NAVIGANCE

Data-driven chemical process optimisation

Lisa Krumpholz

Navigance is a tech startup recently created by Clariant: a cloud-based solution providing real-time recommendations to optimise control parameters in chemical processes. Its innovative approach, combining hybrid plant models and machine learning with process and catalyst expertise, can deliver continuous benefits within weeks, without tying up in-house resources.

Fine tuning a chemical process such as methanol production for optimum efficiency and reliability is an art. Keeping plant systems not only running, but running at their best, takes years of frontline experience and expertise to master. And, despite the many digital advances now within plants' reach, it still takes a considerable amount of educated guesswork in many cases, too.

One of the key challenges for chemical facilities seeking optimisation is their sheer complexity. Their many interlinked and overlaid processes and variables make it difficult to build realistic first principle plant models that describe real-time process behaviour. The control systems commonly in use are also insufficient to enable dynamic, non-linear process optimisation.

Unlocking hidden potential

The power to optimise effectively lies in the data many chemical plants already routinely gather. Successfully tapped, it can help improve operations in both the immediate and longer term.

However, the investment of time and resources needed to study, interpret and extract meaningful insights from immense data sets often precludes any real practical use beyond KPI development and day-to-day troubleshooting.

As a result, most process optimisation decisions are still taken using informed intuition and deep rooted experience of process behaviour. Even for the most experienced operators, making choices based on an incomplete picture of plant data can leave uncertainty as to whether the right decisions are made every time.

Machine learning, a subset of artificial intelligence (AI), offers a way to reduce these uncertainties. Deployed correctly and based on the right foundation, it can pinpoint and distil the data that matters most and identify the changes which need to be applied to process control variables to achieve operational goals.

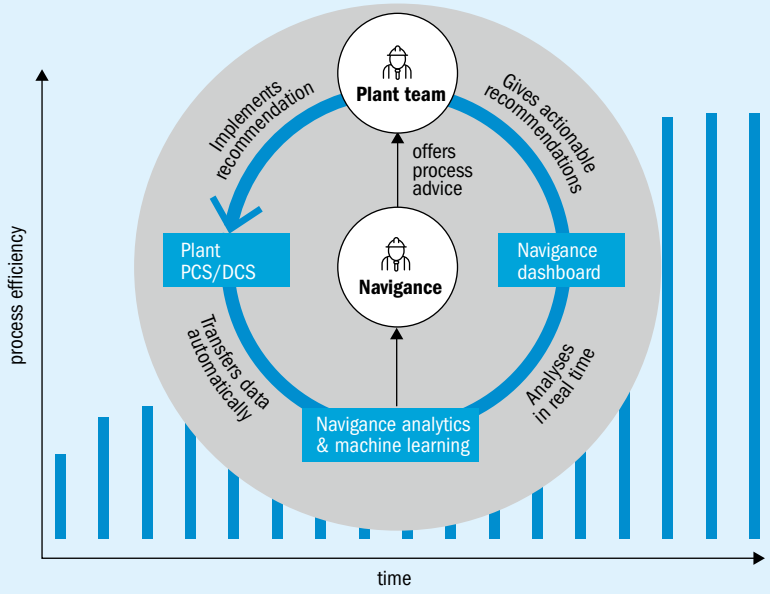
A fresh approach

Such capabilities require fresh thinking and a broad range of expertise, such as sufficient domain knowledge in the chemical process to develop models robust enough for AI-based optimisation and the mathematical and statistical know-how to develop and implement machine learning effectively.

Clariant took up the challenge, investing in Navigance: a new venture and innovative service for chemical producers that harnesses its rich catalyst and process expertise and decades of industry experience.

"What started as an internal initiative within Clariant Catalysts has developed into an entirely independent business and company using digital technologies to offer process optimisation services," says Stefan Heuser, Senior Vice President & General Manager at Clariant Catalysts. "It's a journey that underlines our commitment to delivering and generating value for different players in the chemical industry."

Fig. 1: **Navigance process optimisation cycle**



Navigance

Acting with intelligence

In a purely technological sense, Navigance is a service that enables producers to continuously optimise their chemical process using their own plant data. It provides this powerful support through a cloud-based platform.

Machine learning studies and identifies complex, non-linear patterns in historical and real-time plant data, predicts future performance and spots improvement potential to a high degree of accuracy. These insights are presented as recommendations in an online dashboard.

Operators can act on this advice immediately, adjusting control variable settings to continuously optimise and achieve their defined goals. These may be efficiency goals, such as yield, production output and other operational targets. Equally, the intelligent algorithms used can also identify any deviations and so help to maintain operational reliability too.

Partnering for success

Navigance is more than just a technology solution. Its team works closely with producers through their entire journey towards data-driven decision making – then beyond.

The approach of Navigance is not only to provide AI and data analytics tools to gather data and present findings, but also to deliver prescriptive recommendations and, crucially, provides ongoing expert support.

This starts with planning and deployment. Navigance process and data science experts take the pressure off chemical producers to find in-house resources to introduce real-time optimisation successfully themselves. This expertise remains available once the platform is up and running, providing insights and advice drawn from the data over time that help optimise further, even as conditions change.

The power to act on the recommendations always remains firmly in the operators' hands. Enabling them to optimise based on a clearer picture of plant performance, while freeing them to focus on the many other pressing aspects of running their operation.

Right from the start

While some AI projects fail before they really get started, Navigance helps plant teams identify upfront where digitalisation will deliver great value and the right usage cases. This starts with a check of their digital readiness and potential key areas for improvement.

A feasibility study conducted by Navigance helps to understand the plant, its process, logical connections, key variables and constraints. It also determines if there is sufficient quality and quantity of data to build a realistic digital process model, and what is needed to complete this picture if not.

Navigance builds hybrid plant models that enhance established first principle techniques with machine learning. By carefully integrating unknowns using arbitrary functions, these models can ensure a good fit for all observed data and that all relevant effects are captured, for recommendations of a high predictive quality.

This approach enables hybrid models to respond quickly and easily to real-time data, changing conditions and factors that could affect processes, such as varying load scenarios and deactivating catalysts.

Fig. 1 shows the process optimisation cycle with Navigance.

Ready to optimise with intelligence?

Navigance works with all technology licenses and catalyst types and can suit both older and newer plants, whatever their current level of automation.

Base models, tailored to a specific process, enable producers to optimise quickly to reach their individual goals, with little demand on their in-house teams. ■