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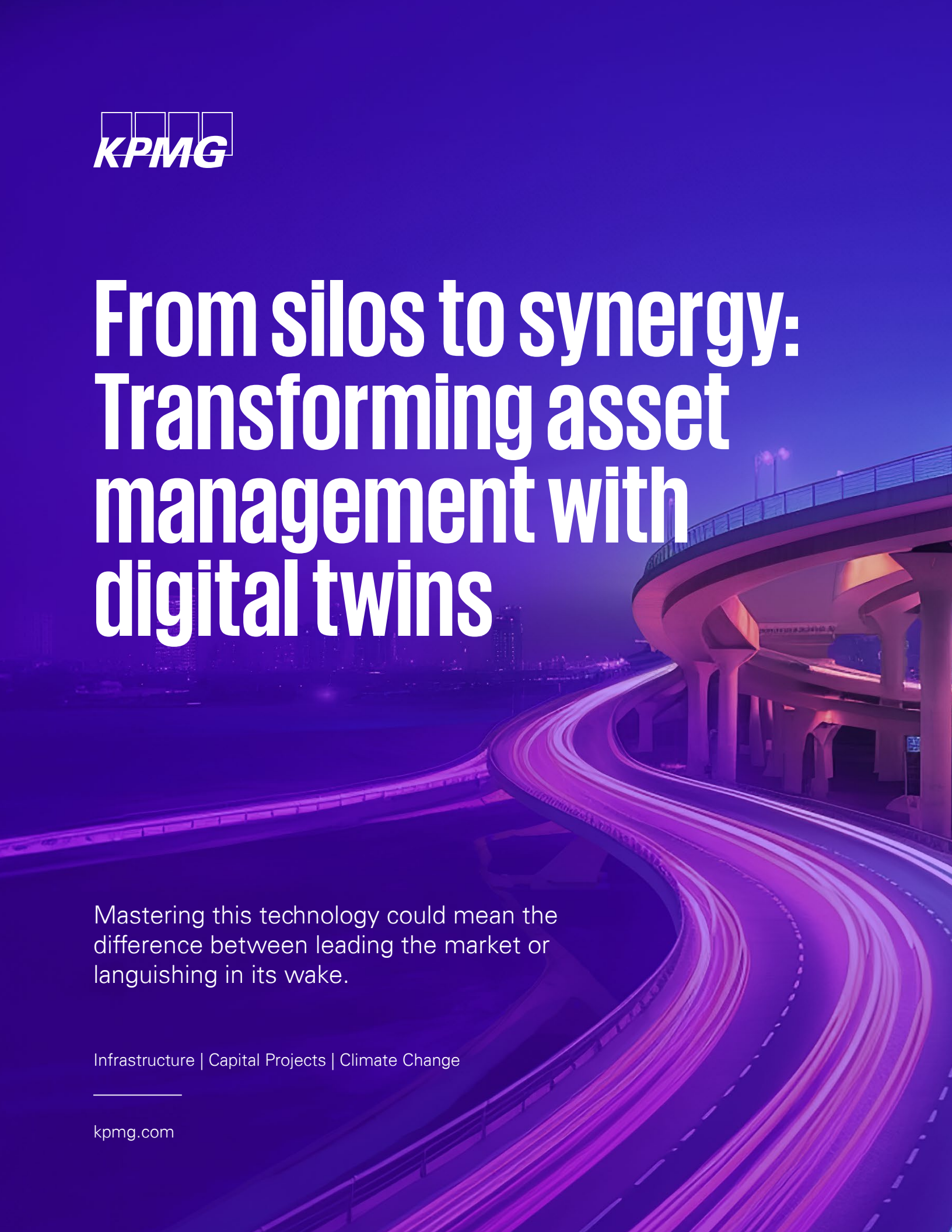
From silos to synergy: Transforming asset management with digital twins



Mastering this technology could mean the difference between leading the market or languishing in its wake.

Infrastructure | Capital Projects | Climate Change

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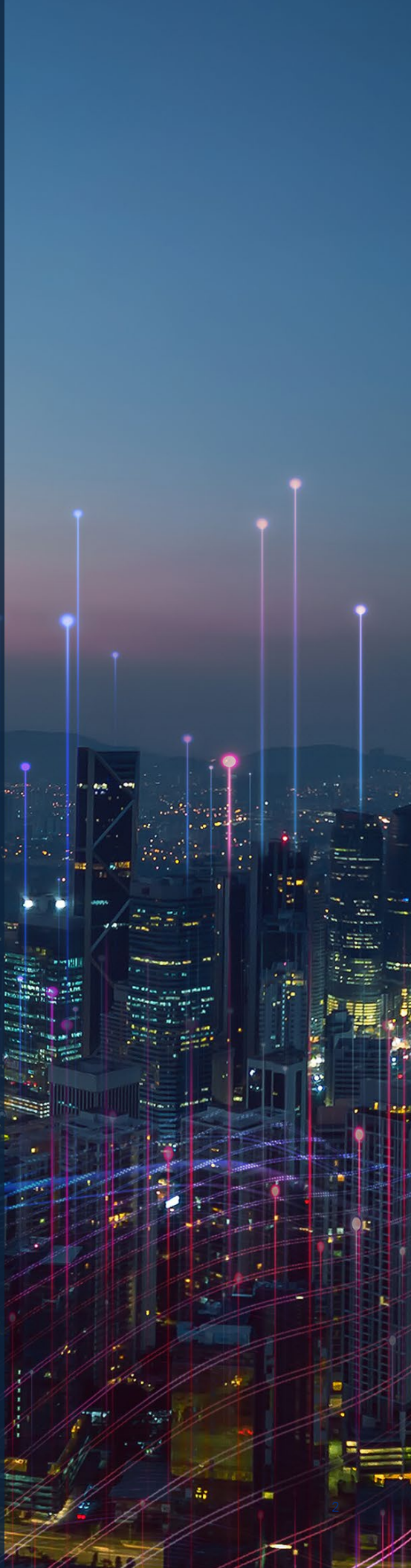
Introduction

In this era of profound social, economic, and technological shifts, it's time to adopt new methods to enhance infrastructure planning, funding, development, operations, and significant capital programs. However, isolated functions across the asset lifecycle limit the necessary information flow to address challenges, including asset management, resource allocation, funding prioritization, and broader issues like climate change, geopolitical tensions, protectionism, regulatory complexity, and ESG mandates.[1] By adopting digital twins, data-driven insights can effectively navigate these issues.

Digital twins are presently used to virtually represent a single physical asset's processes and data. Throughout each project phase, integrating and analyzing data from multiple platforms, datasets, functions, and departments may offer remarkable insights and foresight to maximize asset value. The digital twins become a data-centric nexus for teams managing asset strategy, capital planning, project delivery, and operations.



[1] KPMG. Emerging Trends in Infrastructure.

This paper clarifies the benefits of digital twins in the built environment, specifically focusing on capital programs and asset management. We discuss how digital twins, in combination with other emerging technologies like AI, can unlock powerful capabilities that were not previously possible. We address current apprehension about the technology, including trust issues, ROI concerns, and organizational readiness. Finally, we provide a roadmap to start the journey and show how digital twins can provide new insights, increasing enterprise-wide resiliency when correctly deployed.

A look at the future state and the art of what's possible

Discrete digital twins are not inherently connected. However, by establishing such connections, we can integrate the data from various digital twins throughout the entire asset lifecycle. Organizations that adopt integrated digital twins can then harness transformative digital AI solutions and align their technology with ESG data.

Transform asset management through a combination of digital twins and AI

Digital twins can expand simulation capacity and the depth of related insights by using AI for:

- Predictive maintenance via predictive algorithms powered by AI to detect issues.
- Near real-time adjustment to resource and funding allocations to maximize the value, lifespan, resilience, and energy usage of existing assets.
- More accurate scenario planning via AI-generated simulations that may not be currently feasible in the physical world.
- Improved operational efficiency via algorithm-generated analyses of infrastructure sensors to boost performance.
- Increased safety by simulating the efficacy of training to enhance infrastructure emergency response actions.

Sustainable design solutions via the integration of digital twins and ESG

The combination of digital twins with ESG data enhances insights and foresight in these areas:

- Identify design and construction methods that maximize energy efficiency and reduce waste.
- Enhanced predictability of how assets will perform and react in a natural disaster.
- Recommendations for local and regional planning that enhance equity and inclusiveness.

Potential benefits of digital twins

Digital twins stand at the forefront of revolutionizing asset management, presenting a pivotal shift in managing the lifecycle of infrastructure projects. The following section explores this technology's critical advantages, underscoring its importance for improving operational efficiency, decision-making processes, and overall asset value.

1 Asset-lifecycle integration

Digital twins connect the entire asset lifecycle from capital planning and design to construction, maintenance, and operations through refurbishment and/or decommissioning. This connecting link is missing in today's infrastructure and capital projects space.

Data captured during multiple phases of construction is not transferred efficiently from one project phase to another. If we create these links between different asset lifecycle phases using digital twins, the capital planning phase could benefit from insights provided by the construction or operations phases and possibly influence decisions on selecting or modifying another asset to achieve a higher return on investment.

Another wasted opportunity involves the poor transfer of the as-built models developed after construction to begin the operations phase, resulting in the need to spend additional time and money to correctly field-map the built assets to reflect them for Asset Management stakeholders. Assuming the use of digital twins, the as-built models can be integrated with the Building Management System (BMS) or Enterprise Asset Management (EAM) system, limiting, if not eliminating, field mapping.

2 Decision-making insights

Improvements in digital literacy across industries make digital twins a more compelling investment today. By leveraging data-driven analytics and visualizations, a digital twin can identify inefficiencies in the physical asset lifecycle, guiding opportunities for improvement while forming a foundational dataset to generate predictive models.

Operations personnel can heat map the movement of people through built assets like a public transportation hub, sports venue, or an extensive public education system, measuring the congestion in specific hallways, congregation areas, bathrooms, and other portions of the asset. The calculations can inform decisions in the design phase on potential adjustments to the existing asset and future asset models.

In another example of digital twin usage, designers and the procurement team can access asset-specific performance data during the planning phase, such as parts availability and lead time. This capability supports a better selection of equipment before the asset is built. By utilizing a digital twin to increase cross-functional data visibility, teams can significantly reduce the time spent on meetings, emails, and calls searching for answers, as they can easily browse asset information across the portfolio in a centralized location.

3 Increased asset value/decreased operational costs

Deploying digital twins across the entire asset lifecycle can help maximize asset value. A case in point is asset optimization. By leveraging an analysis of the layout, mechanical, electrical, and plumbing systems, and maintenance demands of different commercial office spaces in a portfolio, ideas may burgeon on how to rework the planning and design of a commercial office space slated for renovation.

Another example involves the life expectancy of an asset. By leveraging "what if?" analyses of previously recycled spaces—a warehouse transformed into modern office space, an outdated retail area refurbished into a mixed-use

development, or any similar process that upgrades or repurposes an existing space or structure rather than demolishing and rebuilding it—assets can be reworked and maintained to extend the cradle-to-grave timeframe.

Utilizing digital twins can reduce expenses related to the day-to-day management, maintenance, and functioning of an asset or infrastructure project by optimizing processes. An example might be a commercial facility manager implementing digital twin technology to monitor real-time HVAC system performance and optimize energy consumption based on occupancy patterns and environmental factors.

Through predictive maintenance, the digital twin can also identify potential issues with the systems before they become critical, allowing for timely repairs or replacements. These improvements decrease operational costs by reducing energy consumption, avoiding costly equipment failures, minimizing the need for reactive maintenance, streamlining decision-making, and increasing overall asset efficiency.

Challenges to implementation and adoption

While the concept of digital twins has existed for decades, adoption has been limited in the infrastructure and capital projects. We've identified five key challenges impeding organizations from implementing and adopting enterprise-level digital twins.

Trust concerns. A common concern about digital twins is the lack of widescale adoption. As with all emerging technologies, organizations tend to postpone deployment, waiting for competitors to test the waters first. Another issue is data quality across individual functions and systems. Integrating and analyzing poor-quality data from multiple systems exacerbates the likelihood of drawing inferior conclusions.

Organizational readiness. Many organizations are accustomed to a set way of doing things, increasing feelings of stability but making them resistant to change. The level of stakeholder buy-in and involvement across all departments in implementing and adopting an integrated digital twin exceeds their comfort level.

ROI concerns. Implementing and adopting digital twins requires significant investments to establish full asset lifecycle models. Like all significant new projects, calculating the investment return is challenging. Considerable time may be needed to realize a return due to the lengthy timespan to plan, construct, and maintain large,built assets.

Added work. Assuming the use of digital twins, the greatest number of potential insights depends on the greatest number of data connections and integrations throughout the cradle-to-grave asset lifecycle. In planning this end state, however, not all the data connections may be identified at the front end. This possibility may require more time, work, and capital to restructure the data and reestablish connections as additional integrations are identified.

Data standardization, quality, and interchangeability. A systematic approach to design, implement, and operate digital twins requires applying technology to various steps of a project to evaluate aspects such as time, cost, errors, and other possible improvements. Without consistent quality data across the organization to assess process inefficiencies, the evaluations will not be very helpful in suggesting optimal process changes.

Imperatives to overcome challenges

Organizations may want to consider the five following strategies to surmount these challenges to enterprise-level implementation and adoption of digital twins.

1. Sponsorship and leadership

Senior management executives should endorse the initiative, define the organizational vision, outline the critical problem statement and expected outcomes, identify vital sponsors, and set the team's direction and messaging. A shared vision makes it easier to attract the interest of stakeholders and staff to gain their support, secure necessary resources, and enable alignment with other enterprise-wide projects, inspiring project teams to proceed confidently.

2. Digital twin use cases

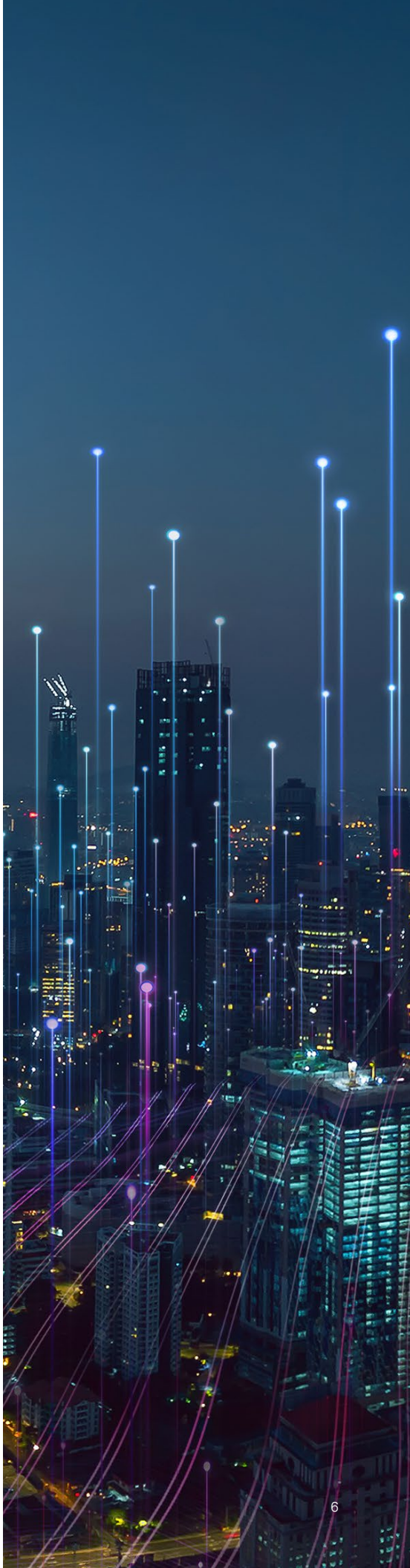
Key sponsors of the digital twin initiative should implement a business use case adoption framework that builds off of the organization's digital twin strategy and roadmap. The adoption framework can consider business leads' requirements and unique business cases to support the generation of an aligned digital twin end-state vision, which can manage the cost outlay over a longer horizon. Additionally, an iterative use case approach can help identify funding, development, and delivery dependencies and enable the capabilities of the digital twins.

3. Sequencing digital twin capabilities for enablement

Organizations can allocate funding for future releases and updates to enhance data integration, analysis, and modeling objectives by adopting an iterative, case-by-case approach. For each use case to succeed, it is essential to identify the specific business, technical, and personnel capabilities required.

When implementing digital twin technology, each specific tool contributes to the overall capabilities in the following ways:

- **Data capture methods:** Mobile solutions and IoT devices gather the essential data needed to create the digital twin.
- **Data storage and integration technologies:** APIs and cloud platforms store and consolidate various data components to form the digital twin.
- **Analytical methods:** AI and ML technologies analyze data, pinpointing patterns and insights for digital twin optimization.



- **Modeling methodologies:** Simulation and discrete event analysis tools create virtual models of the physical systems represented by the digital twin.
- **User experience technologies:** AR/VR and 3D immersive environments enhance visualization and interaction with the digital twin, offering a more engaging and intuitive experience.

By sequencing these capabilities, specific areas needing funding can be identified upfront, strengthening enterprise-wide data integration, and maintaining sustainable support for ongoing releases and updates.

4. Upskilling and change management

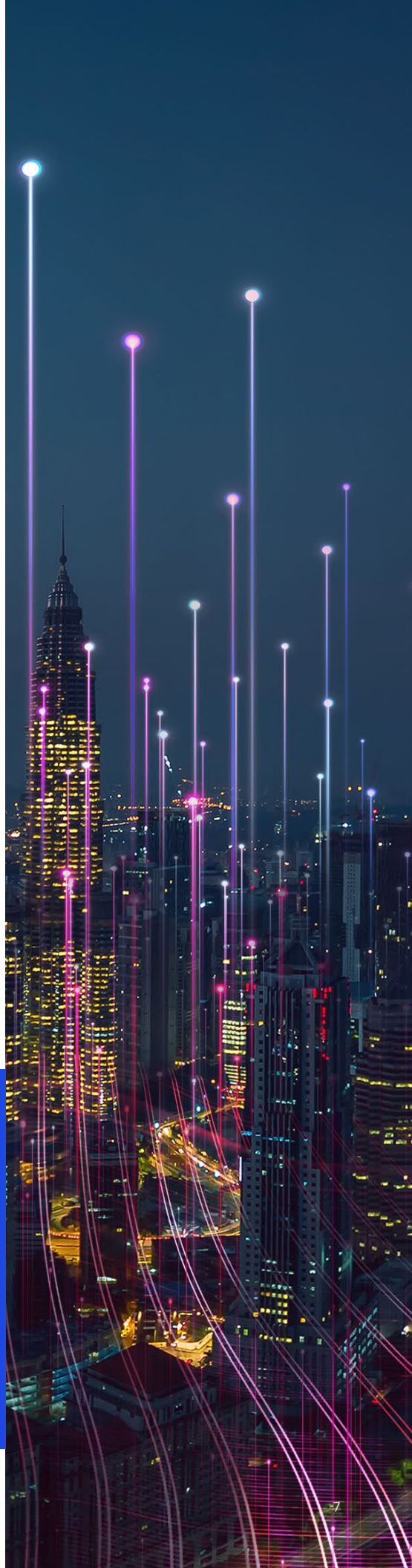
Understanding the stakeholder impact is imperative to achieve buy-in and involvement across all departments/functions for the digital twin initiative. People tend to resist change because of concerns over the need to learn something new that may result in added responsibilities beyond their capabilities. A series of targeted change interventions engaging users in a multi-phase journey prevent this concern by upskilling stakeholders on a phase-by-phase basis. This approach goes well beyond teaching people how to use software, as it promotes a culture of continuous innovation, encouraging stakeholders to make better decisions through improved data quality and more sophisticated analytical capabilities.

5. Capturing early benefits to secure further funding

Organizations that sponsor a case-by-case approach may realize tangible benefits early in the initiative by tracking costs and associated outcomes to secure additional funding for the ongoing program. Cost savings benefits may include reduced capital earmarked for service delivery, management, asset ownership, and data collection. Value-generating benefits may include better project selection, improved infrastructure design, and commercialization opportunities to monetize data.

Conclusion

In an era where technological innovation is not just an advantage but a necessity, embracing digital twins is a strategic imperative for leaders aiming to secure their company's position at the forefront of the market. The transformative power of digital twins, highlighted through their capacity to integrate asset lifecycles, enhance decision-making, and drive operational efficiencies, is a prelude to tapping the potential within your organization's reach.



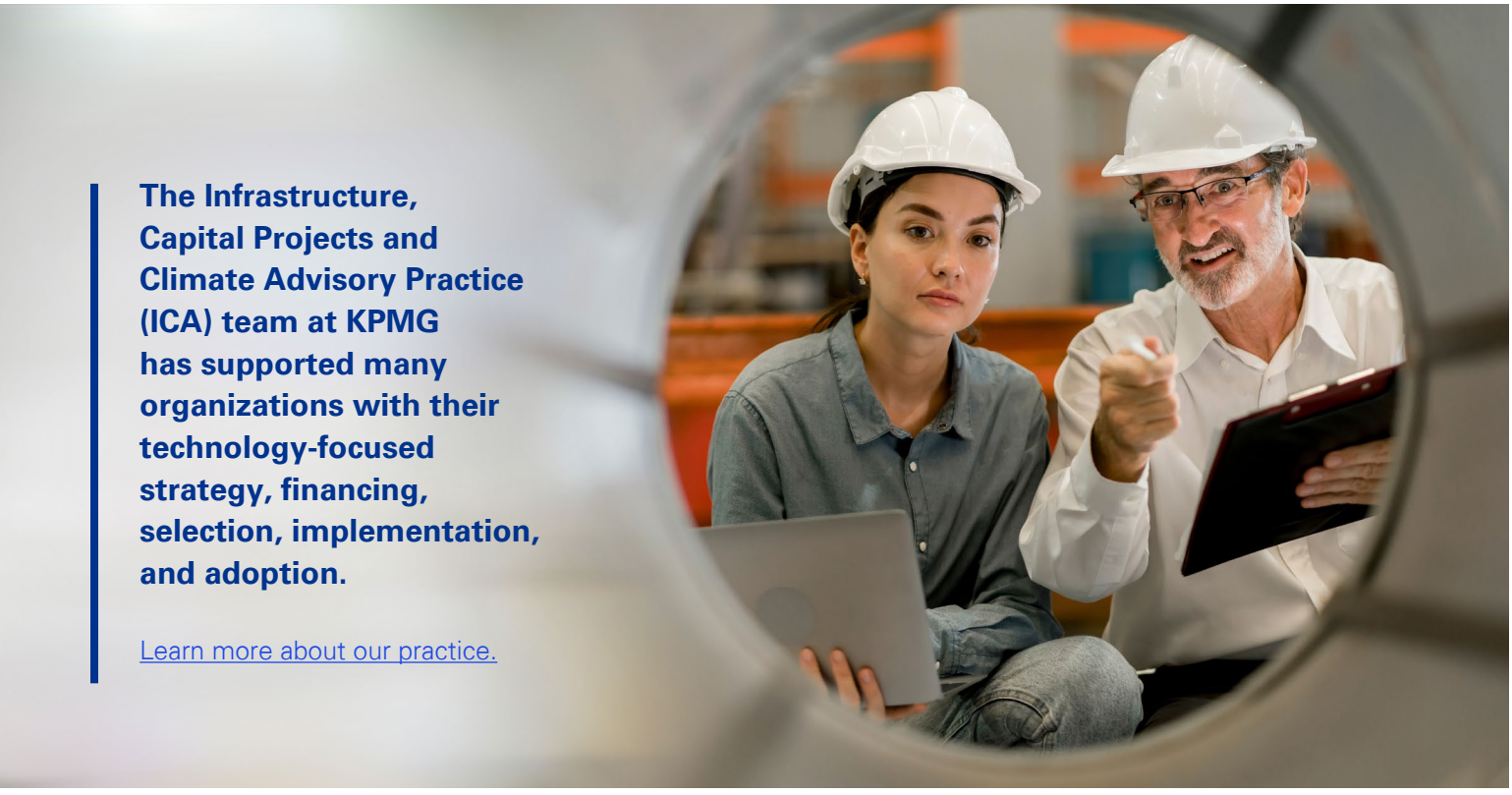
How KPMG can help

Aligning this technology with AI and ESG initiatives paves the way for improved agility and resilience and positions your enterprise as a leader in sustainable and socially responsible business practices. As we stand on the brink of this technological revolution, we welcome the opportunity to talk with you about how our expertise can help your organization enter a new era of leadership and innovation in your industry.

KPMG can assist government entities and private and commercial organizations to leverage transformative technologies, like digital twins, to generate improvements in capital assets. Our Infrastructure, Capital Projects, and Climate Advisory Practice has the knowledge, expertise, and experience to help navigate successful digital twin journeys.

Our services include:

- The crafting of the digital strategy and roadmap for deployment, addressing business need and organizational readiness.
- Asset strategy alignment to help ensure the integration of digital twins across the entire asset lifecycle into a holistic ecosystem.
- Data governance and intelligence, including the development of data standards, assessment, and analytics.
- Technology solution design, delivery, and deployment.
- Technology-enabled ESG benchmarking and monitoring.



The Infrastructure, Capital Projects and Climate Advisory Practice (ICA) team at KPMG has supported many organizations with their technology-focused strategy, financing, selection, implementation, and adoption.

Learn more about our practice.

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Chris has 28 years of expertise in asset management and strategic advisory across critical infrastructure sectors globally. He has led initiatives in the U.K., Europe, Middle East, Canada, and the US, achieving significant savings and performance enhancements. An IAM Fellow and AMP, he contributed to ISO-55001:2014 and the IIMM and currently serves as president of the Institute of Asset Management, guiding global asset management professionals. He is the current president and chairman of the board of the Institute of Asset Management—a global professional body for those responsible for managing physical assets.

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Reid is a principal for Infrastructure, Capital Projects, and Climate Advisory at KPMG, and leads the Programs, Strategy, and Infrastructure technology services. With more than 20 years of experience developing advanced technology solutions for capital programs across multiple sectors, he enhances client efficiency and governance with innovative tools and strategies, driving better project execution and operational performance through automation, analytics, and transparency.

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Cindy has more than 20 years of experience in physical asset management strategy, planning, and delivery. She leads digital transformation projects by recommending, implementing, and deploying project and portfolio management systems (PPMS) and emerging technologies, including the use of AI and digital twins specific to construction and asset management.

We would like to thank our contributors:
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