Digital Twins

Strengthen 4 Elements for Successful Management and Governance of Digital Twins

Toolkit: Enterprise Readiness for Digital Twin Deployment

Use 4 Building Blocks for Successful Digital Twin Design

Recommended For You

Summary Translation: 3 Steps to Agile IT Service Management

Summary Translation: Market Guide for Servers

Supported Control Implementation for the Public Cloud (Pfizer)

Ignition Guide to Creating a Control Framework for the Public Cloud

Overcoming 3 Common Barriers to Agile L&D