

# DIGITALISATION IN DOWNSTREAM OIL & GAS

Does it hold the key to  
greater profitability?

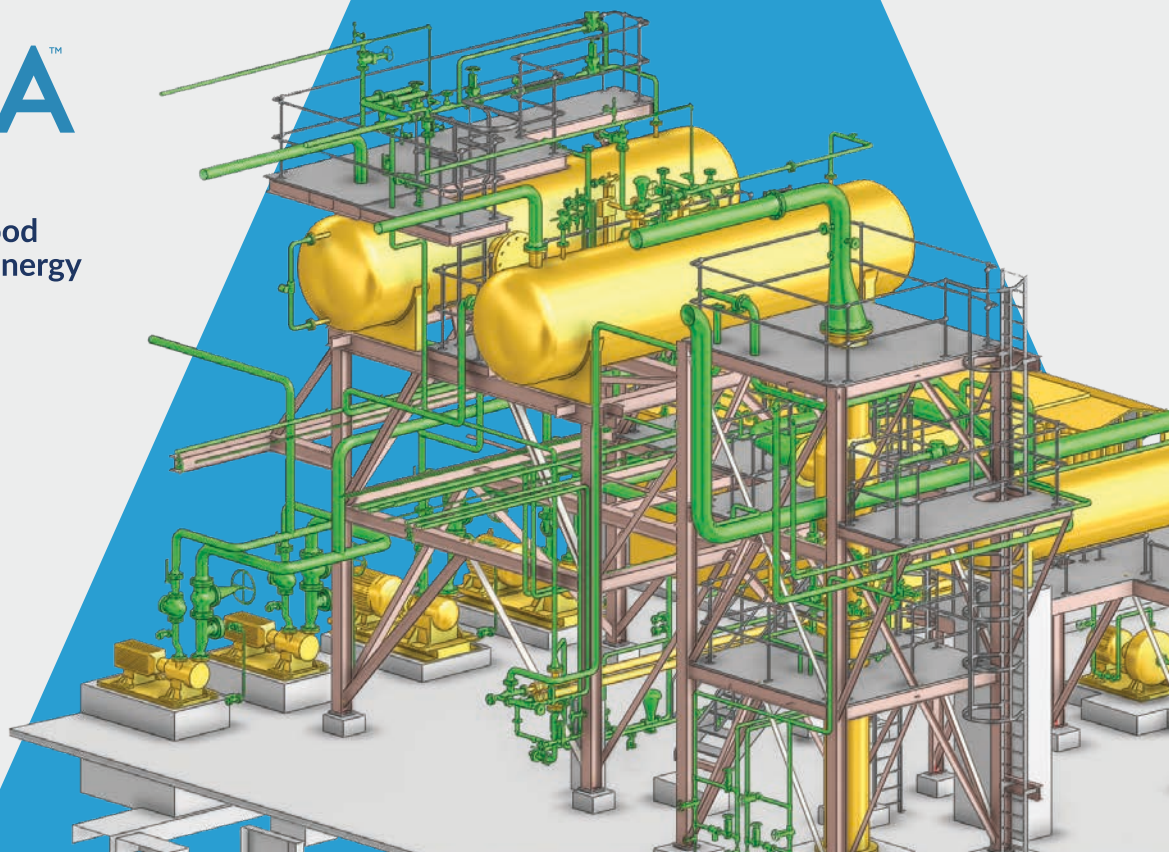
March 2018



# AVEVA™



Westwood  
Global Energy  
Group







# INTRODUCTION

High asset utilisation is vital to downstream profitability, and routine maintenance is vital to utilisation. This has never been truer than it is today, as refinery and gas processing operators look to balance the need to improve the productivity and reliability of the assets they have with the drive to upgrade and expand their plants to profit from recovering prices and the growing demand for gas.

This dynamic led us to explore digitalisation as a core strategy by which operators can maintain, upgrade and expand their assets – all as drivers toward greater downstream profitability.

AVEVA partnered with Westwood Global Energy Group (Westwood), a leading provider of research, data analytics and consulting services to the global energy industry, to interview a wide variety of refinery and gas processing stakeholders about what they are doing to digitalise their assets today and about their views on whether digital holds the key to greater downstream profitability.

We found that, while individual operators vary widely in their rate of digital adoption, they are aligned in their belief that digitalisation has become a core focus for the industry as a means to reduce OPEX costs, increase efficiency and deliver higher asset utilisation. Further, we found that operators see data as both a significant challenge and one of the greatest opportunities inherent in digitalisation. Given that the downstream sector is relatively early in its digital transformation today, the field is wide open for operators that take a data-driven approach to digitalising their assets and their entire organisation.

**Digitalisation creates efficiency and lowers costs within your asset. O&M costs are reduced and the efficiency of the workforce is improved with better processes and fewer personnel requirements – all resulting in a more profitable asset.'**

Refinery Operator, North America

# DOWNSTREAM DIGITALISATION IN CONTEXT

For the downstream sector, unplanned maintenance causes a drop in utilisation and has an adverse effect on revenues. This problem is particularly acute for integrated operators that rely on downstream revenues to cushion falling upstream revenues.

This puts a sharp focus on maintenance as a means of optimising utilisation and sustaining associated revenue and profit. Three key themes emerge as downstream operators make the case for routine and robust maintenance plans:

1. **Cost rationalisation**
2. **Ensuring asset safety and reliability**
3. **Optimising asset uptime**

These same three themes make an equally strong case for digitalisation as a core strategy for maintaining existing assets, upgrading and expanding facilities, and undertaking greenfield projects.

- Digitalisation of downstream assets can improve profitability through greater efficiency, lower downtime and higher utilisation.
- Digital transformation with real-time access to data can create a safer, more reliable, more robust environment.
- Improved data access and accuracy, along with advanced analytics – especially in real time – facilitate better, faster, ultimately predictive decision making, and facilitate asset productivity and longevity.

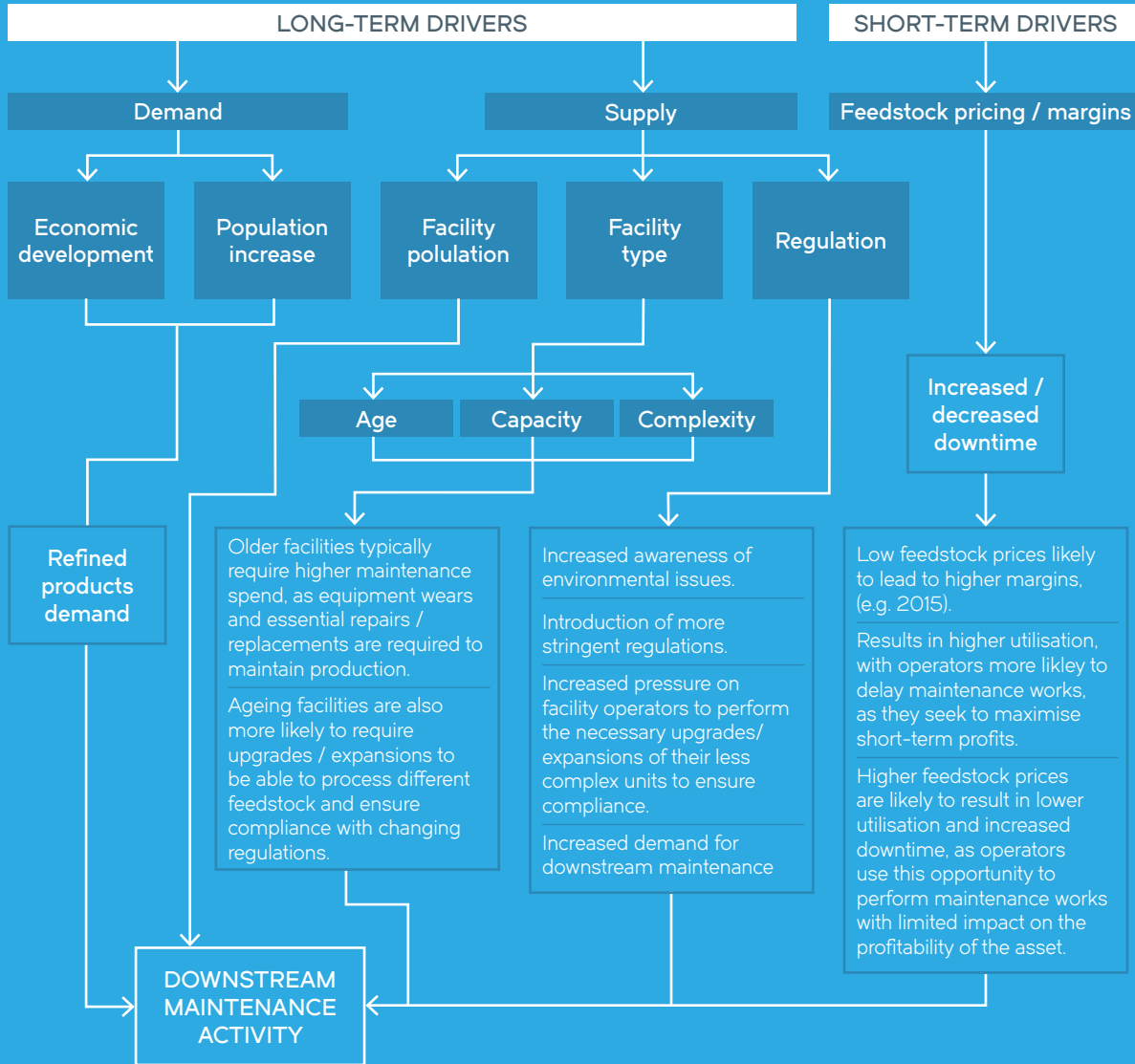
Before we delve into the case for digitalisation, let us look at the context in which digitalisation is being pursued by refinery and gas processing operators. In addition to exploring broad market drivers and economic indicators, we will take a look specifically at the outlook for maintenance work scopes that may drive increased focus on digitalisation projects.

## Long-term and short-term market drivers

High utilisation of assets is vital to sustaining downstream revenues, so it should come as no surprise that unplanned downtime due to unexpected maintenance can have an adverse effect on the financial health of the business. Therefore, it is important that operators have a sound plan for proactive maintenance of their assets, designed to create a safer, more robust and more reliable environment.

Such a plan must consider a combination of long- and short-term drivers, as maintenance does not happen in a vacuum and, in many ways, is predicated upon a complex set of external market drivers.

- **Long-term drivers include** the demand for refined products, supply factors such as size, age and complexity of the downstream population, and regional and international regulations. Among other things, these drivers put pressure on operators to not only maintain but also upgrade existing assets and invest in new ones in order to address new opportunities and requirements.
- **Primary short-term drivers are** the feedstock price and associated margin. These factors result in increased or decreased utilisation which, in turn, informs an operator's stance toward the timing of routine maintenance.



It is important to note that a sound strategy for maintenance must do more than address needs 'right now'. It must also prepare and position the organisation to maximise productivity and profit over the long term.

This is why digitalisation is a fundamental element of any plan to maintain and upgrade assets. Digitalisation of downstream assets improves profitability by improving productivity, as digital assets become optimised for efficiency, uptime and utilisation.

Through real-time access to accurate data, intelligent information management, and robust analytics that produce actionable insights, digitalisation not only creates a safer, more robust, more reliable environment; it empowers operators to be not only proactive but predictive when it comes to maintaining their assets to maximum advantage. Let us look at how downstream operators are already investing in maintenance, overall and by region.

# WORK SCOPE OUTLOOK: ASSET SERVICES DRIVE DOWNSTREAM MAINTENANCE SPEND

Downstream operators are already investing in maintenance, particularly on asset services which account for the majority (approximately 72%) of maintenance spend in both the gas processing and refinery segments.

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Asset Services work scopes focus on the repair and maintenance of structural, mechanical and electrical systems on downstream facilities.

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**These include:**

Fabric Maintenance

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Mechanical Services

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Electrical & Instrumentation

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Process Equipment

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Rotating Equipment

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Asset Integrity work scopes are people-driven services that focus on supporting the efficiency of asset services and upgrades.

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**These include:**

Asset Management

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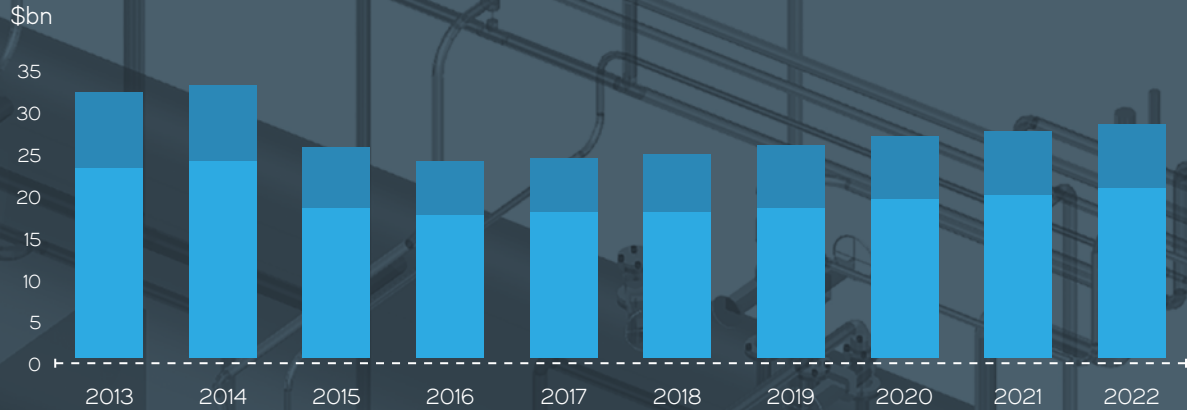
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Integrity Services

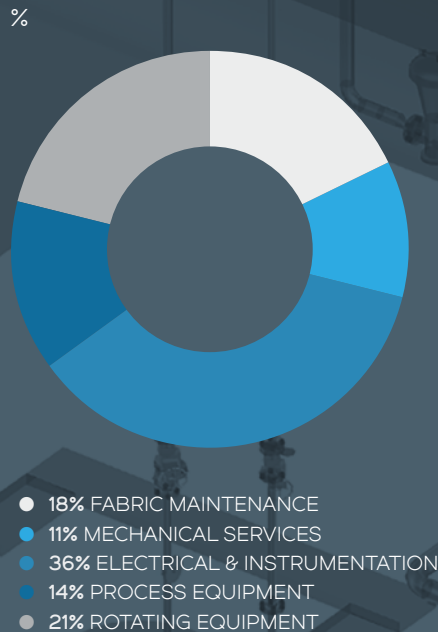


### GAS PROCESSING AND REFINERY MAINTENANCE SPEND BY WORK SCOPE 2013-2022



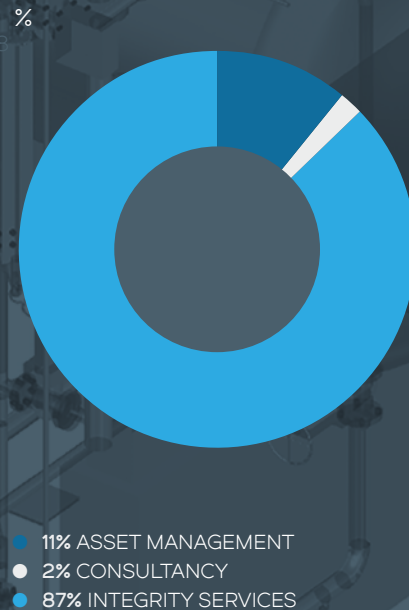
Within asset services work scopes – which focus generally on the repair and maintenance of structural, mechanical and electrical systems on downstream facilities – electrical and instrumentation (E&I) services are the single largest driver of spend (36%).

### ASSET SERVICES MAINTENANCE SPEND BY WORK SCOPE 2018-2022



This is largely due to the retrofitting of up-to-date instrumentation systems, reflecting a push from players to upgrade equipment that measures and analyses equipment performance such as pressure levels, flow and temperature. This is significant from the standpoint of digitalisation as it relates to efficient and regular data analysis.

### ASSET INTEGRITY MAINTENANCE SPEND BY WORK SCOPE 2018-2022



Although asset integrity work scopes account for a smaller portion of the maintenance market, it is, nonetheless, worth noting the key drivers of this spend. Asset integrity work scopes are people-driven services that focus on supporting the efficiency of asset services and upgrades, with integrity services accounting for the vast majority (87%) of investment among these areas.

In March 2016, margins began to decline in response to the sustained low oil price environment, the glut of refined products and slow economic growth expectations. ”







# REGIONAL OUTLOOK

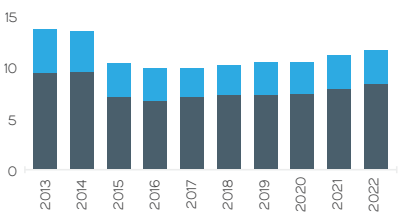
While maintenance spend in all regions saw a decline in 2015, Westwood's analysis points to ongoing investment and even modest increases over the coming five-year period.

North America is the largest region for maintenance spend, driven by the large asset population of both refineries and gas processing plants, and stringent regulation. APAC will also be a significant region for expenditure as it accounts for the approximately 34% of the global refinery population. APAC, Africa and the Middle East will see the greatest growth as brownfield and greenfield projects add to the existing capacity.

## NORTH AMERICA

40% OF GLOBAL SPEND 2018-2022

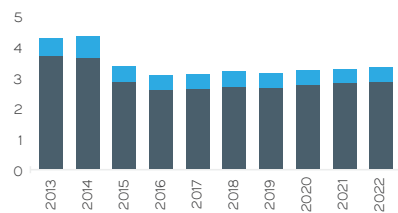
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## WESTERN EUROPE

12% OF GLOBAL SPEND 2018-2022

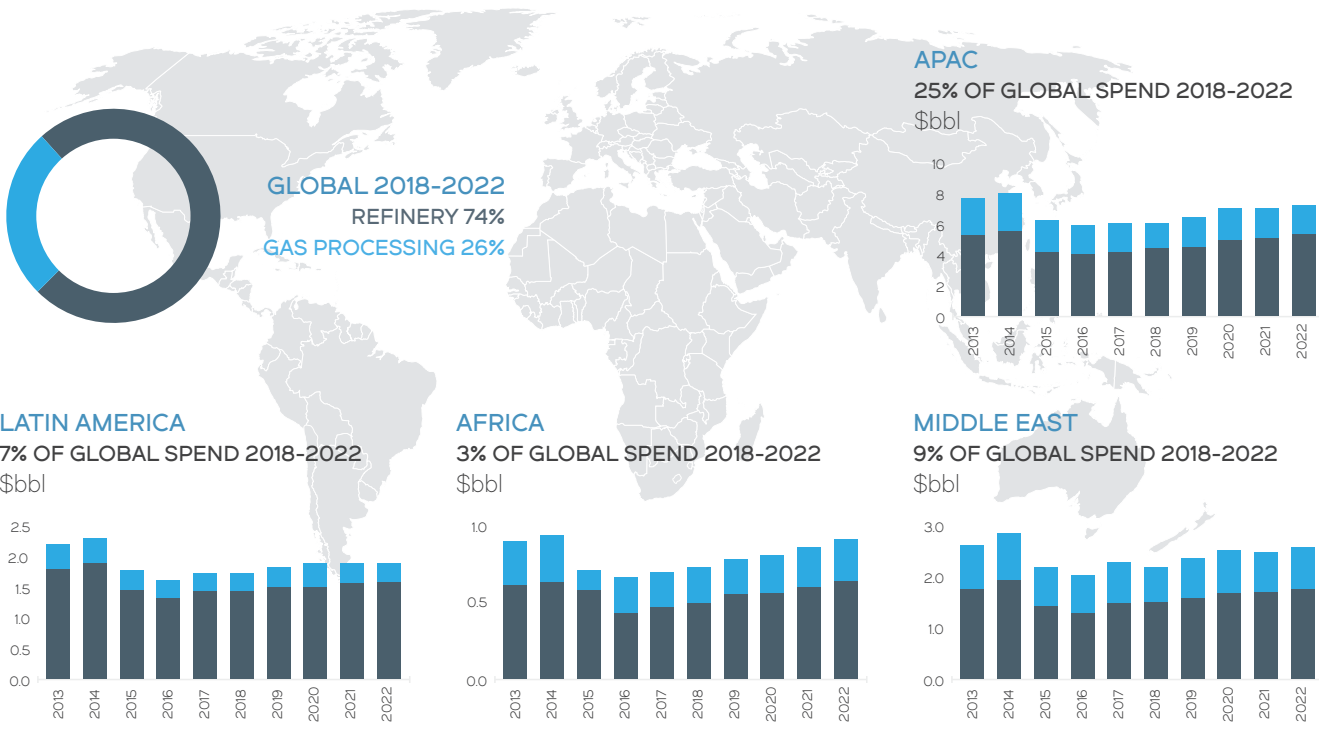
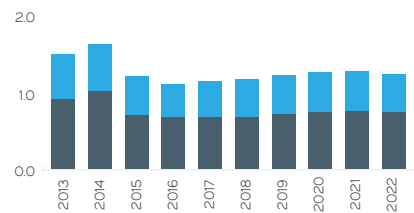
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## EE & FSU

5% OF GLOBAL SPEND 2018-2022

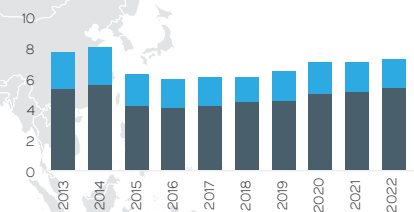
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## APAC

25% OF GLOBAL SPEND 2018-2022

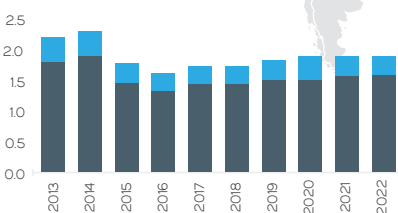
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## LATIN AMERICA

7% OF GLOBAL SPEND 2018-2022

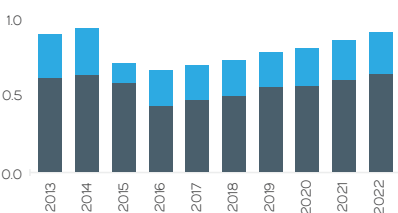
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## AFRICA

3% OF GLOBAL SPEND 2018-2022

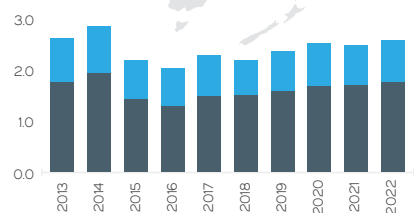
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## MIDDLE EAST

9% OF GLOBAL SPEND 2018-2022

\$bbl





Now, let us look at the trends shaping the refining and gas processing segments separately and in greater detail, as this will help us identify the ways in which digitalisation plays a key role in helping downstream operators optimise their assets and their organisations for the future.



# SPOTLIGHT ON REFINING

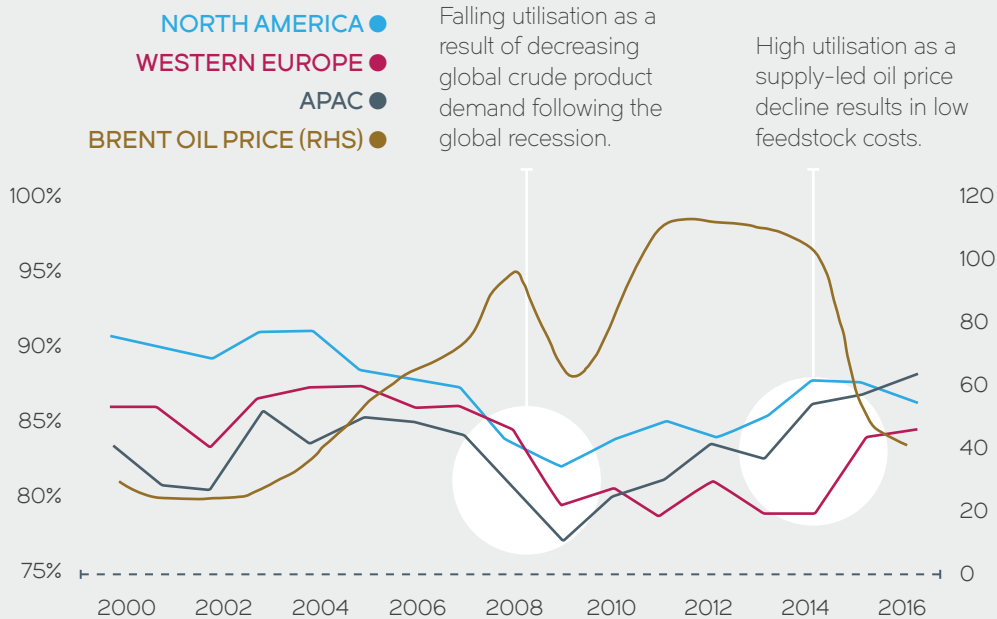
## The importance of maintenance even amid high utilisation

Sustaining utilisation through routine maintenance procedures is vital to refining profitability. Although large maintenance turnarounds are often delayed during periods of high asset utilisation, it is important that refineries keep up with routine maintenance in order to prevent unplanned downtime.

Global economic activity is an important driver of the demand for refined products. The market is typically cyclical, with the summer and winter months bringing high fuel demand for transport and heating. Periods of low oil consumption, such as those following the global recession in 2008, result in low refinery runs with utilisation falling from an average of 86% in 2007 to around 80% in 2009.

The recent supply-led oil price recession has had the opposite effect, with utilisation increasing as refineries profit from improved margins. Refineries in North America and Western Europe were working close to full capacity at approximately 85% utilisation in 2016.

**REFINERY UTILISATION AND ANNUALISED OIL PRICE**  
%, 4/bbl (RHS)



Fluctuations in the oil price result in changes to the price of refining feedstocks and corresponding fluctuations in refining margins. The recent oil price downturn reduced feedstock costs which initially widened refining margins and led to high utilisation as refiners sought to benefit from the higher margins.

While this push to reap higher margins through high utilisation may cause refinery operators to deprioritise and delay efforts to maintain or upgrade their assets, this decision is likely to have unintended negative effects on profitability as this approach results in a greater risk of unplanned downtime. Over the long term, this may also result in an asset becoming uncompetitive in a market where more

progressive refiners digitise their assets to make better use of equipment performance data.

Today, margins are above the 10-year average, although they remain significantly suppressed since their 2015 peak. In March 2016, margins began to decline in response to the sustained low oil price environment, the glut of refined products and slow economic growth expectations. Further oil price recovery is likely to put additional pressure on margins.

This trend provides refineries with even more incentive and opportunity to embrace digitalisation proactively as a means of optimising operations and to get the most productivity out of existing assets.

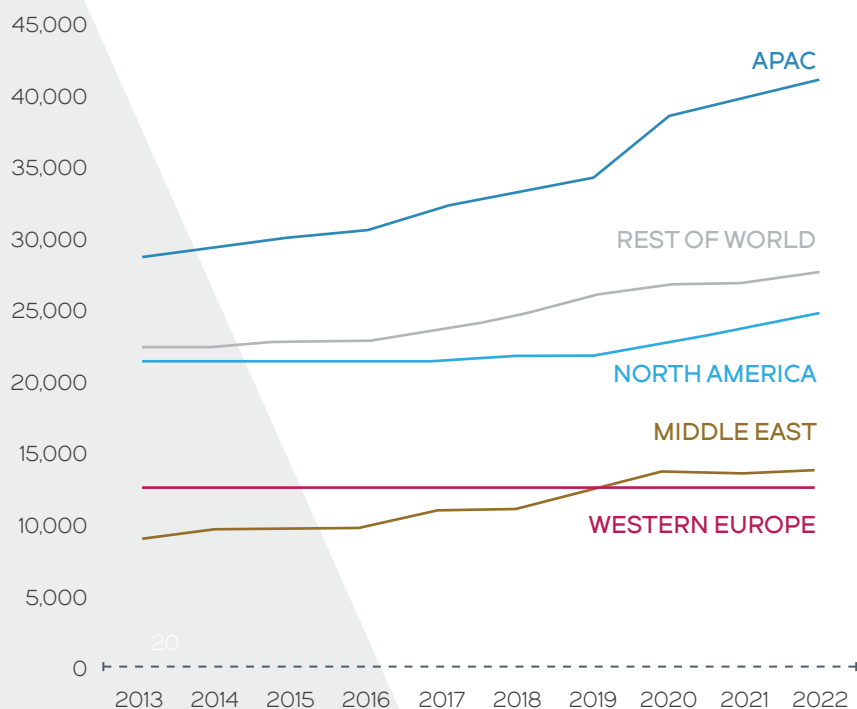
**'Reducing unplanned plant downtime, making upgrades to the refinery faster and improving efficiency. Real-time data delivery to different parties is something we are looking at to optimise operations. A lot of our measurements are manual so would need a lot of work, but automation would be quite beneficial.'**

Independent Refinery Operator, Europe

## Understanding the refining facility population

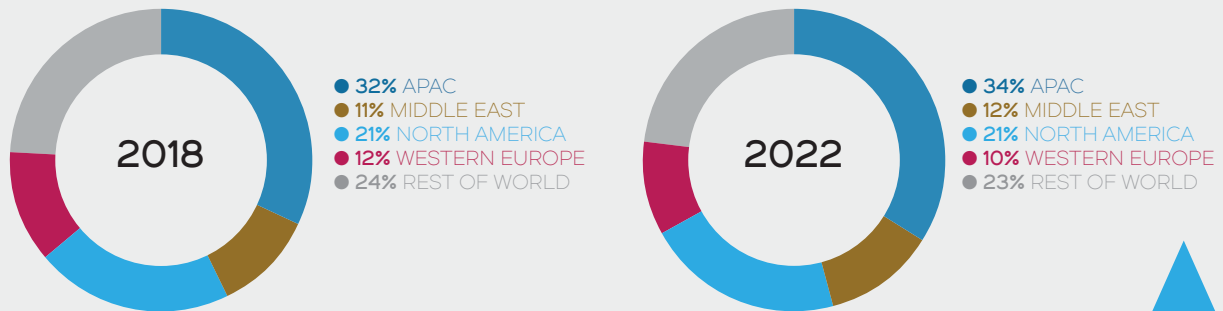
The global refining population drives the need for maintenance, particularly where facilities are ageing. Changes in feedstock and growing competition from regions such as the Middle East signal the need for the expansion or modification of many facilities, and a push for new operational standards.

GLOBAL REFINING CAPACITY BY REGION

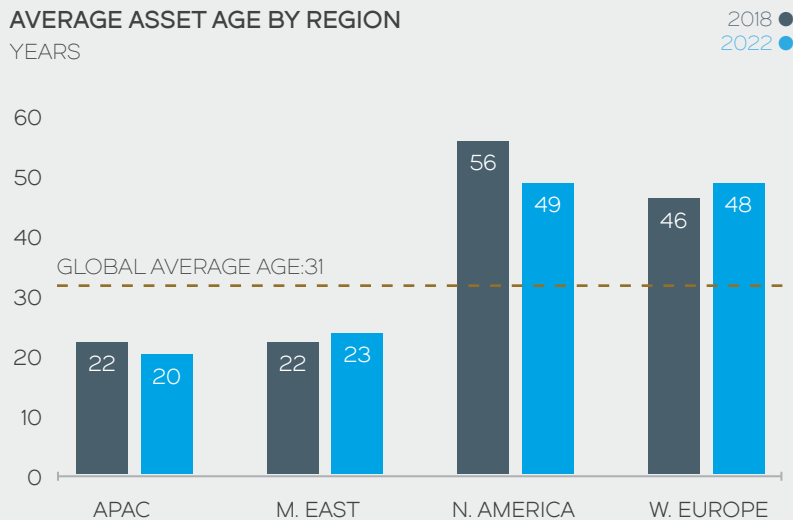




### REGIONAL SHARE OF GLOBAL REFINING CAPACITY 2018 AND 2022



### AVERAGE ASSET AGE BY REGION YEARS



APAC is by far the largest region, with China accounting for approximately 12% of global capacity in 2018. Growth will be driven by projects in China and India to meet rising oil product demand from the growing economies.

US capacity has remained stable, with no major new refineries since 1977. However, the recent shale boom has created a need for the industry to adapt its refineries for processing the abundance of light, sweet shale oil.

Key US greenfield projects include Raven Petroleum's \$500 million refinery in South Texas, able to process 50 kbb/d of light crude; MMEX Resources' c. 50 kbb/d Fort Stockton Refinery in the West Texas Permian basin; and Meridian Energy Group's c. 55 kbb/d refinery in North Dakota.

Capacity growth within the Middle East is predominantly driven by a desire to diversify economies that are heavily reliant on crude export revenues and to reduce dependency on imports of goods such as middle distillates, diesel and gasoline.

Ageing facilities in Western Europe have faced tougher competition from newer and more complex facilities in APAC and the Middle East which are able to process lower quality, and thus cheaper, feedstocks.

# SPOTLIGHT ON GAS PROCESSING

Growing demand drives need for maintenance

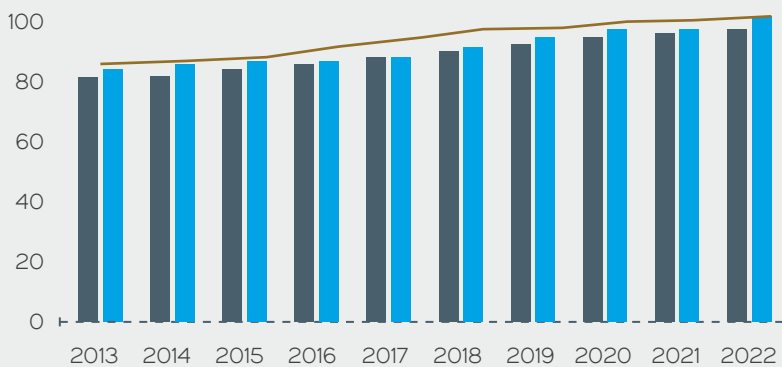
Growing gas demand and recovering prices should encourage significant spend on maintenance of gas processing facilities and on capacity addition, as operators continue to favour gas production. Recovering the increasing percentage of natural gas liquids (NGLs) produced with natural gas is expected to become a key priority.

The main drivers behind gas processing are the demand and the price for natural gas. These forces dictate the gas processing capacity required to prepare natural gas for distribution and consumption. Gas has seen an increased share of the global energy mix, as a function of growing demand and the development of liquefied natural gas (LNG) technology.



**GLOBAL NATURAL GAS OUTLOOK  
2013 - 2022**  
mm/boe/d

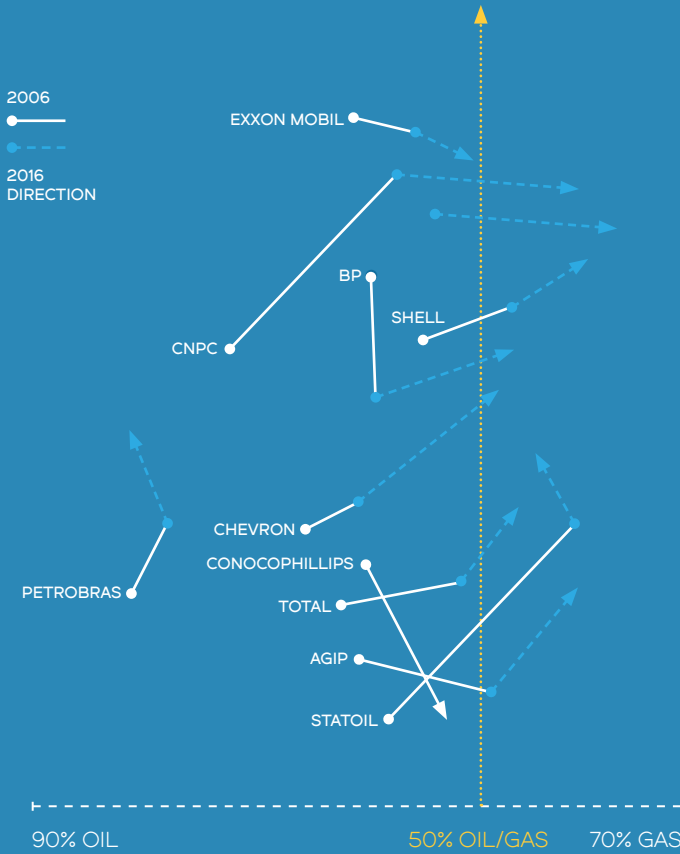
DEMAND ●  
PRODUCTION ●  
CAPACITY ●



Due to the substantial increase in the use of natural gas for power generation in recent years, the majority of large E&P companies have increased the proportion of natural gas in their output mix. The global push towards using cleaner fuels is expected to intensify, further driving the shift of operators towards natural gas production.



SHIFTING OPERATOR FOCUS  
HYDROCARBON PRODUCTION VS. %OIL/GAS



The shifting operator focus is expected to support demand for gas processing expansions and new facilities, which in turn will drive future demand for gas processing maintenance expenditure.

Utilisation of gas processing facilities has dropped following the downturn to its lowest at around 93% in 2017. However, utilisation is expected to recover at a rate of roughly 2% year on year to reach 99% in 2021.

As produced, natural gas contains impurities such as carbon dioxide and other hydrocarbons, mostly NGLs. Gas processing plants are required to remove the unwanted substances to obtain the products sought after by end-users.

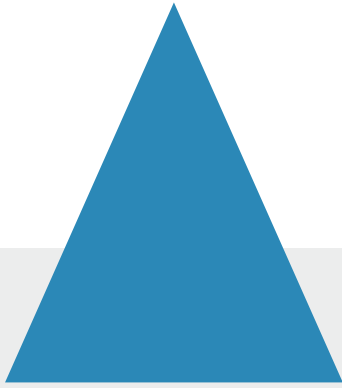
To meet pipeline standards, as production of natural gas increases, the need to separate the heavier hydrocarbons from the commercial natural gas becomes greater. Gas prices dropped roughly 40% following the downturn but recovered approximately 18% in 2017 from the lowest point in 2015. Increasing prices are expected to encourage capacity additions.

On the other hand, the increasing use of NGLs (for example, as feedstock for the petrochemical industry) has kept the price of these liquids relatively high compared to natural gas prices. Due to the NGL-rich composition of US shale and Middle East gas basins, new gas processing facilities are expected to be designed to recover higher percentages of NGLs for commercial use.

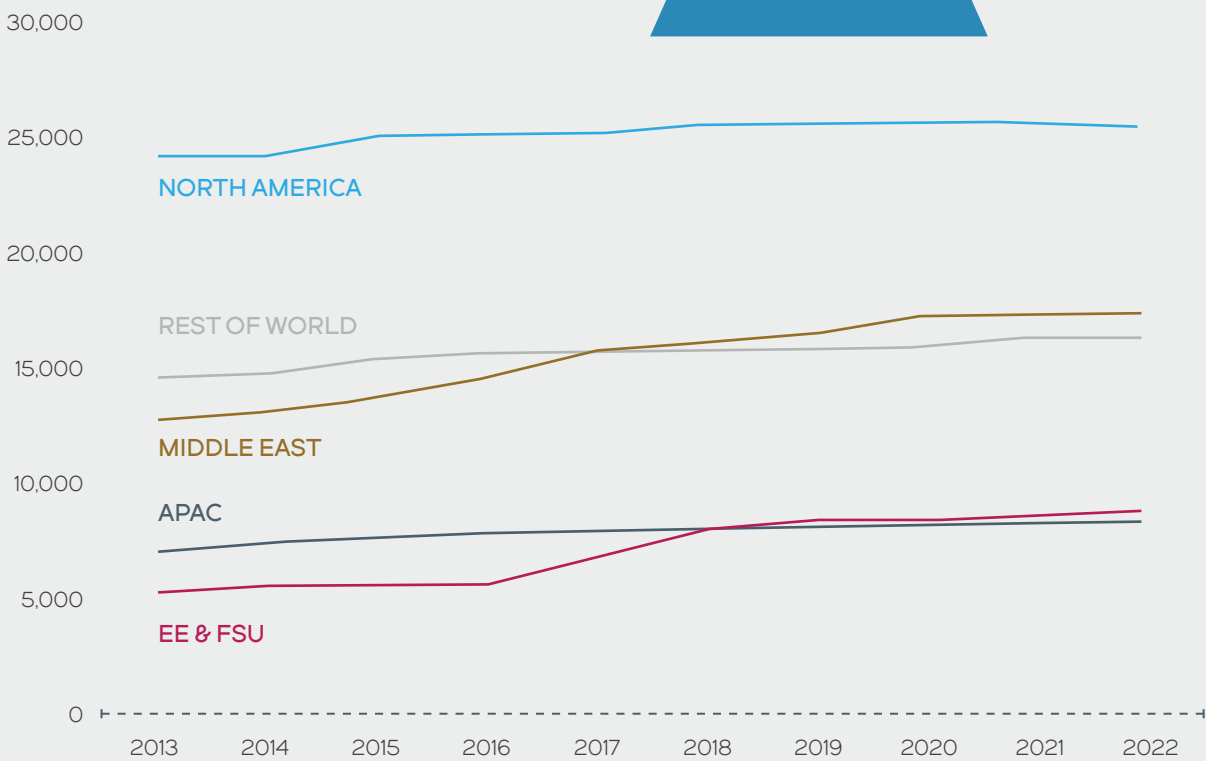
Whether looking to upgrade existing assets or build new facilities to support rising demand, gas processing operators can turn to digitalisation and intelligent data management as mechanisms for optimising productivity and profitability. New facilities and expansions present particularly ripe opportunities for going digital from the start, allowing progressive operators to turn leading-edge technologies and robust data capabilities into competitive advantages. This said, operators are smart to look to digitalisation even for brownfield projects as a means of not only modernising but also future-proofing older assets.

## Understanding the gas processing facility population

Global gas processing capacity drives the need for maintenance of the ageing population, which averages 69 years.



GLOBAL GAS PROCESSING CAPACITY BY REGION



The global population is relatively flat going forward, although the Middle East, Eastern Europe and Former Soviet Union (EE & FSU) will see significant growth driven by increasing natural gas demand. This is largely a result of the need to deal with expected growth in gas production combined with rapid gas demand growth, as governments reduce their reliance on oil for power generation.

Iraq has announced plans to limit gas flaring, providing an incentive to invest in new gas processing facilities. Contracts have already been awarded for a plant to capture and treat gas from the West Qurna-1, Zubair and Rumaila fields.

Large greenfield projects include Gazprom's Amur plant in Svobodny in Russia and Saudi Aramco's Al Fadhili and Khurais plants in the Kingdom of Saudi Arabia (KSA).

North America is the largest region for gas processing activity, primarily due to the abundance of natural gas in the region, particularly from recent shale developments.

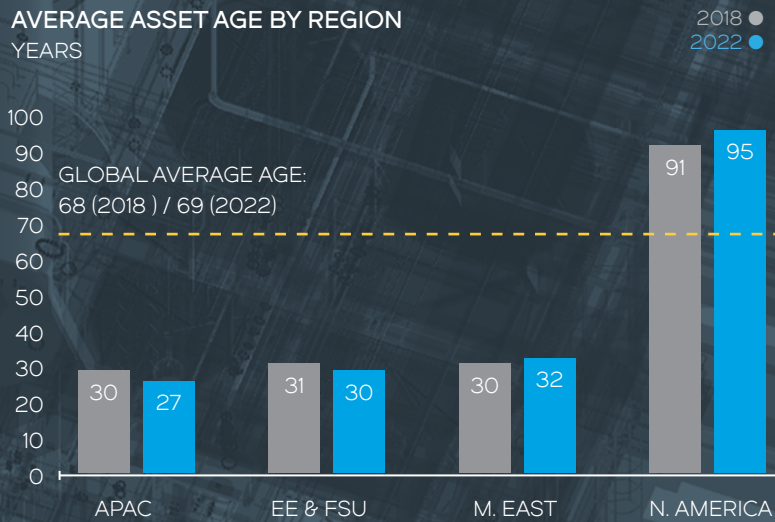




### REGIONAL SHARE OF GAS PROCESSING CAPACITY 2018 AND 2022



### AVERAGE ASSET AGE BY REGION YEARS



Digitalisation is a core thing, it's a given. It's how we now design refineries and the way we build them, or any GTL asset to that extent. Everything is digital. ”

EPC, Europe





# INDUSTRY VIEWPOINT

Will digitalisation drive downstream productivity and profitability?

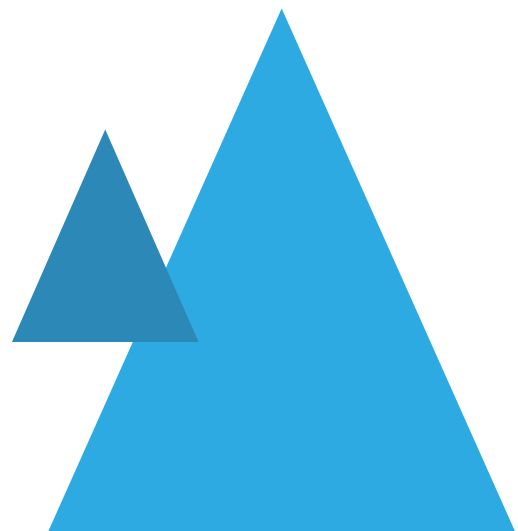
AVEVA, in partnership with Westwood Global Energy Group, conducted interviews with refinery and gas processing plant operators (integrated and independent), to gain a better understanding of how digitalisation is currently being implemented within the downstream refining and gas processing sector.

The interviews focused on:

- The extent of digitalisation adoption within the downstream sector.
- The challenges associated with digitalisation, particularly during the implementation process.
- The perceived benefits of digitalisation and areas for value addition.
- Lessons learnt from existing digitalisation initiatives.
- Next steps for digitalisation in the downstream sector.

We found that, while individual operators vary widely in their own digital strategies and in their rate of digital adoption, they all agree that the digitalisation of downstream assets can improve profitability by allowing for greater efficiency, lower downtime and higher utilisation.

Further, our findings confirm that digital transformation with real-time access to data can create a more robust, safer and more reliable environment. While some downstream assets are fairly well digitalised with automation and significant data collection, downstream players can add value through ensuring accurate data collection and advanced analytics to enable a fully effective digital information management system. Current digitalisation initiatives also make clear the need for planning, communication and sufficient training to guarantee successful implementation.



# THE STATE OF DOWNSTREAM DIGITALISATION

Downstream operators agree that digitalisation is a growing focus within the sector, with downstream players recognising digital as a vital mechanism for better, faster decision making. This, in turn, allows operators to achieve greater efficiency, higher productivity, improved cost savings and increased profitability.

Despite this widespread understanding of the value digitalisation can provide to downstream players, the actual extent to which digital has been adopted varies by operator. This suggests that where an organisation stands on digital implementation is largely based on the asset operator's own preference and strategy.

It may also be influenced by an operator's mind set.

Some respondents view digitalisation as a relatively new phenomenon, and an area in which this industry lags behind others, due in part to the complexity of digitising legacy assets.

Others recognise today's drive toward digitalisation as the natural evolution of technological advances already under way across the industry, and a key opportunity to optimise performance through faster, more efficient, more sophisticated analysis of data and application of insights.

**'We're concentrating on digitalisation as the main mechanism for moving forward in the years ahead. It allows us to make decisions quicker and with more knowledge.'**

Integrated Refinery Operator, Middle East

**'The downstream sector has embarked on digitalisation mostly in recent years, which makes it still behind other industries and sectors. A lot of plants are already 10 or more years old, so trying to make digital work at these places is challenging. Most of the initiatives I see are at newer plants and new projects.'**

Integrated Refinery Operator, Asia



Greenfield projects are the most highly digitalised due to the ease of implementation. New assets being built in Asia and the Middle East are likely to be highly digitalised as there are fewer challenges involved with implementing digitalisation in new assets, when compared with brownfield implementation.

In less digitalised assets, the asset operator may have initially focused on the digitalisation of the retail element of the downstream sector. In such examples, the digitalisation of asset operations is considered the next step in the digitalisation strategy.

The digitalisation of downstream plants typically begins with digital planning and management systems (e.g. ERP systems) to ease integration of the supply chain. Digitalisation of process control systems and models may then be implemented to drive efficiency and improve data analytics, with the aim of utilising advanced analytics and predictive maintenance.

The most advanced refineries are beginning the process of creating a Digital Twin, and Westwood's conversations with engineering, procurement and construction (EPC) players indicate that they are receiving interest from many other downstream operators.

**'There's sometimes the perception that we are starting from nothing and that digital will completely transform the way we do business. In reality, it's more of an evolution. Further digitalisation will enable us to interrogate, analyse and take action on data more quickly, efficiently and robustly. It will allow us to do what we have always done, in a deeper way.'**

Integrated Refinery Operator, Europe

**'Digitalisation of our downstream business is mixed. Our retail business is the most digitalised whereas within refineries we still rely on legacy systems which have been built during the 80s/90s. It is high on the agenda, but the digitalisation programmes currently are more customer facing and are more advanced on the retail side.'**

Independent Refinery Operator, Europe

**'Digital is everywhere. We've completed phase one of a refinery project where we are implementing a Digital Twin – scanning all equipment in the plant and assigning attributes. Not all refineries are as advanced, but they are beginning to think about it, and may have progressed, but not on the scale we have in this project.'**

EPC, Europe



## Key benefits of digitalisation

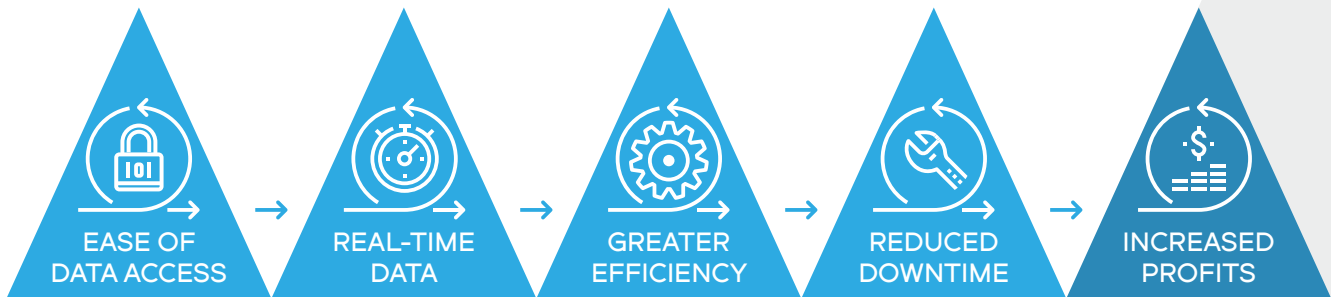
If the adoption of digital varies widely from operator to operator, the main benefits are something our respondents can agree on.

Digitalisation enables downstream players to run a more efficient operation by increasing the profitability of their assets, particularly as the ease of access to real-time data results in greater efficiency, reduced downtime and higher utilisation. As one respondent from an independent refinery operator in Asia said, 'The main benefit is definitely the improvements to the bottom line – digitalisation brings you profit increases.'

**The real benefit is efficiency improvements through real-time data and ease of access from a Digital Twin. You bring data collected from different departments together and incorporate access across the company. This improves communication as it means that the communications of all your departments are now in one environment.** ”

EPC, Europe

### BENEFITS OF DIGITALISATION IN DOWNSTREAM SECTOR



Real-time access to data across an operator's downstream asset base results in better decision making as it:

- Creates ease of access to data across global assets.
- Allows for the immediate remedy of issues or problems.
- Reduces the effort required during turnaround operations, which subsequently reduces downtime and allows for greater refinery utilisation.



'Real-time access to data is invaluable. If you get the information available to each decision maker in real time, that person can make much better decisions. Digitalisation will be required in one way or another by companies in order to succeed in the future – it's a matter of how quickly companies can get it and fully benefit from it.'

Integrated Refinery Operator, Middle East

'Access to real-time data across the world allows better decision making. Digital files can be shared easily in different offices globally. The human touch is missing, but we are achieving the objective effectively and at a fraction of the cost of having us both sitting together.'

EPC, Europe

'Analytics of real-time data can add advantages to the plant operation and the bottom line. In my area of production planning, being able to have a better forecast of a unit's availability and health can greatly improve how we would plan for it. Having many unplanned shutdowns and unreliable data as input can make planning unrealistic.'

Integrated Refinery Operator, Asia

The challenge is to deal with existing infrastructure which is 10+ years old. Until about 10 years ago, software capabilities in the area were not as developed as today. You might have to do some back-drafting to capture old assets. Also, generally, there was no future vision on old assets and things were not properly recorded. ”

EPC, Europe







# BARRIERS TO DIGITALISATION

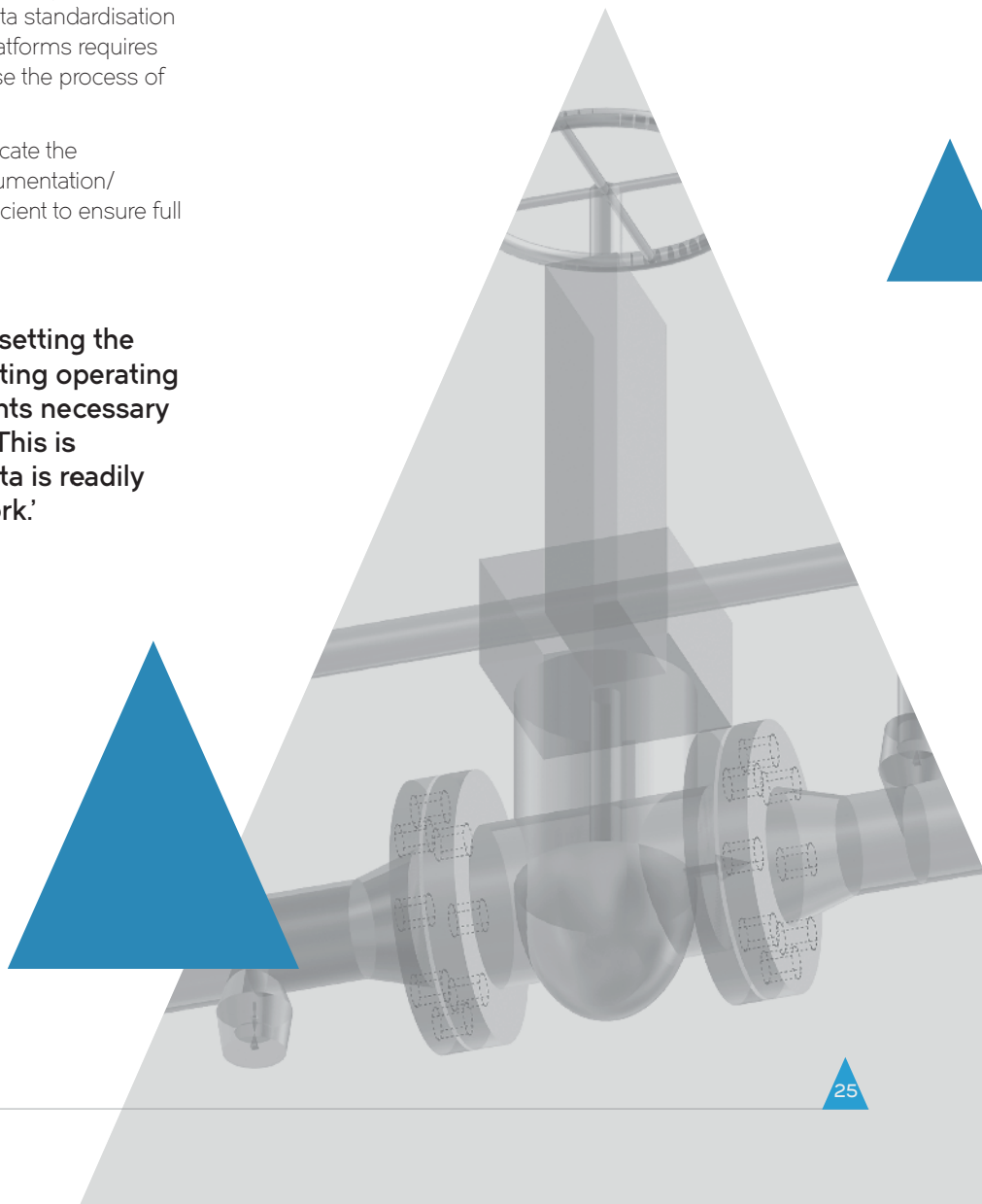
The benefits of digitalisation may be easily understood, but they may not be so easy to achieve. Participants noted that legacy systems in brownfield plants and the need for accurate and reliable data collection are among the main challenges to digitalisation. Digitalisation of greenfield plants is far simpler as all digital processes can be built in from the engineering stage.

Existing assets often utilise numerous software platforms, resulting in integration challenges when data standardisation is required. Ensuring coherent software platforms requires a long-term technology vision that can ease the process of creating a unified platform.

In older assets, legacy systems will complicate the implementation process and existing instrumentation/ measurement equipment may not be sufficient to ensure full data capture and operational benefits.

**'One of the other challenges is setting the system to connect into the existing operating system and get all the data points necessary to move into digital operation. This is required to ensure real-time data is readily available for the analytics to work.'**

Integrated Refinery Operator, Asia



In older assets, legacy systems will complicate the implementation process and existing instrumentation/measurement equipment may not be sufficient to ensure full data capture and operational benefits.

Prevalence of outdated document systems was noted as one of the key challenges to implementing digital information management systems in brownfield refineries and gas processing plants. Incorporating legacy systems into a unified system will require greater time and effort, and the addition of integration layers that standardise the data.

Participants also noted that, to achieve maximum gains from digitalisation, operators need to guarantee data accuracy and ensure that the plant has the level of data collection required to achieve useful data analytics. This is of particular importance for 3D models and Digital Twins.

**'The challenge is to deal with existing infrastructure which is 10+ years old. Until about 10 years ago, software capabilities in the area were not as developed as today. You might have to do some back-drafting to capture old assets. Also, generally, there was no future vision on old assets and things were not properly recorded.'**

EPC, Europe

**'One of the other challenges is setting the system to connect into the existing operating system and get all the data points necessary to move into digital operation. This is required to ensure real-time data is readily available for the analytics to work.'**

Integrated Refinery Operator, Asia

**'The data sits in a wide range of legacy systems – refineries do not all have the same underlying data structures and processes. Integration layers are needed to translate. This can take time and is often a bespoke application. New refineries starting up in the Middle East, etc., won't have the same challenges with legacy equipment.'**

Integrated Refinery Operator, Europe

As many digital transformation analysts note, digitalisation efforts can be hampered not only by technological barriers but also by human barriers. With this in mind, it was no surprise to find that, according to our respondents, not all challenges relate directly to technical implementation and integration.

Participants cited a range of human challenges including the reluctance of management to accept digitalisation as a priority investment area, overcoming security concerns, and the need for staff who are trained and proficient in the new software.

**'For data analytics, the challenge is, do we have the raw data to get the most out of it? There's a lot we don't measure and retrofitting a refinery to increase instrumentation and measurement is expensive. So, just getting the level of instrumentation and data gathering that you need in order to take full advantage of digitalisation is a challenge.'**

Integrated Refinery Operator, Europe

**'With a Digital Twin, you need to ensure the accuracy of the scans. You also need good data – the data from instrumentation, piping, mechanical equipment, etc., needs to be maintained. Everybody uses different programs to manage it and so what you need is one environment which can be used by all to view the master data.'**

EPC, Europe



Utilising the full benefit of the technology is a challenge – the refinery may be 100% digitalised but unless the people using it fully understand how to analyse and utilise it, then it won't be used effectively. Education on what can be achieved is required. Continuous training is needed to get the full benefit. ”

Integrated Refinery Operator, Middle East

# FACTORS FOR SUCCESSFUL DIGITALISATION

With the benefits understood and the barriers identified, we turned our attention to the factors that have contributed to the success of digitalisation initiatives already underway at downstream organisations.

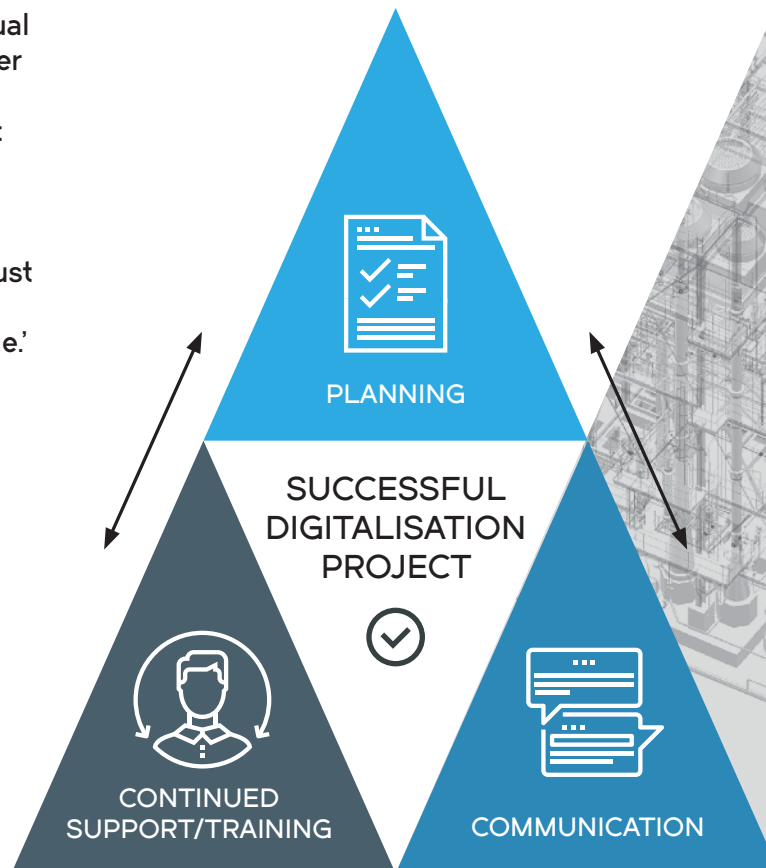
Participants who are already on the path toward digitalisation point to three vital factors for successful implementation:

1. CAREFUL PLANNING
2. CLEAR COMMUNICATION
3. CONTINUED SUPPORT/TRAINING FOR COMPANY PERSONNEL

Even if digitalisation appears simple in concept, the challenges noted by participants are likely to complicate the process in reality. As such, thorough planning of digitalisation projects is essential for a smooth implementation process. There must be a long-term vision so that each decision is made in a coherent manner, and also short-term action that delivers quick wins, applicable learning and achievable outcomes.

**'Theory can be one thing; actual implementation can be another – these things are potentially difficult to do. Reality is that it needs lots of people working together to get value added. If you are able to leverage the technology to get a more robust set of data and insights more quickly, then you can add value.'**

Integrated Refinery Operator, Europe





Start with small projects, learn from them, and move toward implementing in other areas. It's really easy to dream a big change but the effort needed can be a lot. ”

Integrated Refinery Operator, Asia

Throughout the digitalisation process, good communication among all parties involved is crucial in order to overcome challenges and ease implementation.

Support throughout the process and comprehensive training from technology providers will also help ensure that all parties are able to use all new technology to the full advantage.



‘You need good communication. We had some issues at the beginning with communication, as you have input from four major parties who really need to work together and create an environment to create an application that is accessible across users.’

EPC, Europe

‘You need to give time to prepare, so then it's an easy process from non-digital to the digital platform. This is the most important lesson we took – communication. Communicate, communicate, communicate! Make people aware of the value, provide training and communicate during the implementation process.’

Independent Refinery Operator, Asia

‘Having the developer's support through the whole process, to sustain what has been implemented, is vital. We saw much greater success in our own implementation projects when we had the developer's support.’

Integrated Refinery Operator,  
Middle East

# KEY CONCLUSIONS

Although the downstream sector has been affected by the industry downturn to a lesser extent than the upstream sector (particularly refining, which initially saw improved margins in the wake of the downturn), downstream operators have still put considerable emphasis on cost rationalisation.

Given the low-margin nature of refinery and gas processing plants, maintenance is seen as a critical measure for reducing downtime, maximising utilisation, and achieving profitability.

Digitalisation, in turn, is increasingly seen as a core component of any maintenance plan, as it plays a substantial role in improving plant efficiency and reducing the time taken for large turnarounds. Digital, therefore, presents a path toward

reduced downtime and higher utilisation that ultimately deliver improvements to the asset's bottom line.

In short, for downstream operators asking whether digitalisation holds the key to greater profitability, the answer is 'yes'. But achieving the benefits of digitalisation requires operators to first recognise data-related challenges and then mitigate them through detailed long-term planning.



## DATA MIGRATION CHALLENGES ARE COMMON

- ✗ Data migration issues are a common problem, particularly for the implementation of digital information systems and where multiple software platforms exist.
- ✗ Legacy systems in brownfield assets are often problematic, requiring significant time and effort to incorporate into a unified system, and requiring integration layers to standardise the data.
- ✗ Successful implementation of 3D models or "Digital Twins" requires reliable data in order to optimise the results - difficult where master data has not been maintained.
- ✗ The integrity of master data also needs to be maintained during the implementation process.

## MITIGATE THEM THROUGH LARGE-SCALE PLANNING

- ✓ Challenges can be mitigated through detailed planning, core to the successful implementation of a digitalisation project.
- ✓ Extensive planning will limit cost overruns that arise from unforeseen complications, allowing the upfront investment to be recovered quicker.
- ✓ Understanding the limitations of the master data is essential to ensure potential issues are anticipated and data can be collected into actionable and meaningful information.
- ✓ Benefits of the initiative need to be thoroughly communicated with the provision of extensive training, so that change can be managed and processes will be utilised effectively.

## TO ACHIEVE THE MULTIPLE BENEFITS OF SUCCESSFUL DIGITALISATION

- ✓ Lower Opex costs, increased efficiency and resulting higher asset utilisation are key benefits, all of which positively impact profitability.
- ✓ Digitalisation eases data access across departments and assets, improving communication and operational processes.
- ✓ The ability to access real-time data and insights is a key benefit that can improve plant maintenance procedures, particularly when used to support predictive rather than reactive maintenance regimes.
- ✓ Increased safety and fewer personnel are also core benefits achieved through digitalisation.

# WHAT ARE THE NEXT STEPS FOR DIGITALISATION?

Although digitalisation is still in its early days for the downstream sector, operators agreed that it will be a major focus area and a clear strategic priority within the refining and gas processing industries. Participants in our study pointed to three core initiatives that downstream providers can undertake as part of their digitalisation programmes.

First, implement an intelligent engineering master data management system (especially in brownfield assets) to enhance data management across the asset lifecycle. Given the extent to which data challenges – from access to analysis, from migration to integration – can put a damper on successful transformation, it makes sense that downstream operators begin their digital journey by taking control of the data that informs their business. Data not only unlocks efficiencies but provides a level of insight into the operation as a whole and your assets in particular, giving you a better view into productivity and a better lever to maximise profitability.

Second, develop intelligent facilities through the implementation of advanced technologies such as big data, advanced analytics, cloud IIOT, UAVs and 3D models. These technologies not only allow operators to future-proof their plants, they also serve as the basis for increased automation and a rich source of information (data) about operations.

Third, implement a Digital Twin in order to optimise value from effective data collection, analysis and interpretation. In fact, the first two steps are often implemented with the end goal of creating a Digital Twin that enables value optimisation in terms of safety improvements, reliability and profitability.

**'One of the big costs of refining is the routine turnarounds; we're looking at how data analytics can drive efficiencies... Turnaround processes can benefit from increased availability of sensing, monitoring, etc. If you can squeeze 10% efficiency out of a turnaround you can save a lot of money, not even including the saving on the downtime costs.'**

Integrated Refinery Operator, Europe

**'The use of more sophisticated data analytics that give you deeper insight. When things aren't working correctly, big data analytics can take all the plant data and conditions to see if it can reach an insight.'**

Refinery Operator, Europe

**'In my opinion, digitalisation is in its early stages. We are experimenting with new tools, applications, with things that were not possible before.'**

EPC, Europe





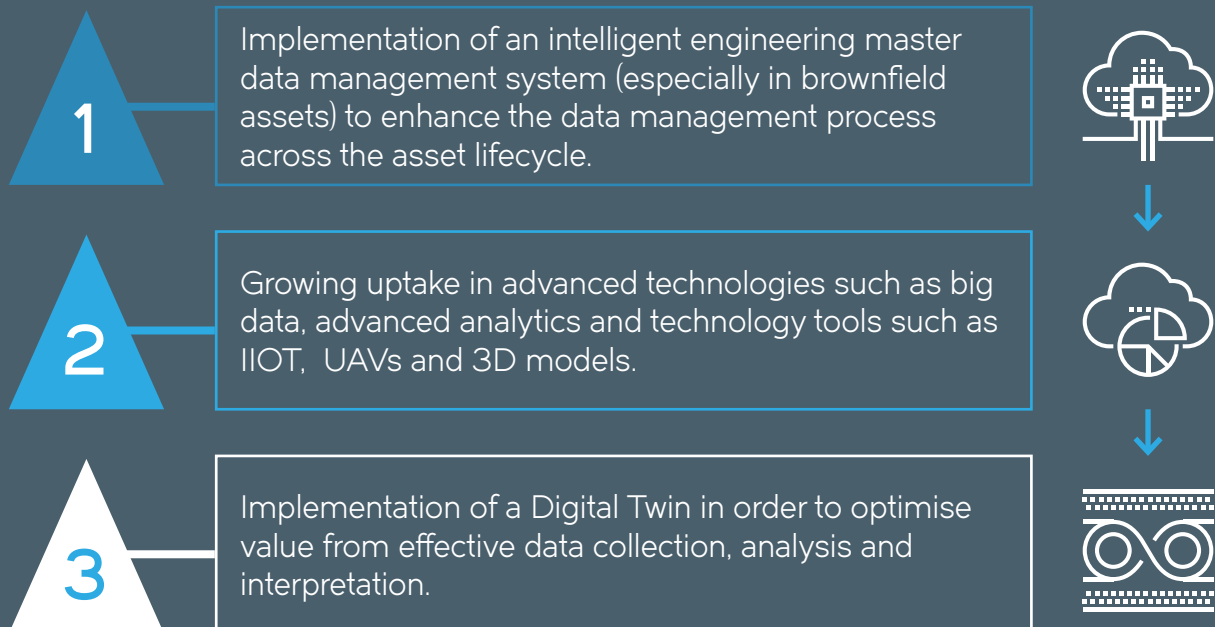
'When we do digitalisation, all of the automation, advanced analytics, cloud, IIOT, etc., are required to make sure it is the most efficient and optimal output. When we start advancing the collection of data, of course we will need to analyse it, and so all of the digital initiatives interlink.'

Independent Refinery Operator, Europe

'I think the cloud will be a big next step. I think over the next couple of years the cloud will really improve. Things will be in the cloud from my point of view, there's no doubt about it.'

EPC, Europe

## Digitalisation Steps within the Downstream Sector



I absolutely think other refineries will look at what we have done with the Digital Twin project and develop their systems similarly. We've had quite a lot of requests and questions about it. New refineries have it much easier, as the processes can be built in. Doing it from a brownfield perspective, as we did, is much more difficult. ”

EPC, Europe





## About the authors



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Westwood Global Energy Group

Arindam leads Westwood Global Energy Group's consulting engagements across the EMEA region. Arindam started his career as a Logging While Drilling (LWD) field engineer and spent approximately five years with Baker Hughes in the Gulf of Mexico. Following an MBA specialising in Finance, Arindam's experience over the last ten years includes financial & commercial advisory services and principal investments in the energy industry. Arindam's international work experience encompasses India, USA, UK and Canada.



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Kathryn primarily works on bespoke consultancy, including due diligence analysis and advisory work for a number of global companies. Kathryn has conducted high-level research into the oil and gas supply chain, particularly in regards to the FPSO, vessels and the MMO market, including a focus on the downstream sector having authored the first edition of the 'World Downstream Maintenance Market Forecast' publication and work towards subsequent editions. Kathryn graduated from the Queen Mary University of London in July 2010 with an Honours degree in Economics.

## About AVEVA

AVEVA is a global leader in engineering and industrial software driving digital transformation across the entire asset and operational life cycle of capital-intensive industries.

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