## DOWNSTREAM

# Designing a digital future

🖥 he downstream refining sector is under threat. Products are increasingly substituted while market demand is stagnant. Means of production are challenged by new alternative technologies, and older inefficient plants are inflexible and face environmental challenges. Regulators make downstream plants costlier to operate. A retiring workforce is depleting the industry knowledge pool, while high-tech industries attract potential new talent. Capital is scarce and investment choices seem limited.

Traditionally, operational technology (OT) is required to last a quarter of a century. As a result, many process operations are controlling their plants with systems which were bought in the 1990s, with only superficial upgrades since then. Such technology is limited in scope and the ability to manage plant assets holistically, rather than as individual stand-alone units, is impaired.

The focus of most plants has been on 'operability' – making sure that each asset is available and runs reliably and safely. Little time is left to driving excellence. The OT infrastructure and tools to get the most out of the plant are rarely accessible and the organisation is not geared up to manage a change in focus.

Plants that are committed to the medium- and long-term must have robust strategies to counter these threats and be competitive. Digitalisation is one of the key strategies that a plant can adopt to address these challenges. The tools of digitalisation are holistic and scalable and should consider the impact of a change in one area on end-to-end plant economics. They are smart enough to identify problems and recommend solutions. They should also be easy to use and automate systems as much as possible.

#### The business case

The business case for digitalisation is becoming more apparent as companies seek bottom line improvements and better asset availability to justify the cost of technology investment. Many oil companies (upstream and downstream) have already nominated C-level executives to



Digitalisation can give downstream operators in the oil and gas sector a competitive edge, explains *Duncan Micklem*, Director of Business Strategy, KBC.\*

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Photo: KBC

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assets, supply chain, human resources) to operate lead their digitalisation efforts. They are looking at digitalisation implementations by other industries and recognise this sector still has a way to go.

A key strategy for the pursuit of operational excellence is the scalable application of digital technologies. In the digital plant, operating costs can be minimised, production optimised, assets are flexible and fully utilised, and the plant is safe and environmentally protective.

Operationally, yield and energy optimisation projects can help refiners maximise the exploitation of their assets, to manage day-today performance safely and reliably; improving the yields of high value products; responding rapidly to market swings; reducing the gap between potential and realised margin; creating more utility for the end customer; extending the problem-solving eco-sphere beyond the plant; and outmanoeuvring the competition.

Digitalisation also enables a process operation to extend its problem-solving ecosphere along

the supply chain – engaging the support, know-how and technologies of key partners, customers and suppliers beyond the plant. It can also turn an organisation that is bogged down in firefighting, reacting to day-today issues and inundated with data and advice, into an agile operation that proactively anticipates issues, and can prioritise and solve them before they escalate.

By deploying digitalisation technologies, downstream operators can also attract the best talent, and sustain competitive advantage by minimising production cost and maximising revenue.

### A new definition

Digitalisation is not simply a matter of upgrading pneumatic and electronic instruments from analogue to digital control technologies, as in the so called 'digital revolution' of the 1980s. Today digitalisation is the scalable application of digital technologies with alignment of organisational capabilities. Indeed, the downstream operation should master digitalisation with a holistic approach, first mapping out the various digital challenges that contribute (or hinder) operational excellence. Once these challenges are understood, a holistic approach will eliminate duplicate or conflicting effort, and assure an

optimum outcome. KBC calls this approach - being 'digitally wise'.

Nevertheless, many in the process industries seem to be confused or irritated by digitalisation. IT vendors are mostly to blame. They push the idea that digitalisation is an IT issue but cannot explain its relevance to operational performance. Some see it as hype. The vendors offer a flood of new buzzwords but fail to articulate a compelling value proposition when challenged with operational reality. Despite this, downstream plant operators should not ignore digitalisation for fear of being left behind. They should look past the confusion to uncover their own unique value and outcomes.

Digitalisation can help organisations capture value through unexploited efficiency or productivity gains; helping them discover and generate new revenue; execute and sustain value in the face of continuous change; solve problems that are not viewed as solvable today; and, as mentioned, improve competitiveness.

#### Survey response

KBC recently commissioned a survey of 100 operations leaders across the oil refining and petrochemicals industry to determine how they are responding to current market conditions and setting themselves on a more sustainable path. One of the three major trends identified was the influence of technology on the sector. Respondents showed a strong desire to obtain a digital blueprint for the future, yet some felt underprepared within their organisations for the adoption of current technologies, including the Cloud, Industrial Internet of Things (IIoT) and artificial intelligence (AI).

The same research also showed that digitalisation leaders can gain as much as 800% higher human productivity in operations, compared to industry laggards. Although still in its infancy, the potential business impact of digitalisation is truly transformational.

#### **Technology and new outcomes**

The main focus of digitalisation is driven by the need for fresh outcomes from both new and existing technologies. A digitalised plant will be able to make the most of its capabilities (ie physical assets, supply chain, human resources) to operate optimally in the face of changing economics, feedstock/ fuel availability and operational constraints, to ensure that the plant resulting in better production and

continuously responds in the most profitable way.

Big Data, for example, is a key digitalisation technology. Many Big Data applications in the consumer world can be extended to the oil and gas industry. Companies sift through vast pools of data looking for meaningful relationships against which to draw inferences. For example, a supermarket chain looks at historical buying patterns in order to target customers with appropriate coupons for various premium products.

In the downstream sector, a typical oil refinery generates at least 100,000 values from process instrumentation systems every 30 seconds – over 5tn unique values each year. In the refinery context, there are two differences versus the consumer world. Firstly, many of the relationships among measured variables are determined by chemical and physical laws, rather than some mysterious pattern to be uncovered through statistical analysis. Secondly, current data is more important than past data in determining what to do next.

Refiners have had the tools for managing Big Data for decades. Historians are optimised for capturing, storing and serving up large amounts of time-related data, giving priority to the present time over the past. Simulators have the chemical and physical models built into them that can analyse past data and match it to current conditions for forward predictions.

Digitalisation is the application of these technologies to value creation and sustainment. The Big Data digitalisation tool for refining is not some statistical analytics tool but the 'Digital Twin'. This is a real-time replication of the refinery in a rigorous simulator calibrated off past data, but continually updated in real-time against current conditions, to assess what improvements can be made and how to make them. Add in the Cloud and the plant can extend its ecosphere of support beyond the plant. Outside experts can also provide feedback on the process operation through the Digital Twin, to help plant operators choose potential improvement strategies and guide implementation for plant optimisation.

Two of KBC's customers have applied such digitalisation techniques in their facilities with outstanding results. One, operating one of the world's largest fleets of refineries, has implemented a Digital Twin and is able to keep its planning tools continuously updated against the actual plant,

blending outcomes and reduced inventory holdings due to inaccuracies, all worth millions of dollars per year.

Another, operating one of the world's largest refineries, has taken that a step further, securely exposing the Digital Twin to the Cloud where KBC experts, each acting as a 'co-pilot', can remotely oversee the plant operation and help with assessing optimal improvement strategies. This refiner claimed over \$6mn of benefits within the first six months. in operations associated with fouling mitigation, and in the process also discovering that some equipment had been installed incorrectly, identifying flow meter errors and recommending changes in operation.

#### Now is the time

Digitalisation can create revenue, improve process and business performance, solve problems that could not be solved before, empower personnel and make them more effective. Ultimately, it builds a culture with digital information at the core.

Though many in the downstream sector are only just beginning their digitalisation journey, some are already pulling ahead. Digitalisation creates and sustains competitive advantage. Fortunately, there are a number of 'quick wins'. But what is important is to mobilise the workforce to embrace a culture of digitalisation and convince the executives who hold the purse strings that their investments are in safe hands, bringing noticeable and measurable returns.

The digital future will look quite different. Downstream assets will operate with agility and flexibility. With more and trusted data to hand, proactive decision making will be streamlined with holistic scope for optimisation. There will be extensive automation and the (probably smaller) workforce will be more empowered. Moreover, there will be a massive reduction in unexpected events; excellent levels of reliability, safety performance and environmental compliance; and significant improvement in efficiency. Assets will operate with agility and flexibility.

No matter where a downstream organisation sits on the maturity curve, now is the time to embrace digitalisation to beat the competition.

\*A Yokogawa company



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