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THE FUTURE STARTS WITH INDUSTRIAL AI

Industrial digital transformation is critical to achieving new levels of safety, sustainability, and profitability—and "Industrial AI" is a key enabler of that change.

Today's industrial organizations, and especially those in capital-intensive industries, stand at a crossroads for opportunity. They recognize the need to reinforce their industrial operations and complex value chains with greater resiliency, flexibility, and agility to respond to shifting market conditions. At the same time, they're investing in autonomous and semi-autonomous artificial intelligence (AI) capabilities to realize their vision of the digital plant of the future—the "Self-Optimizing Plant."

THREE MARKET FORCES DRIVING DIGITALIZATION

Digitalization in industrial facilities is critical to achieving new levels of safety, sustainability, and profitability—and AI is a key enabler for that transformation. While the wariness typically associated with implementing any new technology may be a stumbling block for AI adoption, there are three pivotal needs driving capital-intensive industries to digitize and implement purpose-built AI systems:

1. Compelling need for knowledge automation

Generational shifts in the workforce are creating a loss of operational expertise. Veteran workers with years of institutional knowledge are retiring, replaced by younger employees fresh out of school, taught on technologies and concepts that don't match the reality of many organizations' workflows and systems. This dilemma is fueling the need for automated knowledge sharing and intelligence-rich applications that can close the skills gap.

2. Data value superseding data volume

Industrial organizations are accumulating massive volumes of data but deriving business value from only a small slice of it. Transient repositories like data lakes often become opaque and unstructured data swamps. Organizations are switching their focus from mass data accumulation to strategic industrial data management, homing in on data integration, mobility, and accessibility—with the goal of using AI-enabled technologies to unlock value hidden in these unoptimized and underutilized sets of industrial data. The rise of the digital executive (chief technology officer, chief data officer, and chief information officer) as a driver of industrial digital transformation has been a key influence on this trend.

3. Competitors are digitally transforming

Adopting new technologies unlocks new business models that are integral to sustainability, market competitiveness, and new corporate strategies. The more that competitors digitally transform to reap these advantages, the more that organizations that don't transform will be left behind.

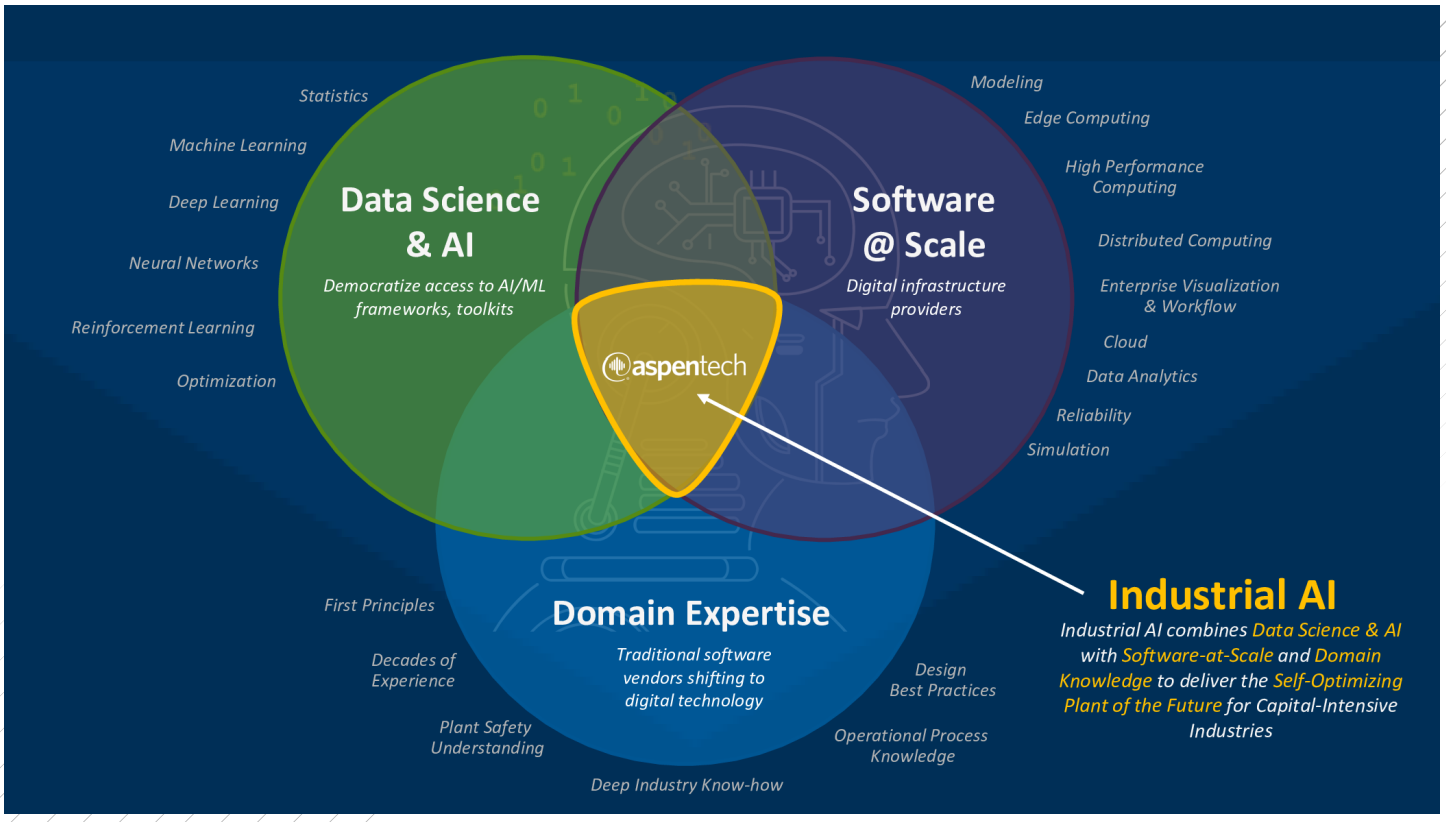
The AspenTech 2020 Industrial AI Research shows that among large industrial companies, 83% believe AI produces better results—but only 20% have adopted it. Barriers to entry, both real and imagined, are stunting AI adoption in process manufacturing.

> **"Domain expertise is the secret sauce that separates Industrial AI from more generic AI approaches. Industrial AI will guide innovation and efficiency improvements in capital-intensive industries for years to come."**
> Willie K Chan, Chief Technology Officer, AspenTech

This has fueled the need for "Industrial AI," a new paradigm that combines data science and AI algorithms with software and domain expertise to deliver measurable business outcomes for the specific needs of capital-intensive industries. Industrial AI disrupts these industries by lowering barriers to adoption, offering new opportunities for industrial organizations to significantly reduce costs, improve efficiency, and transform their operations for the better.

DOMAIN EXPERTISE IS THE SECRET SAUCE

Making AI valuable and actionable in a process manufacturing context means needing to purposefully guide and augment it with industry-specific domain knowledge. That's essential for getting business value out of AI. Industrial AI does this through its unique combination of data science, AI, and industrial domain knowledge—by developing, embedding, and deploying machine-learning algorithms as fit-for-purpose, domain-specific industrial applications.



"Domain expertise is the secret sauce that separates Industrial AI from more generic AI approaches. Industrial AI will guide innovation and efficiency improvements in capital-intensive industries for years to come," said Willie K Chan, CTO of AspenTech. Chan was one of the original members of the MIT ASPEN research program that later became AspenTech in 1981, now celebrating 40 years of innovation.

Incorporating that domain expertise gives Industrial AI applications a built-in understanding of the context, inner workings, and interdependencies of highly complex industrial processes and assets, and takes into account the design characteristics, capacity limits, and safety and regulatory guidelines crucial for real-world industrial operations.

More generic AI approaches may come up with specious correlations between industrial processes and equipment, generating inaccurate insights. Generic AI models are trained on large volumes of plant data that usually does not cover the full range of potential operations. That's because the plant might be working within a very narrow and limited range of conditions for safety or design reasons. Consequently, these generic AI models cannot be extrapolated to respond to market changes or business opportunities. This further exacerbates the productization hurdles around AI initiatives in the industrial sector.

By contrast, Industrial AI leverages domain expertise specific to industrial processes and real-world engineering based on first principles that account for the laws of physics and chemistry (e.g., mass balance, energy balance) as guardrails for mitigating risks and complying with all the necessary safety, operational, and environmental regulations. This makes for a safe, sustainable, and holistic decision-making process, producing comprehensive results and trusted insights over the long run.

Digitalization in industrial facilities is critical to achieving new levels of safety, sustainability, and profitability—and Industrial AI is a key enabler for that transformation.

INDUSTRIAL AI IN ACTION

Talking about Industrial AI as a revolutionary paradigm is one thing; actually seeing what it can do in real-life industrial settings is another. Below are a few examples that demonstrate how capital-intensive industries can leverage Industrial AI to overcome digitalization barriers and drive greater productivity, efficiency, and reliability in their operations.

- A process plant may deploy an advanced class of Industrial AI-enabled Hybrid Models, drawing on deeper collaboration between domain experts and data scientists, machine learning, and first principles for more comprehensive, accurate, and performant models. These hybrid models can be used to optimally design, operate, and maintain plant assets across their lifecycles. Because they are reliably relevant for a longer period, they also provide a better representation of the plant.
- A chemical plant could leverage Industrial AI for yielding real-time insights from integrated industrial data from the edge to the cloud, using the Artificial Intelligence of Things (AIoT) to enable agile decision-making across the organization. Using richer, dynamic workflows, supply chain and operations technologies are seamlessly linked together to detect changes in market conditions and automatically adjust the operating plan and schedule in response.
- A refinery can use Industrial AI to evaluate thousands of oil production scenarios simultaneously, across a diverse set of data sources, to quickly identify optimal crude oil slates for processing. Combined with AI-rich capabilities, enterprise-wide insights, and integrated workflows to improve executive decision-making, this approach empowers workers to allocate their time and efforts to more strategic, value-driving tasks.
- A next-generation industrial facility could apply Industrial AI as the plant's "virtual assistant" to validate the quality and efficiency of a production plan, in real time. AI-enabled cognitive guidance ultimately helps reduce reliance on individual domain experts for complex decision-making, and instead institutionalizes historical decisions and best practices to eliminate expertise barriers.

These use cases are by no means exhaustive, but just a few examples of how pervasive, innovative, and broadly applicable Industrial AI's capabilities can be for the industry and for laying the groundwork for the digital plant of the future.

THE DIGITAL PLANT OF THE FUTURE

Industrial organizations need to accelerate digital transformation to stay relevant, competitive, and capable of addressing market disruptors. The Self-Optimizing Plant represents the ultimate vision of that journey.

Industrial AI embeds domain-specific know-how alongside the latest AI and machine-learning capabilities, into fit-for-purpose AI-enabled applications. This enables and accelerates the autonomous and semi-autonomous processes that run those operations—realizing the vision of the Self-Optimizing Plant.

A Self-Optimizing Plant is a self-adapting, self-learning and self-sustaining set of industrial software technologies that work together to anticipate future conditions and act accordingly, adjusting operations within the digital enterprise. A combination of real-time data access and embedded Industrial AI applications empower the Self-Optimizing Plant to constantly improve on itself—drawing on domain knowledge to optimize industrial processes, make easy-to-execute recommendations, and automate mission-critical workflows.

This will have numerous positive impacts on the business, including the following:

- Curbing carbon emissions caused by process upsets and unplanned shutdowns or startups, helping to meet corporate environmental, social, and governance goals. This reduces both production waste and carbon footprint, driving a new era of industrial sustainability.
- Boosting overall safety by significantly reducing dangerous site conditions and reallocating staff on the operations and production floors to safer roles.
- Unlocking new production efficiencies by tapping into new areas of margin optimization and production stability, even during downturns, for greater profitability.

The Self-Optimizing Plant is the ultimate end goal of not just Industrial AI, but the industrial sector's digital transformation journey. By democratizing the application of industrial intelligence, the digital plant of the future drives greater levels of safety, sustainability, and profitability and empowers the next generation of the digital workforce—future-proofing the business in volatile and complex market conditions. This is the real-world potential of Industrial AI.

To learn more about how Industrial AI is enabling the digital workforce of the future and creating the foundation for the Self-Optimizing Plant, visit www.aspentech.com/selfoptimizingplant, www.aspentech.com/accelerate*, and* www.aspentech.com/aiot.

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