A Wood article:

The rise of digital twins: Delivering on their promise

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In a galaxy far, far away

A long time ago in a galaxy far, far away the goal of a digital twin was clear. From a stolen digital representation, Princess Leia and her rebel commanders could pinpoint the imperial Death Star's fatal flaw – and send in their X-Wing Fighters and Jedi to destroy it.

In the real world

Back in the real world, digital twins are less about destroying intergalactic space stations, and more about optimising the life and operations of hugely complex and expensive assets in a wide variety of industrial sectors. Less cinematic certainly, but infinitely more attractive.

The premise is the same: a digital replica that provides complete visualisation of an asset, relying on data and technology to deliver previously unavailable and remote insight into almost every aspect of its design, operation and performance.

The insight of what-are, what-if and what-will scenarios enables 21st Century digital twins to improve the planning and construction process to make it as time- and resource-efficient as possible. Feeding the twin's information into advanced analytics and data models, gives operators the ability to undertake predictive maintenance, minimise downtime, and prevent potential issues becoming actual problems.

Elsewhere

Digital twins can improve environmental performance and productivity of individual buildings and plants once in operation. They can help asset operators manage end-of-life and decommissioning effectively and efficiently.
And they can help upskill filed workers without sending them to hazardous or remote locations, more so pertinent during a time of pandemic, with travel restrictions and limited on ground expertise.

What's more, the digital twin capacity can be retrofitted to a broad range of existing assets to improve performance and productivity – from immersive technology in the design phase, to informing the supply chain in the operations phase.

The concept of a digital twin therefore is a mature one, and its ability to deliver real value is already proven in the manufacturing sector, for example. So why are digital twins yet to deliver on their promise in key sectors like energy or the built environment?

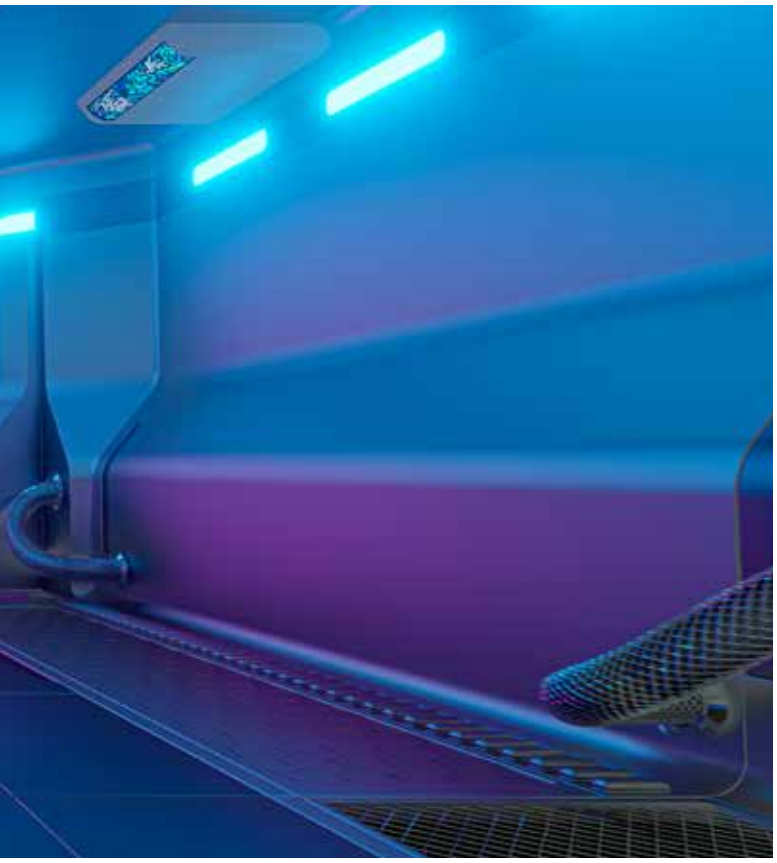
As built vs. as maintained

In part digital twins have succeeded in manufacturing because building them for repeatable, modular asset designs typical in the sector is a more straightforward and cost-efficient process than building them for the unique, location-specific structures found in sectors like energy.

Equally, although design, build and operations specialists have shown themselves to be proficient in creating 3D images of even the most complex, multi-billion-dollar assets, that is usually where the application of digitization has stopped.

Oil rigs and wind turbines to petrochemical plants and pharmaceutical environments, even cities, have all been digitally rendered, and that process has driven significant efficiencies into the planning and construction processes. Crucially, digital twins are almost always 'as built'. Once the asset is handed over to operations, there is very little information on how to run and maintain it at an optimal level, and even less on how they are running in real time. The efficiency and therefore the output of a wind turbine will differ from as-built and change with time due to a variety of factors such as, physical degradation of the turbine, sub-optimal performance due to maintenance, different wind conditions etc. It is essential for the digital twin to reflect the actual condition and performance of each turbine so the performance of the entire windfarm can be optimised.

In other words, the 'as maintained' picture is still largely absent. Once fatigue and degradation take their inevitable toll, digital twins no longer match their physical counterparts. What's the right amount of chemical injection needed to maintain planned productivity levels? What is causing energy consumption and carbon emissions to spike? Where is maintenance budget most efficiently deployed? What is the right investment to make as the asset approaches end of life? Digital twins can provide all these answers – but all too often haven't done so.



That's not to say that work has not been done in this area. There are pockets of brilliance around the world, often buried in different projects, that are looking at bringing more effective data analysis into the mix, so that operators can use and make sense of real-time process information. There has also been work on developing more predictive models, using data coming in from the asset through smart sensors. But to date this has been more akin to digital dabbling than a fully developed digital strategy, and it hasn't really proven to be a scalable reference point on which to build consistent value.

One part of the solution therefore is to extend 'digital twin' thinking out from the design-and-build stage and into operations and maintenance. The next challenge then is to decide who is best placed to deliver the capability needed to create successful solutions for the real world.

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Orchestrated technologies

They may lack the sci-fi gloss of the Star Wars special effects department, but at a technical level real-world digital twins can be significantly more sophisticated. The 3D visualisation, often developed with drone, cameras and laser scanners, is more like a very granular and advanced version of Google Maps than a holographic representation but it can be easily manipulated to produce extraordinary insight.

For example, as a user 'walks' through a digital asset, layers of information can be added to provide real-time or near-real time status updates. Potential issues can be highlighted as red, amber or green and classified as process or asset problems. Visual queries allow users to view specific details – floor plans, maintenance schedules, previous works, equipment serial numbers, costs, schedules, outputs – and make decisions without ever setting foot on the asset.

IoT technology (sensors, connectivity, analytics and cyber-security) create an automatic feedback loop so the asset itself can provide updates on its own status to keep it in-sync with its digital twin. Multiple systems, new and old, are orchestrated, managed, and brought together to create value.

There isn't a single provider that can deliver all of that. So, in addition to orchestrating individual technologies, operators must orchestrate multi-faceted teams of vendors and experts.

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A new hope

This is particularly important where complex assets are concerned. In the five or more years between investment decisions and asset go-live, technology will advance significantly. The SI must be able to help asset operators and building owners navigate that time lag, and so a 'future-ready now' mindset is a key success factor.

Finally, there is the all-important CAPEX vs OPEX question. Renewed capital constraints have placed the issue front and centre, but a successful digital twin strategy is based more on a TOTEX – total expenditure – approach. Digital twins can reduce operational planned and unplanned expenditure by a significant amount, with direct consequences for profitability. But getting the necessary tech specs to deliver on those requirements will almost certainly re-balance the CAPEX and OPEX calculation. Again, this is something that the right SI will be able to support.

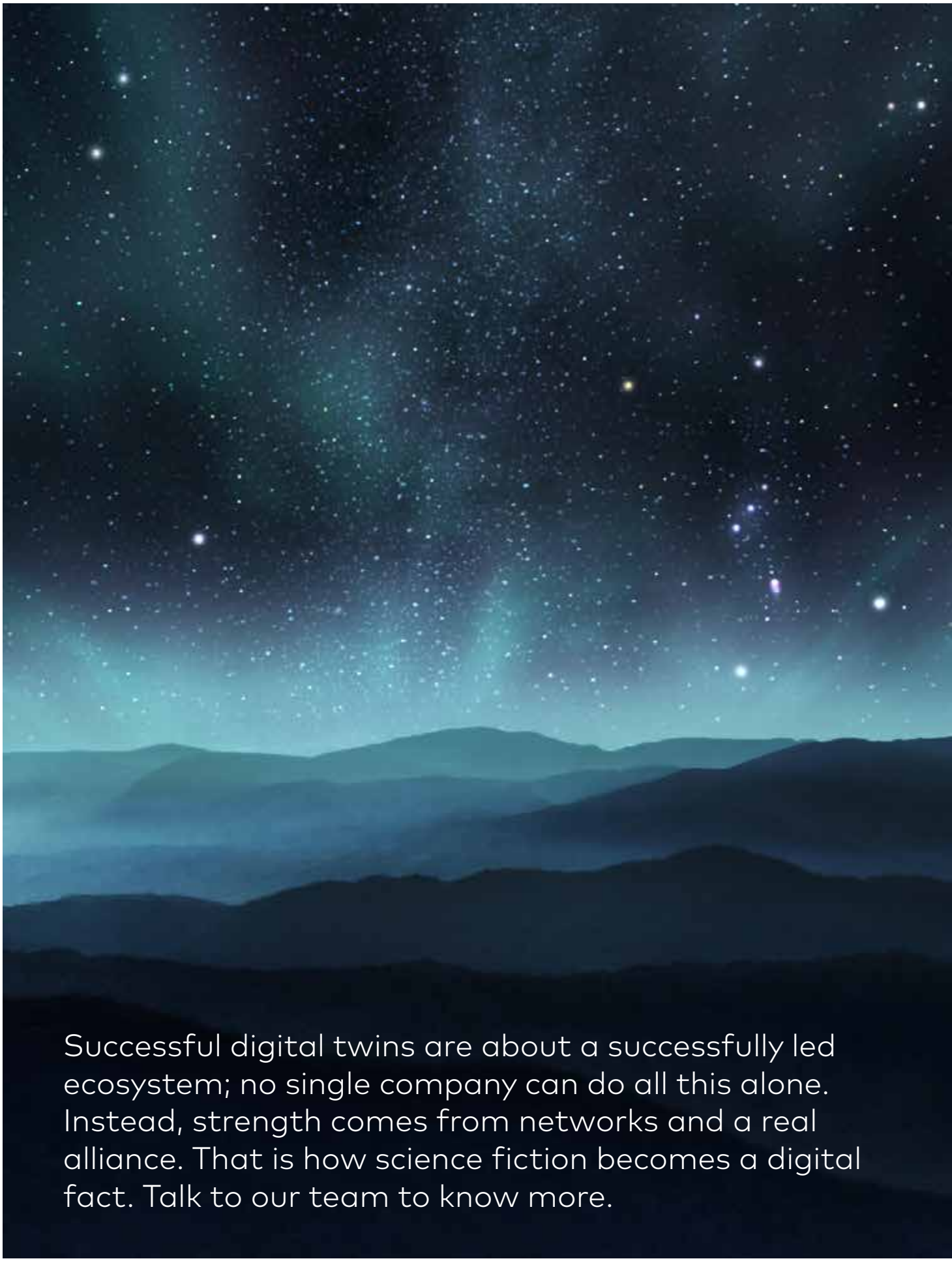
The problem with digital twins to date has not been one of technology. It has been one of approach: of technology first rather than industry first, of traditional financing, and over-dependence on single suppliers. Above all, successful digital twins are about a successfully led ecosystem; no single company can do all this alone. Instead, strength comes from networks and a real alliance. That is how science fiction becomes a digital fact.

Our capability and expertise

The capability is there – so is the expertise. The answer lies in bringing them together effectively. That means adopting more of an ecosystem approach to digital twins and working with partners who can integrate not just the various systems, but the underlying design, build and operate expertise that informs development and maximises value.

As a systems integrator (SI), Wood has put in the hard yards with the hard hats, which means that the team understands the physical reality as much as its digital adjunct. This kind of 'industry-first' expertise is essential to bringing together all the components and skills needed in both the energy sector and the built environment.

The industry-first approach can make fully informed contributions to the design and construction of the proposed asset, or even take on the build in its entirety. Equally, it can determine which assets would benefit from retrofitting and the technology that would be required so that investment can be directed where it delivers most value. Crucially, operators like Wood can contextualise and mediate some of the bolder claims made by technology providers as to their ability to deliver.


Successful digital twins are about a successfully led ecosystem; no single company can do all this alone. Instead, strength comes from networks and a real alliance. That is how science fiction becomes a digital fact. Talk to our team to know more.

Contact us:

If you would like to discuss any of the points raised in this paper in more detail, then please get in touch.

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Wood. Powered by possible

The need for change has never been greater. In our industries, in the way we treat our planet, and in how we live.

To challenge the status quo we must be brave – it's having the courage to forge new answers. We're more than 45,000 inquisitive minds, on a quest to unlock solutions to the world's most critical challenges, across all of energy and the built environment.

United by our mission to create a sustainable future as the world evolves to a cleaner planet. Our bold spirit drives us to lead the charge, our actions transform challenges into solutions, and our curiosity keeps us pushing, innovating, making the impossible... possible.

Because we understand the time for talk is over. Because the world needs new answers to old challenges. Because at Wood, we are future ready, now.

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