AI in Chemicals

Manager's Playbook for Getting Value from AI in the Chemicals Sector

CANVASS

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What does Industrial AI mean for the chemicals industry?

Technologies like artificial intelligence (AI) and machine learning (ML) are transforming the way industries think about and consume data to drive operational efficiencies and enhance business performance. More and more companies are investing in their digital transformation to maintain their competitive edge in a rapidly growing and crowded marketplace. While new technologies like AI and ML find applications across various industries, the possibilities in the chemicals industry are immense. In a report by the International Finance Corporation, the industry's total contribution to the global Gross Domestic Product (GDP) was estimated at US$5.7 trillion in 2017, equivalent to 7% of the world's GDP that year[1]. It is estimated that the industry directly employed approximately 15 million people. Moreover, global chemical sales are projected to increase from US$4.3 trillion in 2019 to US$ 7.3 trillion in 2030.

However, the chemical industry is facing increasing pressure to decarbonize operations amidst the fight against climate change. In 2019, Deloitte Australia conducted a market study of 112 companies around the world, 69% of them in the Energy, Resources & Industrials industries. The report revealed that from 2017 to mid-2019, these 112 companies collectively emitted 4.53 billion tonnes of carbon dioxide, of which 96% was attributable to E&R—oil and gas, chemicals, mining and metals, and power and utilities. Though these figures can only be approximated given variations in reporting standards, they still illustrate the magnitude of the challenge that lies ahead.

This data not only reinforces the importance of the chemicals sector to global economic development but also begs the question: how can we ensure that the sector benefits from lean, efficient operations to meet rapidly growing demand amidst increasing pressure to decarbonize operations? One way to achieve this goal is to rapidly implement digital technologies that enable companies to adopt innovative business models so they can increase their competitiveness and resiliency. This leads those in the chemical industry to ask:

- **How can companies maximize the ROI on their digital investments?**
- **How do we address the skills gap hindering successful deployment of technologies?**
- **What infrastructure and technology capabilities are required to initiate a digital transformation?**

1. International Finance Corporation, Outlook for Chemicals Manufacturing, 2021.

How chemical engineers can make sense of AI

With technologies like AI and ML, companies can optimize production, improve process efficiencies, enhance product quality and improve yield. AI can also reduce unplanned downtime, saving enormous costs. Did you know that the cost of 3.65 days of unplanned downtime is a staggering $5 million? With AI, unplanned downtime can become a thing of the past. AI can build intelligence in your systems and enable predictive maintenance to avoid production and productivity loss. In this scenario, chemical manufacturers need to evolve to meet market challenges head-on and gain a business edge; otherwise, they are likely to be left behind.

A common problem faced by chemical manufacturers is the need to recognize and avoid inefficiencies to improve chemical process control. With the implementation of AI solutions, manufacturers have started leveraging technologies that help in identifying and optimizing production proficiency.

$5M

The cost of 3.65 Days of Unplanned Downtime

However, the definition of AI is more nuanced for the chemicals sector. It is understood to be a myriad of tools and approaches that enhance data interrogation on very large scales in order to:

- Seek new process insights while separating signal from noise, dispelling plant myths, and establishing facts.
- Find faint data signals lost in the tidal wave of data a plant produces every minute and turning these signals into actionable insights for the plant.
- Create models and understanding that will anticipate future problems or help hold the process in check without over-control.
- Help to direct attention to where the problem actually lies, rather than to the multitude of operational distractions that accompany most immediate (i.e., emergency) large-scale manufacturing problems.

What is AI to a chemical engineer who does not come out of school with this preparation or interest? To a chemical engineer, AI should provide a readily accessible tool kit to interrogate immensely large data sets. This multivariate interrogation will reveal correlations and signals that are buried in the massive flow of data that is streaming to engineers and operators on process control screens and information dashboards. While the techniques within can be used for an autopsy in an effort to understand what went wrong, more artful use of AI can make it a tool to provide validated forewarning, and the first tool used to understand systemic problems that are not easily laid to rest. Therefore, what AI should be to a chemical engineer is a method for:

- **Anticipating** problems in a plant or its equipment, predicting longer-term effects of seemingly minor problems.
- **Simulating** changes to setpoints and tolerances within an operation to determine the likely outcomes without interfering with production schedules and customer commitments.
- **Improving** understanding of the interplays within a process and between processes. AI can also be used to allow the data to protect customers from mysterious plant problems and disruptions while scientists and engineers work on the root cause of the problem.[1]

Challenges of applying AI in the chemicals sector

For any AI initiative to succeed, the quality of data is paramount. This is one of the biggest challenges that the chemical process industries face. Most industrials generate a massive amount of data, but only 12% is used to gain insights for informed decision-making.

Accurate, complete, consistent, and timely data is the biggest hurdle to a successful AI implementation.

Where companies have failed in deriving value from AI starts with identifying and leveraging the right data sets to train AI modules. Getting accurate, complete, consistent, and timely data is the biggest hurdle to a successful AI implementation. Another challenge is the massive shortage of trained data scientists. The imbalance in demand and supply means that the available data scientists are not only difficult to find but also expensive.

An Industrial AI platform, like Canvass AI, does not require the expertise of data scientists or coding experience. It puts the power of AI in the hands of your industrial engineers. It empowers your engineers to analyze data and gain deep insights into your operations to create solutions and AI models that can take your chemical processes to the next level.

Canvass AI is purpose-built for industrial engineers to fast-track problem solving and decision making with the power of AI.

1. Industrial implementation of on-line multivariate quality control, Leo H. Chiang, Lloyd F. Colegrove, Chemometrics and Intelligent Laboratory Systems, 2007, 88, 2 pp 143-153

CASE STUDY

Precision food manufacturing with AI

A large American multinational food manufacturing company wanted to reduce costs and increase yield for a particular animal feed additive they manufacture. This additive was a low-margin, high-volume product of the company. However, its manufacturing was marred by a few challenges.

The process of making this additive was complex as it required three stages of fermentation to multiply the bacteria, significantly increasing the time taken to create the final product. Moreover, there were inconsistencies and variability from batch to batch that would affect the yield and overall costs.

They had a process in place to address batch variability, but it had its own set of issues. First and foremost, there was a lack of accurate information. They had to manually analyze every single set of linear models to make predictions over a fixed time horizon. These models also had to be rebuilt constantly based on new variations. This was a labor-intensive approach and the decision to stop the process depended on the understanding and knowledge of the individual operator at the time.

The company had access to different types of data, including:

- **Asset data** featuring temperatures and pressures of different fermenters.
- **Process data** of various flow rates and DP measurements.
- **Calculated data** comprised of cooking times and compositions.
- **Ambient data** including weather, humidity and temperature details.

The company's engineers brought all this data into the Canvass platform. The company was then able to explore the data to gain better insights. Canvass's Industrial AI platform helped them prepare the data and apply filters to easily remove outliers. This enabled their engineers to gain more control over the data, make the data more intuitive, and prepare it for AI.

Canvass's pre-built AI solutions ensured that the engineers could apply AI to their data without data science or coding skills. After running a few experiments and using these different models, the platform was able to predict the batch variability. The company then deployed these predictions, allowing the operator to monitor and adjust the batches accordingly.

PROBLEM

- Batch variability affected yield and overall cost.
- The process to address batch variability suffered due to a lack of accurate information.
- Dependent on manual analysis of every set of linear models to make predictions over a fixed time horizon.
- Labor-intensive approach dependent on the individual operator.

CANVASS AI SOLUTION

The Canvass AI platform helped the food manufacturer to:

- Increase asset utilization by 5%.
- Reduce batch-to-batch variability.
- Save significantly on costs.

Canvass AI Solutions

Canvass AI's easy-to-use AI solutions are designed to simplify decision-making and fast-track problem solving. They help industrial engineers by connecting the dots in data and delivering new insights that help them narrow down the problem or find relationships in the process that their current tools have yet to discover.

Today, engineers are using Canvass AI in their daily work for:

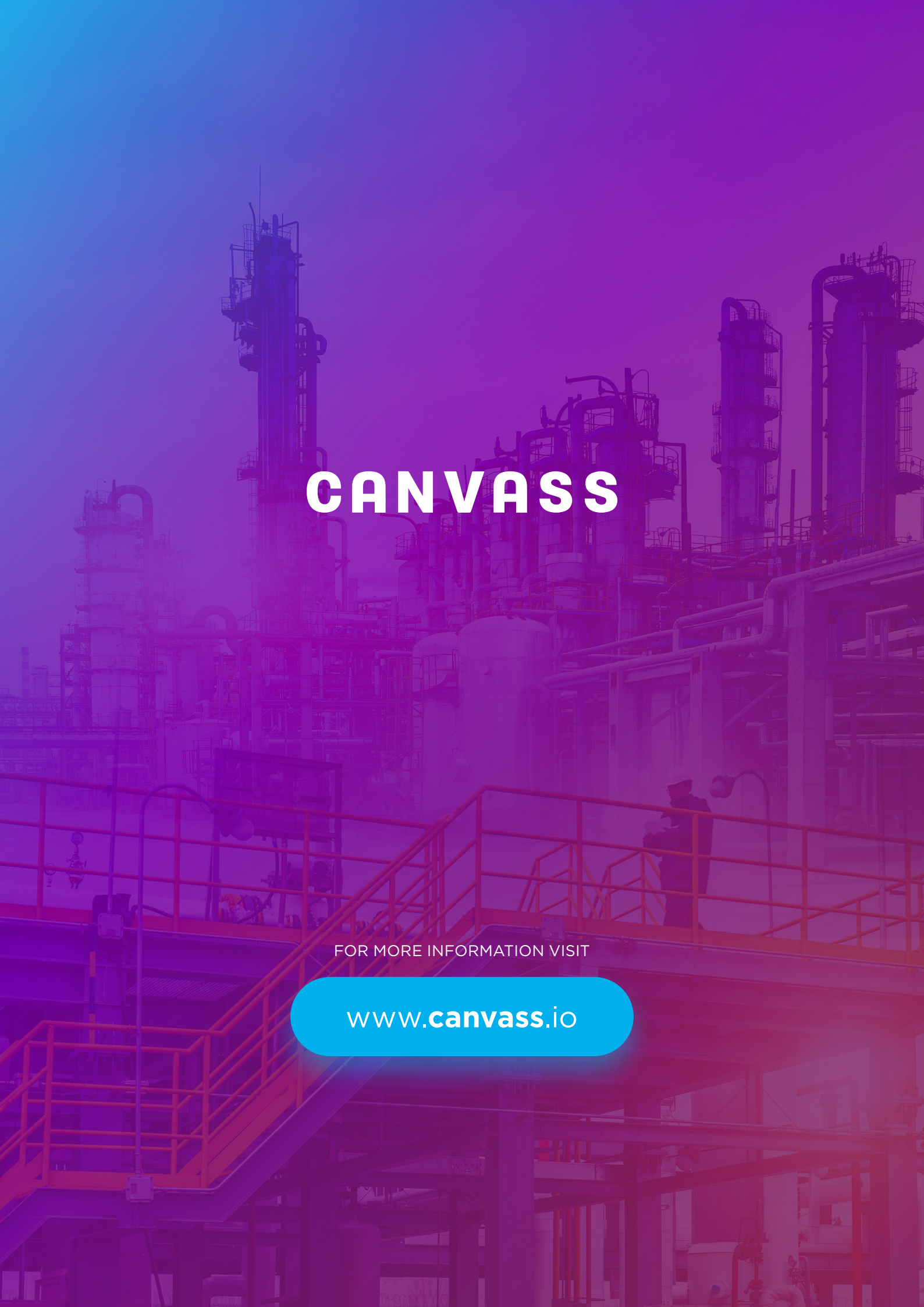
- **Troubleshooting and optimization:** engineers gain value from all of the associated data to understand the impact of other interconnected units, ambient and other conditions etc.
- **Narrowing down and problem solving:** engineers eliminate noisy data and focus on the variables that matter, simplifying the process of solving large and complex problems.
- **Optimizing the supply chain:** Connecting process data to supply chain data helps to streamline feedstock and energy demand, while increasing an operation's efficiency.
- **Running efficient operations:** Predicting disruptions helps engineers detect the problem early and keep the plant running smoothly.
- **Improving plant reliability:** Applying data-informed insights into process behaviors and asset health helps operators anticipate the cycles and plan ahead.

Chemical engineers routinely abide by the maxim that "correlation does not mean causation," which reinforces the importance of applying engineering and chemistry fundamentals during the process of data set interrogation.

Moreover, one of the most notable advantages of using Canvass AI is that when there's no correlation to be found within the specific data set being observed, it helps to identify and decipher issues hiding within a broader data set.

About Canvass AI

Canvass AI is a leading industrial AI software provider that puts the power of AI in the hands of industrial workforces to solve day-to-day operational problems. Some of the world's largest companies use Canvass AI's patented industrial AI Platform to reduce carbon emissions and waste, improve yields, and optimize facility operations. Backed by Alphabet and Yamaha Motor Ventures, the company is recognized by CB Insights as one of the world's top 50 technology companies that is advancing manufacturing.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