WHITE PAPER

Meet data-centric engineering: Engineering better relationships and more sustainable capital projects

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Executive summary:

Capital project delays are costly – and common – but they don't have to be. In a connected industrial economy, data is a powerful currency that unlocks new possibilities. When it's coupled with digital twin technology, EPCs and owner-operators gain access to the right insights at the right time, for better design and execution processes and more sustainable capital projects.

Turning project execution and handover into a strategic partnership

Many EPCs and owner-operators struggle to manage traditional project headaches while overcoming newer market challenges like reducing carbon intensity and emissions. It's no wonder that, according to **Accenture**, 95% of major projects with a budget over $1 billion experience delays or cost overruns. Only 25% of these projects are completed within 10% of the original deadlines, and just 31% come within 10% of the cost baselines. The cause? Organizations often cite missing or incomplete engineering data, a lack of project transparency, and poor communication amongst teams.

Common project hurdles:

- Inaccurate or missing engineering information leads to rework on **30%** of design and construction activity.
- Cross-functional collaboration between stakeholders is cumbersome, causing delays and increasing costs.
- Supply chain disruptions and the need for carbon-efficient and resilient supply chains.
- Sustainability pressures require transparency to inform decision-making.
- Labor shortages and remote work require efficient, autonomous, and connected operations.
- Fluctuating commodity prices demand greater project agility.

While alignment between EPCs and owner-operators is critical to efficient project completion, such alignment remains a widespread challenge in the industry. A data-centric approach to engineering and handover can improve this relationship and its end result–the project itself.

With digital engineering and project execution tools, both parties gain a centralized, collaborative platform in which to work together throughout the project life cycle.

Increasingly EPCs are being asked to progressively hand over a digital twin with trustworthy engineering data as a part of its project deliverables. Both EPC's and Owner-operators benefit, as teams can collaborate much more effectively on deliverables, leading to a more efficient project and a timely handover. Owner-operators also gain continuously updated engineering data that helps operations and maintenance teams populate their systems and plan for plant startup to get to nameplate as quickly as possible.

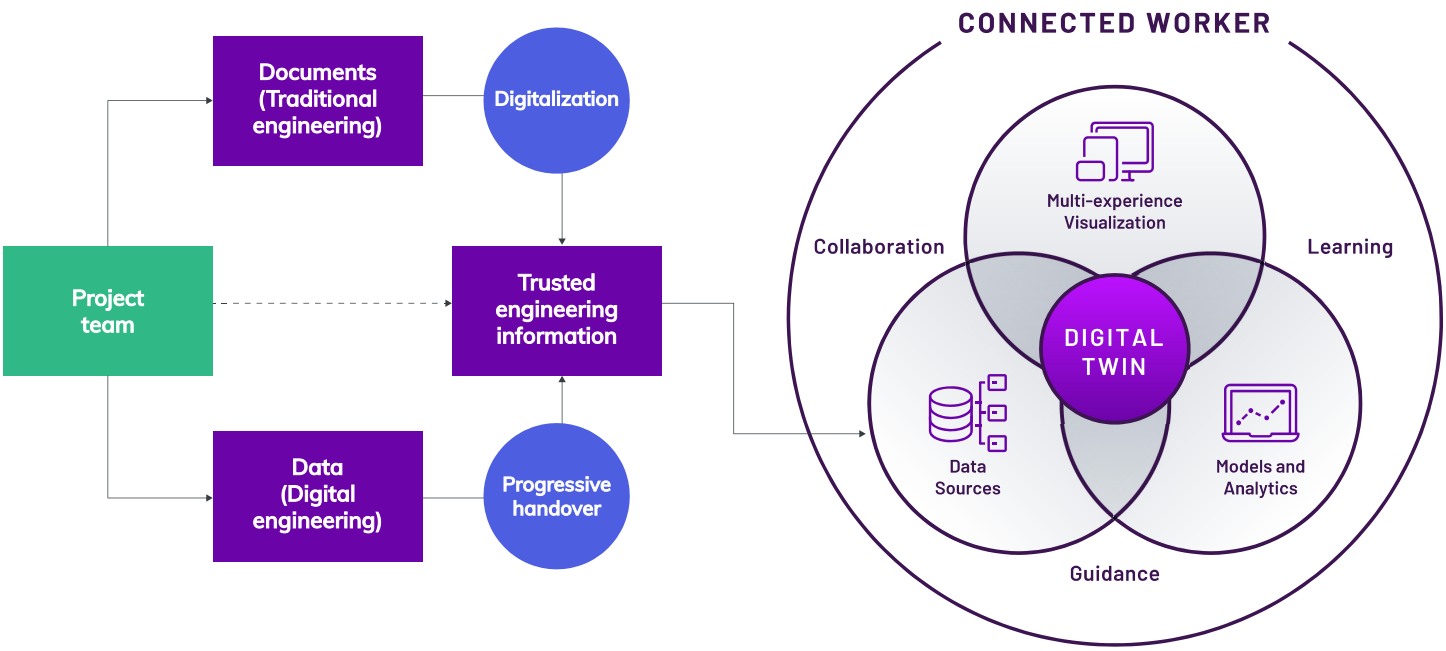
With a digital twin as a deliverable, EPCs and owner-operators can continue to work together after handover – a partnership that ensures the operator has up-to-date, validated engineering information and the EPC has a source of recurring revenue.

$10 million

Annual losses one global owner-operator in the oil and gas industry experienced due to inaccurate asset data.

After conducting a digital maturity assessment, the company found that employees spent 210,000 man-hours per year verifying, correcting, and compiling data to extract insights.

Digital twin success hinges on trusted engineering information



Digital twins ensure collaboration during the engineering life cycle – and after

A digital twin is a virtual representation that serves as the real-time digital counterpart of a physical object or process. Whether it's used in the design phase, when a digital twin might represent a plan for an asset, or after construction, when a digital twin maps to an operating asset, it ensures all stakeholders have access to the same continuously updated information. A digital twin can thus reduce errors and improve collaboration, project transparency, and engineering efficiency – which leads to enhanced asset performance and operational excellence.

Fed by real-time data, digital twins can improve every stage of the engineering life cycle, ranging from improved design fidelity and decision-making to optimized construction, maintenance, and cost management.

45% Overall project cost reduction when digital technologies are applied both comprehensively and efficiently.[1]

1. Fuchs, S., Nowicke, J., & Strube, G. (2017, October 10). Navigating the digital future: The Disruption of Capital Projects. McKinsey & Company.

Benefits of digital twins throughout the engineering life cycle

Conceptual design

Optimize complex design processes by simulating layouts, configurations, operating conditions, and risk scenarios. Ensure efficient, net-zero design using referenceable design data.

Front-end engineering and design (FEED):

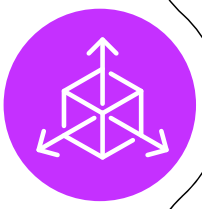
Create a living digital repository for engineering and design data and deliverables to identify potential clashes, optimize resources and construction, and facilitate continual handover and remote collaboration.

Detailed design

Give all stakeholders visibility into the design process, automate progress monitoring, set deliverable expectations, and ensure a straightforward handover, all of which improves remote communication and reduces onsite activity.

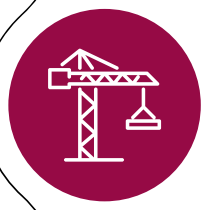
Procurement

Reduce lead time by integrating procurement planning into the design process. Cross-reference design documentation, such as work orders and 3D models, with procurement and commissioning to improve workflows and increase transparency.



Construction

Link design, procurement, and construction processes to enable parallel activities. Create virtual replicas of construction sites to identify potential issues, optimize resource allocation, reduce rework, and improve construction timelines.

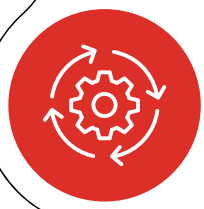


Commissioning

Use digital documentation and deliverables to speed up commissioning and ensure a smooth handover to operations.

Operations

Leverage engineering and design data in operations to increase safety and agility while reducing operational and travel costs, particularly for assets in remote or inaccessible locations.



The case for collaboration

The benefits of digital twins span the entire project life cycle. For EPCs, this entails sharing engineering data long after handover, which some EPCs are reluctant to do – but the potential value-add is high. In addition to engineering efficiency, digital twins allow EPCs to understand the carbon impact of every engineering process, so they can deliver more sustainable asset designs.

Real-time engineering data allows owner-operators to own and maintain a digital twin of their assets, so they can quickly reach production, find optimal operations, and achieve production targets. After handover, EPCs can open up new revenue streams by maintaining engineering data and monetizing operational insights.

EPCs	Owner-operators
Improve engineering efficiency	Speed time to production to close the gap between investment and revenue
Understand the carbon impact of design decisions	Find optimal operating conditions
Deliver projects on schedule	Make offshore maintenance and operations decisions onshore
Open up new revenue streams after handover	Understand the carbon impact of engineering processes

Reduce costs with digital transformation

In addition to safety and efficiency gains, digitally transforming capital projects can **reduce** build costs by 5-10% and operational costs by 10-20%.[2]

Data sharing and digital twins: Where to begin?

- Look for vendor-agnostic solutions that can enable seamless integration and collaboration between providers and partners.
- Take an iterative approach. Deploy where the digital twin is most valuable and then scale to other areas of the business.
- Collect available asset data from across the life cycle and modify those datasets as conditions change. A great digital twin is underpinned by great contextualized data.

2. O'Connor, M., Girgis, H., & Neote, G. (2019, April 8). Digital Capital Projects. Deloitte United Kingdom.

Proof of concept: Industrial organizations using digital twins

Case study: bp

With a budget of over $6 billion in development costs, bp's Azeri Central East (ACE) oil and gas platform in Azerbaijan is a critical project. The company chose KBR as the EPC for the design, procurement, construction, and commissioning of the ACE project and implemented AVEVA digital twin tools and technologies that continued through the operational phase.

In just five months, AVEVA and KBR created a digital twin that aggregates multiple information sets into a single connected environment.

By integrating laser scanning to create a 3D model that correlates with as-built engineering data, users now have cloud-based access to accurate information from their web browsers – without the need for data management. With this centralized facility information, ACE team members visualized and analyzed asset information to identify deviations between what was built and what was designed and collaborated remotely to implement maintenance operations and improved safety before the plant was even operational.

A portion of the $6b ACE project

Learn more about bp's remote operations vision with digital twin technology.

Watch the video

Case study: Wood

Many owner-operators require EPCs to build and hand over a digital twin with the physical asset. Unfortunately, after the handover, many digital twins aren't adopted by owner-operators or users fail to maximize their potential. This is often due to out-of-date or incomplete information, which requires companies to bridge the gap between the project and the operating teams. Wood, a global EPC leader in consulting and engineering for energy and materials markets, ensures digital twins deliver lasting value from capital projects to operations.

Wood uses AVEVA's technology portfolio to develop digital twin strategies for greenfield and brownfield capital projects. Wood creates a comprehensive life cycle representation of assets during the building phase. Wood's digital twin ecosystem integrates multiple customer systems of record from its customers, including real-time and contextualized data, asset information management, predictive analytics, and performance benchmarks to allow clients to track improvements. Thanks to Wood's life cycle view of digital twins, the company enables its clients to maximize return on investment while improving sustainability and performance.

Users can access digital twins anytime, anywhere

Learn how Wood is optimizing digital twins across the asset life cycle

Watch the presentation

Case study: Evonik

Evonik, a global specialty chemicals company, needed a data-driven asset life cycle management system for manufacturing chemical products. However, critical information was often locked in manual servers, documents, files, drawings, or pieces of paper, and needed to be manually linked to corresponding parts. Using AVEVA solutions, Evonik implemented a computer-aided engineering (CAE) system to bring in data from various sources and created a harmonized model that worked in conjunction with ERP, plant breakdown structure, document management, and IIoT system.

Together, these data sources and AVEVA tools make up Evonik's OneCAE, an engineering master data solution. This data-driven approach secures asset information for the full lifespan of a plant, which ensures higher engineering efficiency and supports the asset in operation.

A peek into Evonik's chemicals manufacturing infrastructure

Learn about Evonik's data-driven life cycle management

Watch the presentation

Meet data-centric engineering

Industrial operations face numerous project execution and asset management challenges.

Cross-functional collaboration is slow and costly, making it difficult to overcome unforeseen challenges. Overall, this causes delays, spirals costs, and means many projects fail to deliver on time and on budget. Many of these challenges can be mitigated by taking a data-centric approach to engineering. Through increased transparency and data sharing, EPCs and owner-operators can enable effective real-time collaboration. This new era of handover requires a paradigm shift for those EPCs reluctant to share engineering data.

Organizations are establishing digital twin initiatives to meet requirements for efficiency, agility, safety, and sustainability. But digital twins alone are not enough – true collaboration requires data sharing post-handover, and that sharing can unlock unprecedented value.

Are you ready to improve your project engineering and execution and build more efficient, agile, collaborative relationships?

About the author

Greg Pada is a Professional Engineer and Project Management Professional with 30+ years of leadership, innovation, project, and operations experience. He has worked as a business and project leader driving all scales of projects from multi-billion-dollar thermal heavy oil projects to smaller sustaining capital brownfield projects. Joining AVEVA in 2018, after running his own Digital Transformation consulting business, Greg now works as the leader of AVEVA's Engineering Business, driving the product strategy and delivery of Engineering solutions for AVEVA.

Click here to speak with our team of digital twin experts.