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Reinventing tomorrow.

EXECUTIVE SUMMARY

Digital Twins

Transforming data, technology
and people for lasting impact

EXECUTIVE SUMMARY

The rise of digital twins is testament to the building and infrastructure industry's resilience and drive to reimagine what is possible. Owners, operators and developers are seeking smarter ways to run assets, cut costs and boost performance. At the heart of this shift is the ability to harness asset and organizational data effectively, and digital twins are emerging as a critical enabler.

A digital twin is a dynamic, data-driven model of a physical asset, system or process. It integrates design, construction and operational data to provide actionable insights across the entire lifecycle of a building or infrastructure asset, helping organizations to make better decisions, faster, with greater confidence and with greater long-term impact.



Digital twins take many shapes and forms, but there are three common types:

TYPE 1

FACILITY AND ASSET DIGITAL TWIN

Digital representation of a vertical building or precinct, combining as-built facility Building Information Models (BIM) with accurate representations of all maintainable assets.

TYPE 2

PROCESS SIMULATION DIGITAL TWIN

Digital representation of a frequently repeated process or workflow.

TYPE 3

OPERATIONAL OPTIMIZATION DIGITAL TWIN

Digital representation of horizontal utility and infrastructure assets, combining historic, synthetic and real-time data and machine learning to provide operational insights.

Digital twins can unlock measurable improvements across every phase of the asset lifecycle.

— DESIGN PHASE

They enhance collaboration, visualization and planning, enabling teams to optimize designs, reduce cost and schedule risks, and accelerate speed to market.

— CONSTRUCTION PHASE

By integrating real-time site data, they track progress, identify issues early and ensure adherence to budgets and timelines, boosting productivity and minimizing delays.

— OPERATIONS & MAINTENANCE PHASE

They enable plant and process optimization, increasing capacity and throughput. They support continuous monitoring and predictive maintenance, reducing downtime and lowering costs. They can also optimize energy use and environmental performance, supporting sustainability goals and net-zero ambitions.

In short, digital twins transform underutilized data into strategic insights that drive efficiency, resilience and sustainability.

A structured approach to success

Visioning and implementing a digital twin is a complex undertaking, involving people, processes and technology — in that order of importance.

A robust planning process and a keen eye on challenges organizations commonly encounter in each phase ensures success:

PHASE 1

Define vision and strategy

Establish the project's mission, identify stakeholders and prioritize use cases. Develop a roadmap that aligns with organizational goals and facilitates change management.

During this phase, it is important to lay strategic groundwork early, communicate the vision clearly and often, and engage the right stakeholders, including project "champions" and "blockers".

PHASE 2

Assess digital maturity and potential for disruption

Evaluate current data quality, technology readiness and organizational appetite for transformation to determine the pace and scale of change.

During this phase, it is important to understand existing data quality, learn from past digital initiative successes and failures, and think big but start small to keep the pace of change manageable.

PHASE 3

Review the existing technology stack and identify potential solutions

Identify gaps in tools and data, explore solution options and create an initial systems architecture.

During this phase, it is important to prioritize function over form and be ready to compromise on functionality for the sake of faster adoption.

PHASE 4

**Data analysis
and execution plan**

Document data-centric requirements, refine functional and technical specifications, and establish a data management plan to ensure integrity and accessibility.

During this phase it is important to validate requirements, check and recheck the critical components of the solution, and plan for how the data and technology will be maintained in future.

PHASE 5

**Develop
and implement**

Define roles, update tools, document workflows and standards, and implement a robust change management plan for smooth deployment.

During this phase, it is important to maintain a degree of flexibility in the solution, gather feedback from key stakeholders frequently, and keep documentation current as the solution evolves.

Accounting for the human factor

While the data and technology are essential, digital twins succeed when people embrace new ways of working. Implementing a digital twin requires rethinking processes, building stakeholder buy-in and managing change at every level. Organizations that balance vision, technology and human engagement are best positioned to overcome challenges and unlock long-term value.

The bigger picture

The convergence of fiscal challenges and technology imperatives is reshaping how we design, build and manage assets. For many organizations, digital twins are a strategic enabler for efficiency, productivity, sustainability, resilience and innovation, helping operationalize insights, reduce risk and deliver positive environmental and economic impacts.

Adopting digital twins requires a clear vision for the future, commitment to collaboration and courage to change. Organizations that embrace this transformation will be better equipped to solve complex challenges and create smarter, more sustainable built environments.

Read the full Digital Twin paper at jacobs.com

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