INDUSTRY SOLUTION

Creating a Reliable Digital Twin

The importance of intelligent data management and digital continuity

AVEVA is a leading provider of digital twin technology. In this paper Rick Standish, VP for Solution Strategy, reflects on the process and plant industry's digital journey from data management to intelligent information management, and now, to living digital twins to enable advanced data programs and drive value across the asset lifecycle.

Digital twin technologies are transforming operational effectiveness in many sectors. The traditionally conservative process industries are beginning to adopt the latest digital thinking, following the lead of the discrete manufacturers in automotive and aerospace. Organisations are increasingly using intelligent engineering master data management to establish reliable digital twin technology platforms that can transform their operational decision making, boosting plant efficiency and increasing flexibility in challenging market conditions.

Being confident in the quality of their 'as-operated' information, means that companies can translate their engineering data into business value by using it to gain insight into operational processes, highlight potential mechanical failures and mitigate safety hazards before they happen.

With such technical momentum building, contractual and cultural processes must change too, enabling the technology to provide digital continuity throughout the life cycle of the plant. This digital continuity from conception, through detailed design and, via capital project handover, to the operate phase, helps to ensure that employee behaviours and corporate culture are in step with the new way of operating. It also retains, in an accessible manner, all of the information and decisions taken.

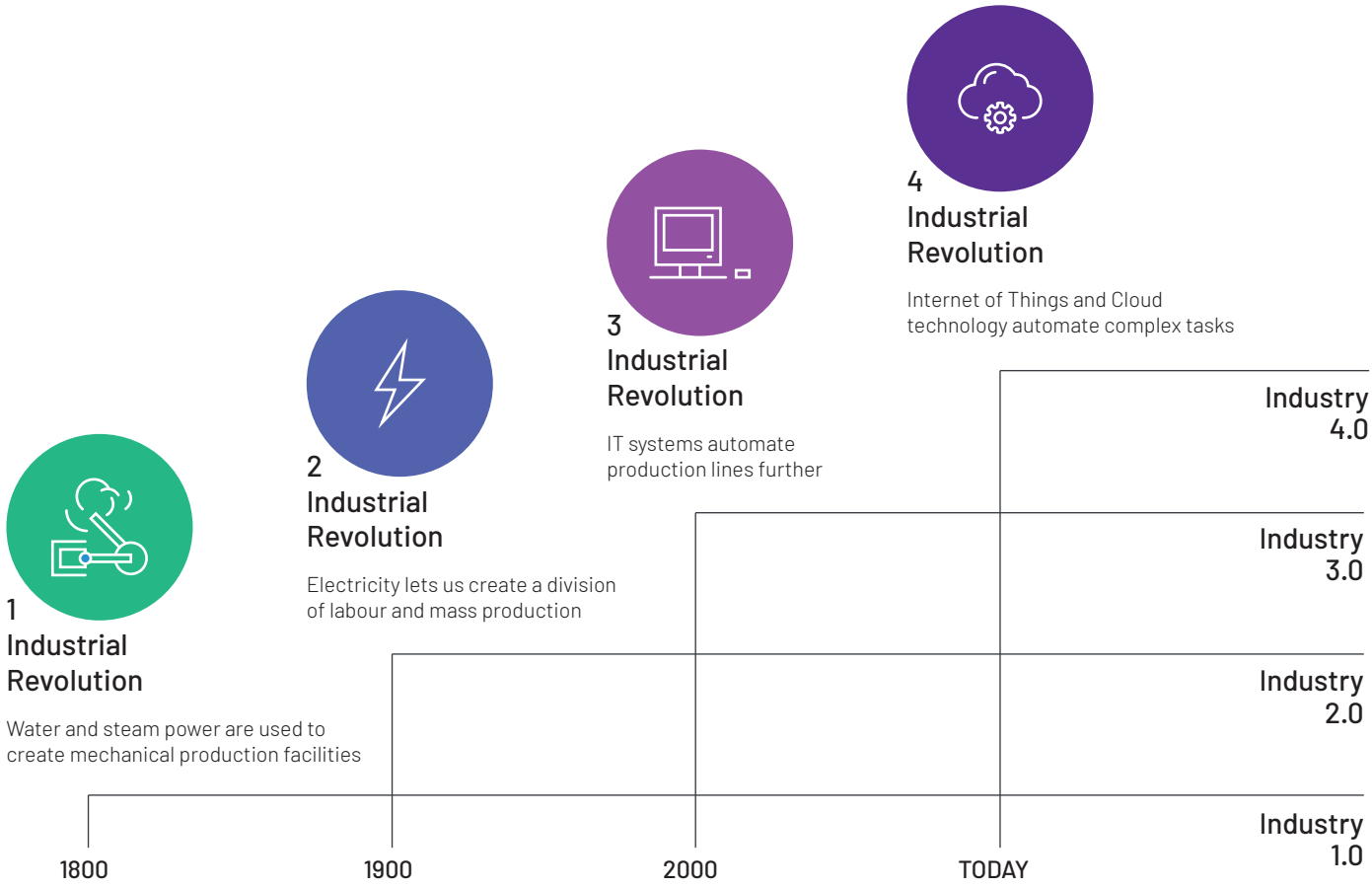
Companies that succeed in realising the potential savings from effective intelligent master data management, whether as part of a pan-industry initiative, or on a corporate basis, will reap the transformative benefits of digital twin technology.

How intelligent engineering master data management can transform operational decision making

The digital revolution, particularly since the digitisation of operations technology in the late 90s, has changed industry in unimaginable ways. The fourth industrial wave is already happening in discrete manufacturing and architecture, engineering and construction (AEC), yet the plant and process sector has been slower to embrace the potential of these innovations; from high performance Cloud computing to the Internet of Things (IoT). To combat increasing global competition and turbulent market conditions, the Oil & Gas, Chemicals, Power, Pulp and Paper, and Pharmaceutical industries are adopting digital technologies to increase the efficiency, performance and safety of their operations.

Innovation brings its own challenges. In industry 4.0, a by-product of digitalisation is that companies now must collect, store and assess increasing amounts of information generated by new tools, platforms and sensors, as the chart below shows. With an ever expanding 'data reservoir' beneath them, businesses need ways to extrapolate and act rationally upon information, without being confused by its sheer volume.

Industrial Revolution Timeline



In this context, intelligent data management – systems or tools that automatically sift information flows to identify relevant themes or link related pieces of information – is becoming central to success. When those intelligent systems are combined with a unitary platform that enables a company to retain and access data over the life cycle of a complex capital project, they can transform a company's competitive edge. It is just this kind of long-term, intelligent master data management that the digital twin needs if it is to be effective.

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Translating data into value

Today, the availability of data and the cost of processing and analysing it have ceased to be barriers, as the chart below shows. However, each organisation's ability to integrate this data with broader corporate experience and fleet knowledge, and to build trust in analytics and recommendations are daily challenges.

If we cannot ensure that the workforce and cultural operating practices keep step with the technological systems and the innovations they can bring, digital insights will not be effectively incorporated into operating practices.

Many organisations have already learned the value that immersive digital insights can bring to operational processes. With the recent rise of intelligent information management systems, others are now able to quickly follow in their wake. Contrary to legacy information management and engineering data warehouse systems, intelligent systems must now work flexibly with the organisation's current systems. Intelligent integrated engineering systems and design tools need to automatically aggregate and process engineering information from master registers, schematics, model and laser scans, together with construction planning data to provide context to engineering and maintenance processes. This is much more than simply a reference for engineering information.

Such systems are emerging features in leading engineering, procurement and contracting projects. They are providing considerable competitive advantages in terms of increased efficiency and time- and cost-savings. Indeed, for the process plant, the intelligent management of engineering data sits at the heart of every digitalisation project and is the foundation of a successful digital twin strategy.

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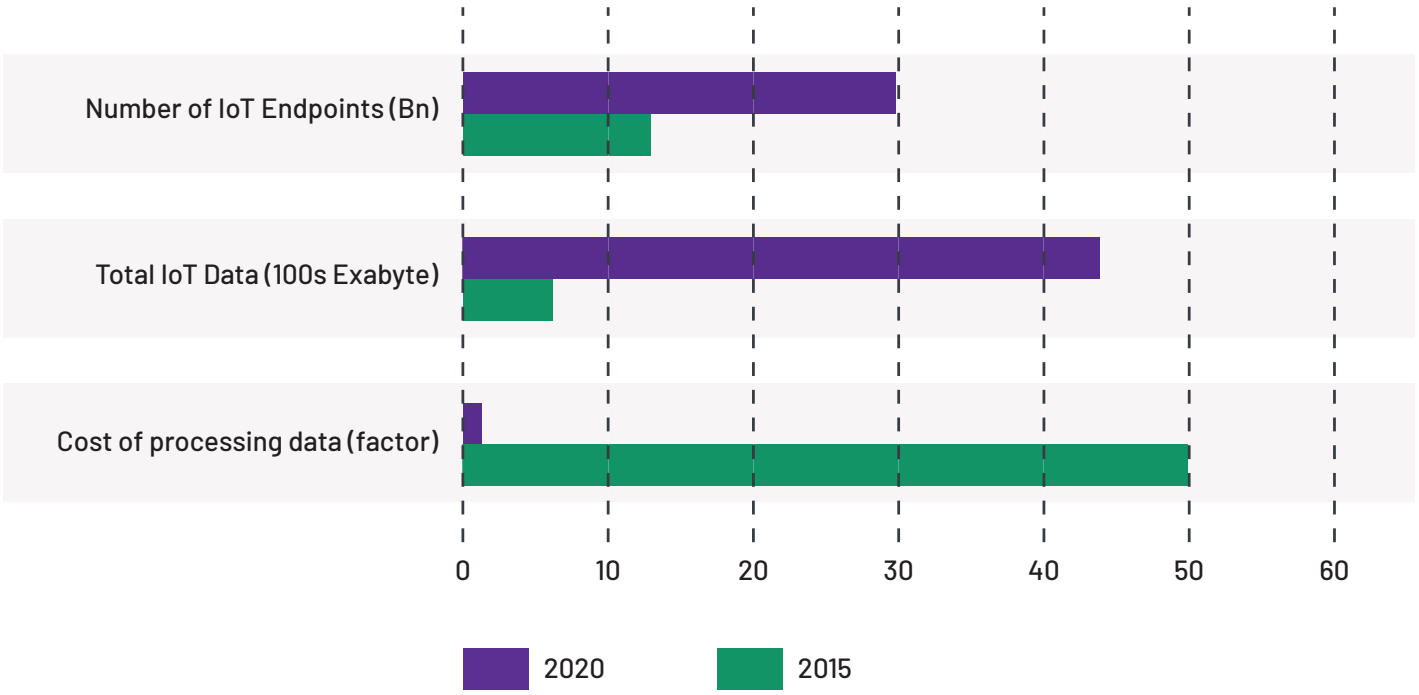
The Impact of IoT and Cloud Computing (IDC - 2016)



A reliable digital twin can achieve all this and more

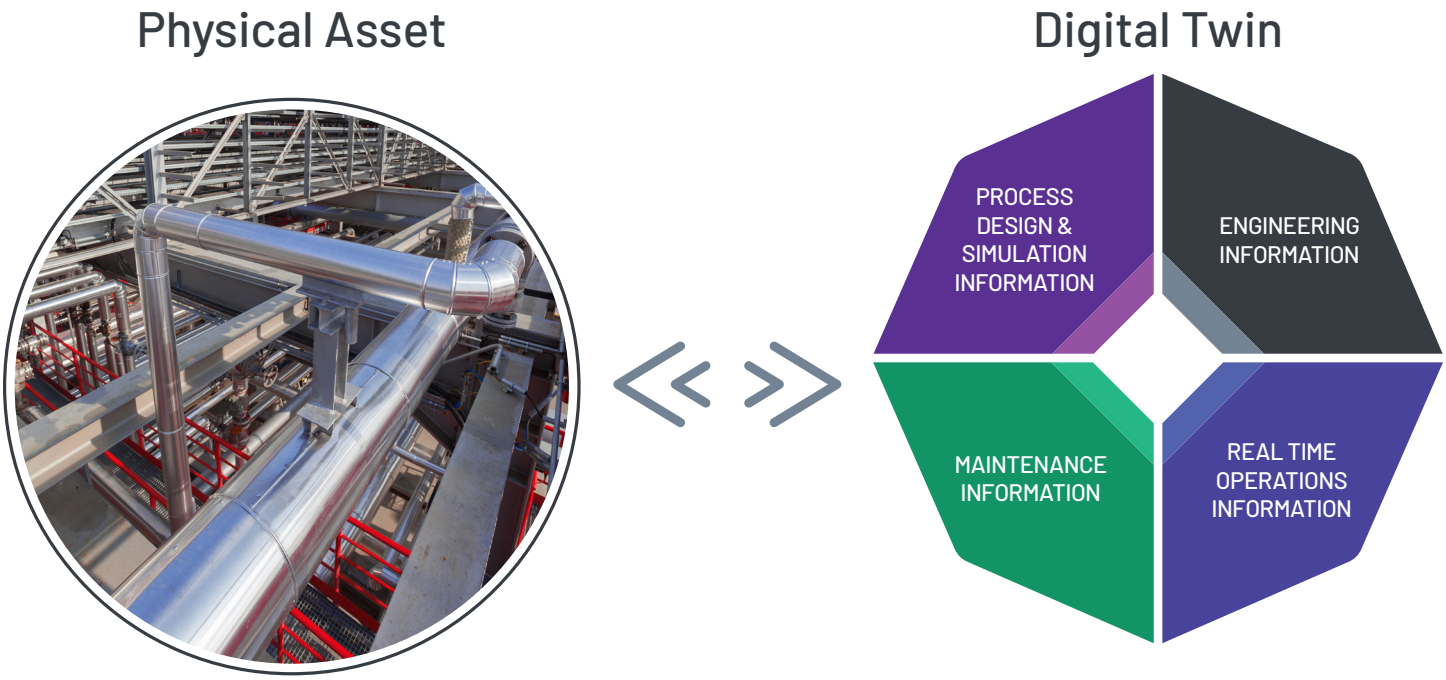
A 'digital twin' is a representation of the physical object in terms of data and information. It faithfully reports the current state and behaviour using IoT data and sensor information from the live asset. With unprecedented levels of detail and analytical capability, the twin can also become a behavioural tool that can predict future events. In other words, the digital twin can predict potential failures of its physical counterpart, well before they happen, and can suggest ways to prevent those failures.

But there is a potential flaw. The digital twin can only be as good as the detailed engineering master data that it is built on, combined with the real-time data it gathers. It also requires detailed, accurate contextual information and real-life understanding of systems, areas, units and rooms in which the digital twin exists. Only then can the twin represent the true 'as-operated' state that an engineering team can trust.

This means that each twin system requires a strong foundation in engineering master data, often referred to as the digital asset. This spans plant design, through construction and commissioning history and maintenance history.

This, in turn, leads to another challenge: the need for digital continuity throughout the life cycle of the asset. But what does digital continuity mean in the context of a digital twin, and how best can it be achieved?

> Digitalisation of plant operations to continually improve safety, reliability and profitability becomes possible if the underlying plant design information describing the structure of the physical plant is fully digitalised and part of the complete digital twin of the asset.



Ensuring digital continuity

Every major operating asset sets out to improve its safety, reliability and profitability on an ongoing basis. The process industries have long recognised the importance of digital data and systems in improving productivity, ensuring safe operations and reducing overall project time.

A significant proportion of the capital budget of any given project today is expended in creating the very digital foundation that the industry 4.0 transformation requires. Yet many process industries still lag behind other sectors. It is not uncommon to find that the complete digital representation of a complex plant is poorly specified at handover, platforms or systems are non-collaborative and the digital handover process has been executed with a short-term mindset and no detailed thought regarding how data can be usefully accessed and maintained in the future. Such a low-quality digital asset represents a poor return on the massive investment of the capital project.

The efficiency gains of an intelligent digital twin, being constantly fed with digital asset information, are already being exploited by nimble start-up sectors and progressive operators.

In plant-based businesses, the challenge of digital continuity does not stop at the information transfer during the handover process. It takes place throughout the asset life cycle, as the graphic below shows.

This means that a true digital twin requires a set of foundation services that enable effective insights throughout the operational span of a project.

To establish an effective digital twin strategy, each asset requires a different set of asset data services, together with engineering master data, effective visualisation tools, and collaboration and workflow procedures. The diagram below gives a sense of the services and foundations that need to be present in a digital twin in diverse assets, to show the depth and breadth of the information streams required.

An effective digital twin synthesises and applies those data streams in a deep and broad way, embedding technology seamlessly into core business processes, and ensuring that data is readily consumable and integrated with low-cost, high-performance, computer-based analysis.

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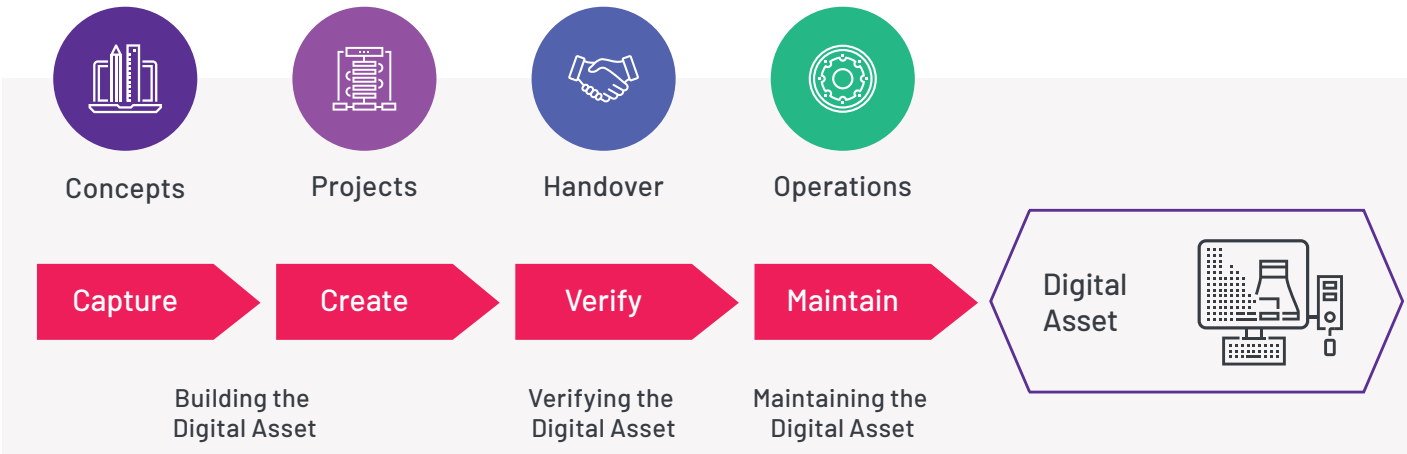
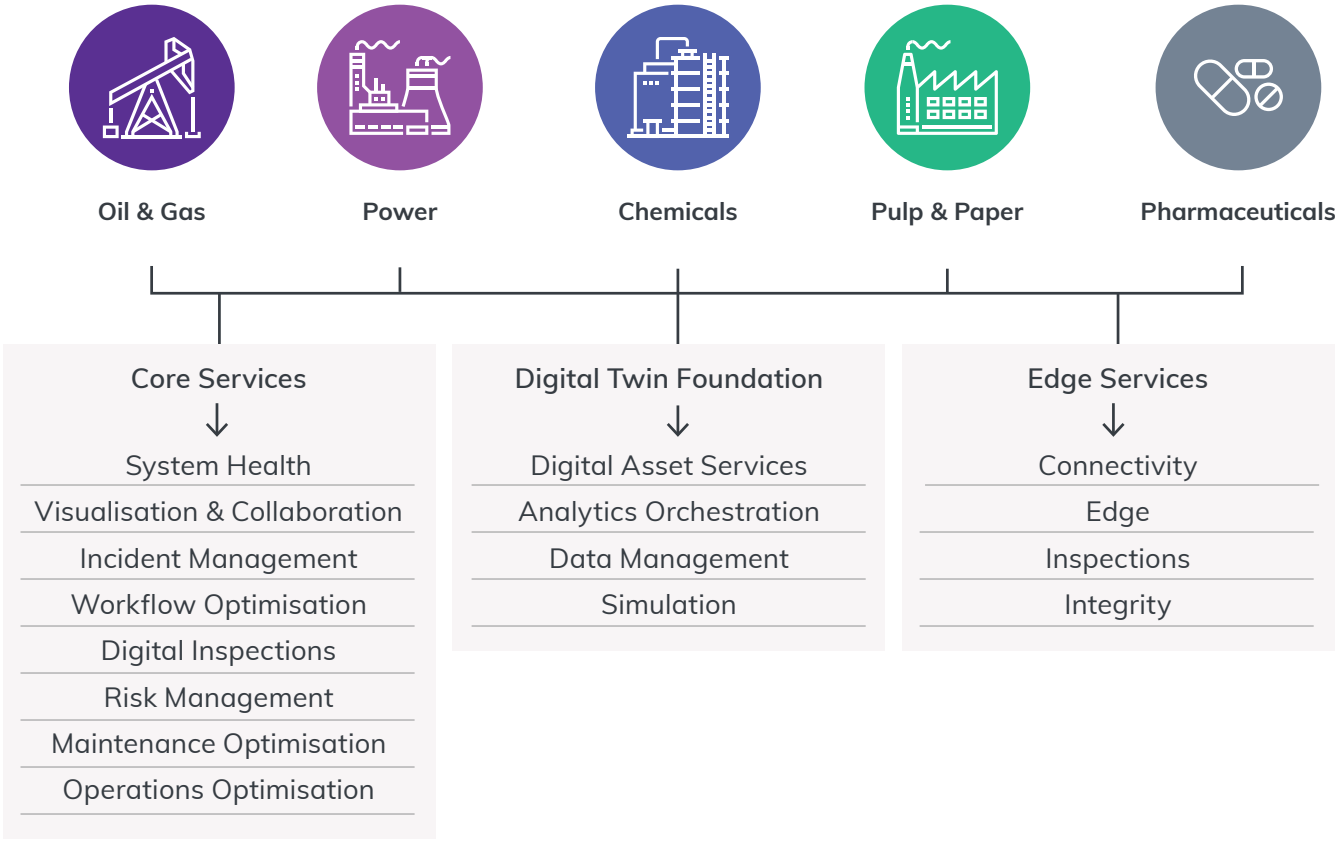
Digital Continuity



Click the links on the red bar above to learn more

The basis of the digital twin



Let us take the example of maintenance optimisation: this combines predictive analytics from Asset Performance Management (APM), maintenance scheduling from Enterprise Asset Management (EAM), situational awareness from 3D visualisation and detailed engineering data.

This information is synthesised into a work pack, as the graphic below shows. Now the maintenance manager can see at a glance the performance stress points and the detailed design workings, and can use that information to predict possible challenges or opportunities for the plant.

Changing behaviours in step with technology

The power of the digital twin is easy to demonstrate on a screen. To achieve meaningful operational efficiency gains, improve safety performance and reduce costs requires a different way of thinking about, and interacting with, the data and the asset itself. It also requires a change in mind-set in owner operators, who in the past saw digitalisation investments as discretionary spend.

For the process plant, the rise of the digital twin demands that companies put in place a robust digitalisation strategy requiring assured, reliable digital engineering master data, maintained and managed throughout the asset life cycle. This is as much a cultural and human process challenge as it is a technological one. But it is a challenge that the industry's leaders are beginning to take up with increasing urgency.

The opportunity for digital continuity

The plant industry is starting to embrace the possibilities of the digital twin and it is learning and adapting its knowledge at a faster rate, assimilating learning from sister industries' experiences.

Capital Handover

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Safe operation by reliable access to information of known quality & integrity

Integrated decision, asset performance, maintenance & operations

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At AVEVA, we believe that, as industry embraces digital continuity, companies will re-evaluate and reform relationships throughout the supply chain. Supported by research completed by Gartner, this could include:

- Moving away from a project-centric view of data ownership, with minimal contractual handover of data at stages of the asset design, build and operate life cycle.
- Faster digital adoption and a move towards a data-centric way of working, using intelligent engineering data management, in a similar transfer to that achieved by AEC and BIM.
- Increased corporate and industry sharing of lessons learned to improve digital twin efficiency and operating intelligence.
- A gradual acceptance that boundaries created by artificial 'application favouritism' must make way for a data-led approach. For example, a logical next step could be to improve the continuity of digital data into the operate phase based on a BIM-style handover information template.

Digital continuity is the foundation of an effective digital twin. As leaders in digital continuity continue to uncover new value drivers for data usage across the lifecycle, digital twins are no longer a hot trend on the cusp of innovation, but a foundational element to drive even more advanced operational excellence programs like predictive maintenance, IIoT, and artificial intelligence.