



EPC Perspectives: Accelerating Digital Transformation

A Blueprint for Engineering Digitalization for the Process Industries

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Introduction

Despite preexisting stressors and the COVID-related downturn, EPC firms that were already under stress are investing heavily in digitalization initiatives. The intended results of such initiatives—streamlining technology, automating the flow of project data, creating digital twins—could help redefine an industry that is critical to the creation and operation of much of the world’s key infrastructure.

According to a June 2020 McKinsey & Company report, **“The Next Normal in Construction”**, two thirds of 400 EPC executives interviewed indicated that they believe COVID-19 will lead to an acceleration of their digitalization initiatives, and half have already raised investment in that regard. This could be good news as the article also says the industry could potentially double its profits by enacting structural reforms such as digitalization.¹

Dual Supply and Demand Shocks Impact Capital Spending Plans

The double shock of oversupply of oil from OPEC+, along with the fall in demand for transportation fuels as a result of COVID-19 has led to a sustained drop in oil prices. Add in the resulting increase in uncertainty in demand for both basic and specialty chemicals and you have an environment that might test the mettle of even the most well-positioned firms. In response, process plant owners have cut near-term capital spending between 20 percent and 50 percent and have indicated that these spending cuts will likely persist for several years.



EPC Firms Are Responding Cautiously and Strategically

After the recessions of 2008 and 2014, a large percentage of engineering, procurement and construction or EPC firms cut deep and fast to re-align costs to lower revenues. In response to the pandemic, many are taking a more strategic, even surgical approach to cost cutting. Executives leading EPC firms lived through those previous down periods and understand that deep cuts hurt a firm's ability to compete when capital projects rebounded. Hoping to avoid repeating the mistakes of the past, EPCs are attempting to preserve core competencies and personnel by cutting costs elsewhere, by reducing dividend and bonus payout amounts and hiring fewer contract workers. While layoffs may not entirely be avoidable, EPCs are striving to cut costs in a way that protects their ability to compete when things inevitably rebound.

More Challenges Ahead for the Short Term

The economic uncertainty brought about by COVID-19 is further stressing an already beleaguered industry. Pre-COVID, EPCs were already confronting a number of big challenges, including a perceived commoditization of their services, regular cost and schedule overruns, risky lump sum projects and average net margins of less than two percent. Resulting bankruptcies, mergers and frequent changes in management were common, with some firms even walking away from the troubled energy and chemicals sectors altogether. These issues have only continued to worsen throughout the pandemic, and there are no signs of them easing in the short term.

The Silver Lining: New Opportunities Emerge

Despite these issues, there may be a silver lining for engineers and contractors. With several high-profile defections from certain process segments and more EPCs coming out with statements that they'll be more selective in the projects they pursue, the balance of power with owners may be shifting, potentially creating an opportunity for more work at better terms in the future. Owners are also realizing that there is too much value currently being lost due to gaps in owner-EPC collaboration and are signaling that they might be open to closer collaboration and more equitable risk sharing with their contractors.

While EPCs have long looked at expanding their services into the areas of operations and maintenance with no real action, it seems that COVID has resulted in many firms now making meaningful investments in those two areas to diversify their revenue streams and increase customer intimacy. Digitalization of project data is viewed as a key enabler of these services that will be enhanced through digital handover and digital twins.

Two-thirds of EPC industry executives agree the pandemic has resulted in an acceleration of their digitalization initiatives.

McKinsey report, June 2020

The Path to Digitalization and Four Key Challenge Areas for EPCs

While overall, plant owners may be further along in their digital journey, EPCs have been ramping up their own digital initiatives in earnest. And, while some are still in the process of defining an overall digital direction and specific initiatives, there are many who have already moved into full execution mode. But what does digitalization look like for an EPC? Common digital initiatives can be divided into four key areas:



1. Data Management. Move from document-to data-centric workflows for creation, management and sharing of engineering data.

This means less reliance on documents to store and share information. It means breaking down common deliverables into the data contained in those documents and making it more generally available for review and use by others. In addition, managing changes and handing off to downstream participants is easier and faster.

Digital technologies can play a critical role in helping businesses manage and move massive amounts of data more efficiently. For instance, AspenTech supports a data-centric workflow, where engineering information is no longer trapped in documents alone, but can be more easily moved, shared, checked and updated through a more data-centric approach. Our concurrent engineering method and integrated economics for conceptual design, conceptual plant layout and front-end engineering and design (FEED) allow the teams to work

together, share work and stay in sync. This also helps to facilitate a digital handoff of that data to the detailed engineering teams and ultimately to the owner for use in operations and maintenance.

2. Technology Consolidation. Consolidate and simplify technology platforms, apps, and software to reduce complexity and eliminate redundancy.

Most engineering departments, even those at medium-sized EPCs, have well over 150 unique pieces of software and technology in use. From solution-level applications from large, tier one suppliers to homegrown applications and small niche tools that are used infrequently or by only a few engineers, it's often a "bird's nest" of technology with little hope of connecting the applications and automating the flow of data.

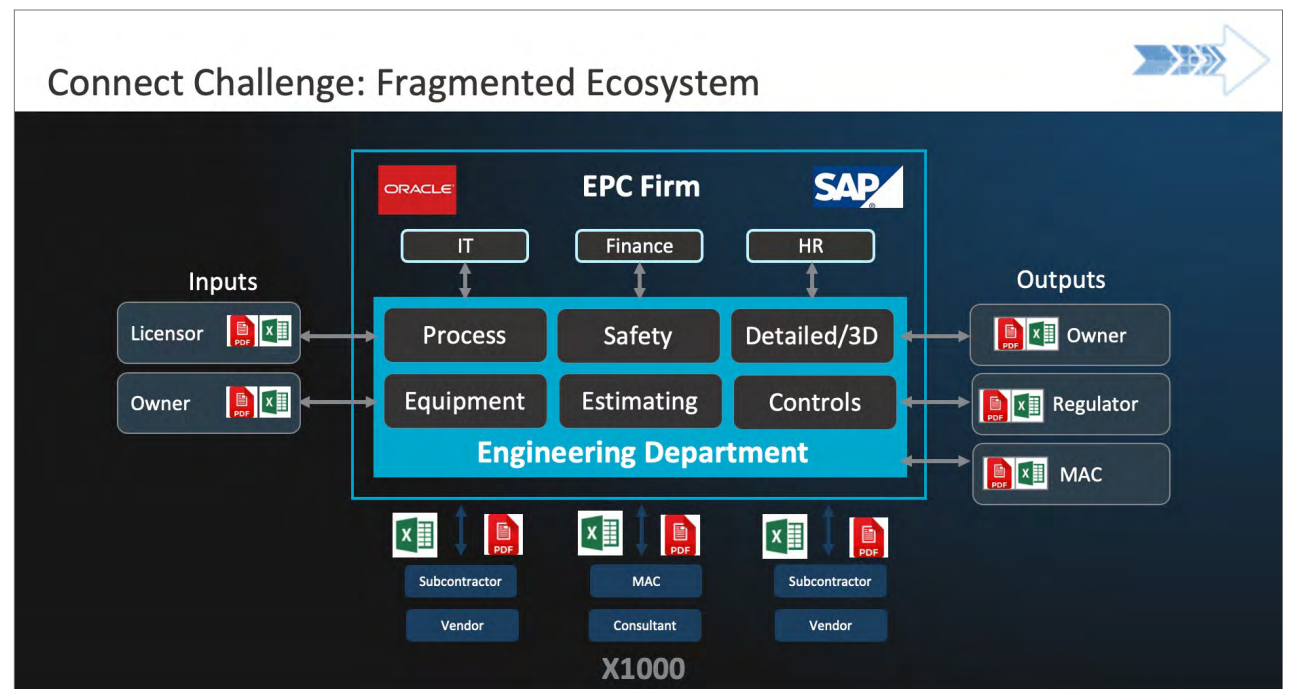




By standardizing and reducing the overall number of software providers, eliminating redundancies, and using stricter criteria for support of smaller, niche apps, CIOs and heads of engineering are simplifying the landscape of software they rely on.

AspenTech is one of the tier one software suppliers, with a broad portfolio of software that works together across multiple disciplines enabling a concurrent engineering workflow. Process engineers, safety engineers, equipment engineers and estimators can all work together in a common data environment to get their work done faster while developing a greater understanding of the engineering and economics of a project.

We currently have important strategic partnerships with Hexagon and Emerson for detailed design and engineering and plant automation expertise. Our innovative Aspen AIoT™ Hub software supports a more consolidated, streamlined ecosystem by enabling the moving of data from third party tools to AspenTech tools and vice versa.





3. Apps/Data Integration. Connect applications and data sources and automate the flow of information; re-use data across the EPC phases including digital handoff to customers.

Once the portfolio of software is rationalized and consolidated, the work of integrating remaining apps is getting underway. Connecting remaining apps with the intent of automating flow and reuse of data is the priority.

4. Expanding digital twin-based services. Leverage digital engineering and operating data to provide value adding services during operations.

The same engineering data used to design and build the plant can be used to enhance start-up, training and operations, while providing needed additional and diverse revenues for EPCs.

Some examples include the use of engineering tools to ensure models used on running the plant are accurate and up to date; dynamic models and operator training tools to ensure safe, profitable operations; and predictive maintenance services to maximize asset uptime.

The same data used to design and build the plant can be used to enhance start-up, training and operations, providing an additional revenue stream.

Digital-Twin-Based Technologies Provide New Service Lines for EPCs

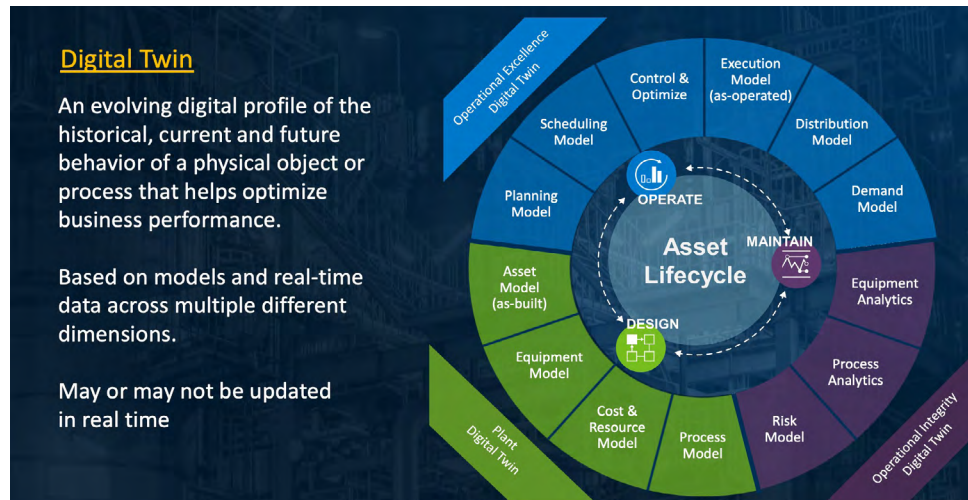
Expanding on the last point above, digitization of project data can be central to marketing and delivery of new digital twin-based services. Digital project information enables creation and delivery of true digital twins that can be used to support delivery of these new services. Digital twins of the physical asset and its operating conditions asset are a marriage of digital representation of the physical plant such as equipment data (size, capacity, material, model and serial number, etc.) and the information about the processes occurring within that physical equipment (temperature, flow, pressure, etc.).

Three Views of a Digital Twin

AspenTech describes a digital twin as an evolving digital profile of the historical, current, and future behavior of a physical object or process that helps optimize business performance. The digital twin can be viewed through three lenses:

- **Plant Digital Twin.**

The Plant Digital Twin provides equipment and process models of the plant, along with relevant costing data. It is typically used for plant design, debottlenecking, and revamping, as well as tuning operation of the asset during operations and maintenance.



It is deployed offline and online, calibrated to plant operating conditions through autonomous model tuning. Used for equipment monitoring, operator open-loop advice or autonomous optimization, the scope may range from a single piece of equipment to unit operations (such as catalytic cracking), plant-wide (such as energy and utility systems), or enterprise wide (such as risk models encompassing multiple plants and sites). They can be simulated dynamically to provide operator training.

- **Operational Excellence Digital Twin.**

This twin provides plant operations, from a business level to a control level, modeled and virtually viewed as planning, scheduling, control and utility models. Such digital twins inform business decisions such as crude selections and products trading; as well as technical decision making, like optimizing quality, throughput, energy use, emissions compliance and safety.

- **Operational Integrity Digital Twin.**

This variation provides guidance on both tactical and strategic decisions around prescriptive maintenance, offering real-time recommendations to maximize uptime, adjust production to deal with failing equipment, minimize environmental impacts, mitigate production losses, and prioritize safety. In addition, quality and risk assessments provide a future view of equipment and asset health, risk profiles and root causes of failures to improve uptime and operational integrity. The scope ranges from a single piece of equipment or process unit to plant-or enterprise-wide.

Digitalization will fundamentally change the way EPCs bid and execute project work, and how they handover and support projects.





EPC Digitalization Success Stories

While some EPCs are still planning and strategizing their digital efforts, others are further along on the journey, having already implemented several initiatives and achieved significant success. Some recent AspenTech customer successes include:

Worley

Worley's SpeedFEED initiative as the name implies is designed for speed without compromised quality. It relies on digital information from concept and FEED to inform a digital estimating platform from Aspen Capital Cost Estimator™ to help clients get to a final investment decision (FID) up to 50 percent faster. Benefits include expedited evaluation of concepts through the AspenTech process simulation software, automated plant layout and piping designs through AspenTech's acquisition of OptiPlant, and coordinated estimates tied to the engineering information.

Hargrove Engineers and Constructors

The firm uses AspenTech software to provide digital twin-based services that improve plant operations, profitability, and reliability. Hargrove provides digital twins that represent a virtualized copy of the historical, current and future behavior of the physical plant asset and the physical

Digital Investments Provide Significant Returns			
<p>Engineering Productivity</p> <p>Data-centric processes speed engineering, reduce errors and improve outcomes</p>	<p>Reduce Effort by 30%</p>	<p>Worley energy chemicals resources</p>	<p>Increased capacity 30%</p> <p>Aspen Basic Engineering increased capacity 30% and promoted global work-sharing</p>
<p>Business Development</p> <p>Estimating tools can reduce bidding time and risk</p>	<p>50% Faster</p>	<p>S&B Engineers and Constructors</p>	<p>Reduced Estimating man-hours by 90%</p> <p>5 : 1 improvement in FEL 1&2 2.5 : 1 improvement in FEL 3</p>
<p>Digital Twin Services</p> <p>Diversify revenues from over reliance on CAPEX</p>	<p>New Revenue Streams</p>	<p>hargrove</p>	<p>Digital Twin Services for O&M</p> <p>Predictive Maintenance Operational improvements</p>
<p>Human Capital</p> <p>Knowledge Automation guides engineers to better outcomes, faster</p>	<p>Weeks to Hours</p>	<p>BURNS & McDONNELL</p>	<p>Evaluate design options in hours not weeks</p> <p>By 2025 'digital natives' will account for 75% of the global workforce</p>

and chemical processes occurring within that plant, so that their customers can realize increased throughput and quality, lower operating costs and increased equipment uptime.

Burns and McDonnell

Leveraging digital design and engineering tools from AspenTech, Burns and McDonnell created a digital representation of a conceptual plant design to quickly redesign a column from traditional design specifications to a more efficient divided wall column. The redesign was accomplished in a matter of hours instead of the normal weeks-long effort. This was only possible because the multi-disciplinary team could collaborate around digital project information.

Summary

Prior to 2020, the majority of EPCs were already embracing initiatives to digitalize areas of their businesses. With uncertain market conditions likely to continue into the foreseeable future, digitalization is accelerating and will fundamentally change the way EPCs bid and execute project work, how they handover projects to customers, and support projects throughout their operating lifespan. Digitalization also enables closer collaboration with owners which can drive significant new value for the entire ecosystem while enhancing the quality and sustainability of the asset.

AspenTech's broad scope, depth and scale of digital twin tools and models are creating strong business value in asset-intensive industries. With support for the entire concept to FEED process now enabled with integrated digital design, layout and estimating software, customers can now explore and optimize options for both greenfield and brownfield projects quickly and efficiently, providing their owner-operator customers the highest value from their investments while improving their business relationships through enhanced customer service, higher-quality deliverables and ultimately delivering assets that run faster, greener, safer, and longer than before.

Visit [the EPC page](#) of our site to learn more.

¹ McKinsey & Company, The next normal in construction, How disruption is reshaping the world's largest ecosystem, June 2020



About Aspen Technology

Aspen Technology (AspenTech) is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets safer, greener, longer and faster.

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