Future Proof Your Assets with Digital Twinning

In today's business world, implementation of artificial intelligence (AI) is no longer an option, rather a mandate. The author, here in this article, has given a very comprehensive account of how AI empowers digital twinning to future-proof the plant assets. His narration encompasses many different aspects of plant facilities to achieve sustainability and operational excellence through efficient prediction and monitoring.

The debate has ended. Not implementing artificial intelligence (AI) is no longer an option. Every company should have an effective AI strategy in place, as the pace of innovation accelerates and presents increased opportunities to change businesses. Big data is the bedrock of AI. AI gains momentum via machine intelligence and insights by employing business and operational data streams. Currently, companies have only been utilizing a fraction of the data collected. This provides a huge opportunity for the implementation of a digital twin, which is nothing but the virtual copy of company's assets and business information. A digital twin can unlock the potential of the massive data mountain in each company.

In 1984, "Neuromancer" – a scientific fiction novel, authored by William Gibson – captured the imagination of readers as a prelude to the world of AI. Gibson envisioned the massive value & power that digital twins can bring, and how they can change the world. Today's technology has surpassed what writers, in the past, could only dream of. More than three decades later, Gibson's vision materialized in the enterprise world. Virtual copies of physical locations provide an insightful way for companies to harness the true value of data, as AI helps human beings to access this massive world of multi-dimensional data. Turnkey solutions for digital twins lie in the power of AI and the interconnected industrial world to extract critical insights via data mining and leveraging domain expertise.

No longer dream time

The future has arrived with advanced technology, available on demand. Now the golden question is: Where to Invest as digital twins transform asset-intensive businesses, especially the ones from energy and chemical sectors. In today's volatile, uncertain, complex, and ambiguous (VUCA) marketplace – the deployment of digital twins can help companies to achieve sustainability and operational excellence. Digital twinning technology is a business necessity that can greatly impact the industry. It provides a valuable model of the physical asset to help plants explore "what-if" scenarios safely and provide forecasting capabilities, therefore advises on degradation, asset failure events, and more. Digital twins also function as business models to optimize various business scenarios.

Based on models and real-time data, the digital twin is an evolving digital profile of the behavior of a physical object or process that optimizes business performance. This provides important insights into system performance, which in turn, leads to actions in the physical world. The digital twin takes advantage of asset data to stay updated and is increasingly made more intelligent by AI agents. First, the digital twin ensures that the process plant is modeled vigorously using engineering models, enhanced via AI techniques with embedded cost and risk models. Second, the operational digital twin ensures that plant operations are modeled and viewed virtually as planning, scheduling, controlling, and utility models. Areas covered include planning and scheduling, demand models, distribution models, energy demand and supply, as well as control and optimization. Third, the operational integrity digital twin provides tactical and strategic decision guidance around prescriptive maintenance and real-time decision-making to maximize uptime, adjust production, minimize environmental impact and production losses, and also to prioritize safety. The digital twin also covers asset condition and sustainability. Overall, companies need future-proof digital reference architecture to structure the implementation of digital twins supporting collaboration and integration across business functions.

Powered by business value

Boston-based LNS Research conservatively estimated that more than 1,000 digital twin models may be required to model the operations of a typical refinery. The scale of digital twins will deliver value for the enterprise. For example, unit level models can deliver very high value returns for digital twins – involving process, asset condition, and the control & optimization of online models. Energy and utility models, refinery and bulk chemical planning, specialty chemical scheduling, debottlenecking and de-risking, as well as emissions are very high-value opportunities for plants to adopt digital twin models. As a new but important area, enterprise-level digital twins enable rapid analysis of available enterprise profit opportunity options and effectively present actionable information at the executive level.

Turnkey solutions for digital twins lie in the power of AI and the interconnected industrial world to extract critical insights via data mining and leveraging domain expertise.

Examples of how digital twins can add value to businesses:

- A Bolivian upstream company, YPFB Andina, has increased yield via an asset-wide digital twin model.
- A major US-based international refiner has adopted machine learning digital twins to improve refining uptime and margins, saving money in the process.
- Abu Dhabi National Oil Company (ADNOC) via Equinox, has constructed an asset-wide twin with a visualization dashboard to achieve better decision-making and sustainability milestones.
- Sustainability is a key business driver for Bharat Petroleum (BPCL). This resulted in the deployment of an integrated digital twin to optimize sulfur recovery – encompassing software, such as AspenTech's self-diagnosing adaptive process control and engineering software models to improve contaminant removal, as well as visualization and key performance indicator (KPI) dashboard. Within six months, the implementation resulted in 90 percent reduction in sulfur emissions and economic value from the recovered sulfur for sale.
- A service provider in Alberta oil fields, Process Ecology, mitigated costs in fine payments via online digital twin models, in the area of compliance and permitting.
- Via a digital twin, Momentive Specialty Chemicals optimized their supply chain daily, in the area of order fulfillment and working capital.
- Forbes has also reported that AspenTech's customer – Perstorp – one of the leading global specialty chemicals manufacturers, has a model that contains 1.5 million variables and 500,000 constraints. Perstorp has been reportedly evaluating demand-supply scenarios based on marginal contribution impact and plans to have the whole company in a unified model.
- A polymer producer implemented data analytics digital twin, principled on a multivariate analysis, to manage a wider range of specialty chemical applications where product quality is the key and often problematic.

Conclusion: Companies have been progressing with new and advanced technologies, as it is necessary to be strategic and to have a roadmap to get ahead. As companies invest in digital twins, it is critical to observe (at a high level) how this technology will help businesses to overtake the competition. Beyond technology, companies should also take note of their organizational change and evolution. The organization's ability to adopt, as well as the level of enthusiasm and readiness should be managed regularly, as the value creation in business is the key driver for technology.■

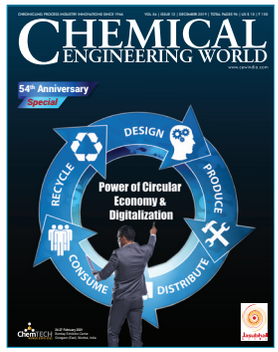
Digital twins transform asset-intensive businesses, especially the ones from energy and chemical sectors. And the golden question that arises for the businesses is: Where to Invest.

Author Details

Ron Beck
Marketing Strategy Director
Aspen Technology Inc.
E-mail: ron.beck@aspentech.com

Sunil Patil
Solutions Consulting Director
Aspen Technology Inc.
E-mail: Sunil.Patil@aspentech.com

Contribute to CEW



Dear Readers,

Chemical Engineering World (CEW), the Official Organ of ChemTECH Foundation, is India's premier technology magazine for the chemical process industry professionals. This highly reputed monthly publication provides novel insights on the dynamics of Indian and global process industries. CEW, a niche publication with proven track record, has been disseminating authentic information on process industry innovations for more than five decades.

You can contribute in the magazine with technical articles, case studies and product write-ups. The length of the article should not exceed 1,500 words with maximum three illustrations, images, graphs, charts, etc. All the images should be of high-resolution (300 DPI) and attached separately in JPEG or JPG format. Have a look at our editorial calendar on the Website – www.cewindia.com.

To know more about ChemTECH Foundation, Jasubhai Media and other publication and events, please visit our Website – www.chemtech-online.com

Thank you,
Regards,
Mittravinda Ranjan
Editor
Jasubhai Media Pvt Ltd
T : +91-22-40373636
D : +91-22-40373615)
E-mail: mittra_ranjan@jasubhai.com