

THE BUSINESS CASE FOR REFINING OPERATIONS MANAGEMENT – PART 1

Enabling Step-change in Performance with Refining
Operations Management

WHITE PAPER

October 2018

By **STANLEY DEVRIES**,
Senior Director, Solutions Architecture

STUART PARKER PH.D., PE
Director, Global Consulting

SREE HAMEED,
Enterprise Software Solutions Support

Executive Summary

Leading petroleum refineries are continuously pressured to achieve, sustain and then again reach the next level of performance. AVEVA Refining Operations Management (formerly known as the Integrated Refinery Information System or "IRIS") is a proven solution that digitises operations management business processes, accelerates the decision-making activity, and delivers far more trustworthy information. Revenue increases of at least 1% and cost reductions of at least 1% can be realised and sustained.

AVEVA[™]



Audience

This document is intended for business leaders in the Refining industry who are seeking to drive a step-change in performance improvements across their end-to-end value chains by leveraging a digital operations strategy.

Summary

Leading petroleum refineries are continuously pressured to achieve, sustain and then again reach the next level of performance. Recent investments in catalyst and process equipment, automation and information technology cannot easily produce further improvements by themselves. A system that enables the management of real-time operational information in an integrated manner, like AVEVA Refining Operations Management (formerly known as the Integrated Refinery Information System or "IRIS"), can help break through to the next level of performance in the following ways:

- **Refining Operations Management helps unlock hidden/captive value:** Performance gains made by early adopters of Refining Operations Management show significant contribution to profitability goals and invested capital.
- **Refining Operations Management closes the digital operations gap:** Addressing the steps in an end-to-end refinery value chain as an integrated whole is driving the next productivity frontier in petroleum refining. Although it goes by different names (Digital, IoT, Industry 4.0) they all reflect a common theme of digitisation of business processes, with huge potential especially for areas like operations management.
- **Refining Operations Management enables a step-change in process:** Unlocking the captive/hidden value requires dealing with events closer to real time — in particular, the many minor performance deviations or "value leaks" that occur on a daily basis. Schneider's approach to real-time performance management is based on the principle of systematically compressing the closed loop (Detect-Understand-Decide-Act) decision-making process by increasingly embedding or shifting more of the business rules and policies closer to the front lines of execution. This is a key element to achieving further improvements.
- **Refining Operations Management is a proven solution adopted by industry leaders:** AVEVA has worked with a number of leading companies to help their operational transformation initiatives in enabling Refining Operations Management in real time.

Companies evaluating an integrated, real-time operational system like Refining Operations Management are encouraged to consider the business decision in terms of enabling the right level of operational integration to gain the agility where the business can adapt to changing business conditions and exploit new opportunities.

Unlocking Captive Value Potential within Refining Operations

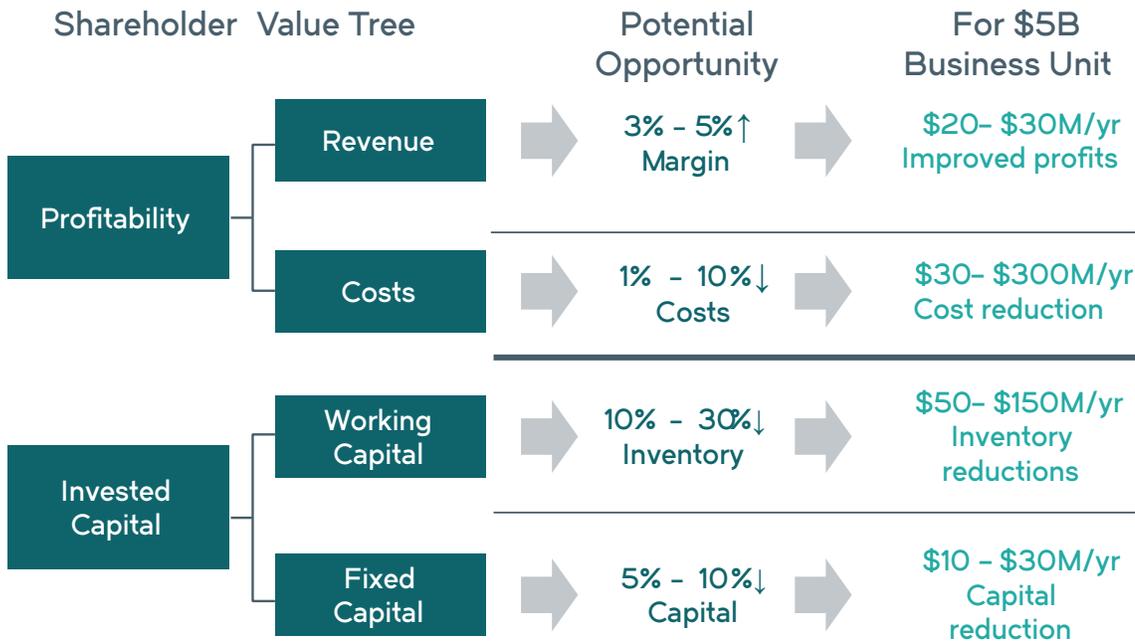
To understand the performance improvement potential in quantitative terms, consider the benefits to a 400,000/bpd refinery from integrated refinery information management processes:

- Revenue increase of at least 1% which is worth more than USD 67 Million per year per percent improvement, which is achieved through improved availability and yield
- Energy efficiency increase of at least 4%, which is worth more than USD 20 Million per year, which is achieved through proactive operations and closer coordination through the "internal value chain"
- Further cost reductions of at least 1%, which is worth more than USD 60 Million per year per percent improvement, which is achieved through logistics improvements within the "internal value chain"

In qualitative terms, the deployment of Refining Operations Management achieves further improvements in the following ways:

Area of Business Value	How Refining Operations Management Enables This
Enables planning with utmost accuracy	Refining Operations Management enables Planning and Scheduling processes to tightly couple with Supply Chain and Operations Management and allows accurate planning based on accurate demand forecasts and real plant constraints.
Allows the plant to operate optimally, reliably and safely while meeting the targets	Applications like Operator Logbook, "Operating Window," "Offsites Management" and other applications enabling digitised business processes allow: <ul style="list-style-type: none"> • Enhanced operator productivity • Improved decision making • Working within the operating envelope at all times to improve plant efficiency and asset lifecycle • Safe and reliable operations
Measures performance with accuracy	<ul style="list-style-type: none"> • Tightly integrated quality management processes benchmarked against stringent quality standards • Well implemented Real-time database, Laboratory Information Management Systems (LIMS), Mass & Energy Balance, Production Accounting • Accurate plant models • Single version of truth achieved through the seamless flow of validated data across all applications via an integrated environment
Analyses performance compared to plan with a collaborative analysis tool	<ul style="list-style-type: none"> • Accurate and robust progress measurement tool to ensure high level of integrity in reporting • Roll-up of individual KPIs to the corporate KPIs • Powerful Visualisation and Event Management tools • Seamless flow of validated data and designed version of truth
Improve continuously by agile decision-making based on reliable information	Well-designed business processes and work flow management leveraging state-of-the art technology and industry standards

The long term, cumulative value to a refining business upon implementing a "step-change" in operational performance management via a Refining Operations Management system is estimated to be the following:

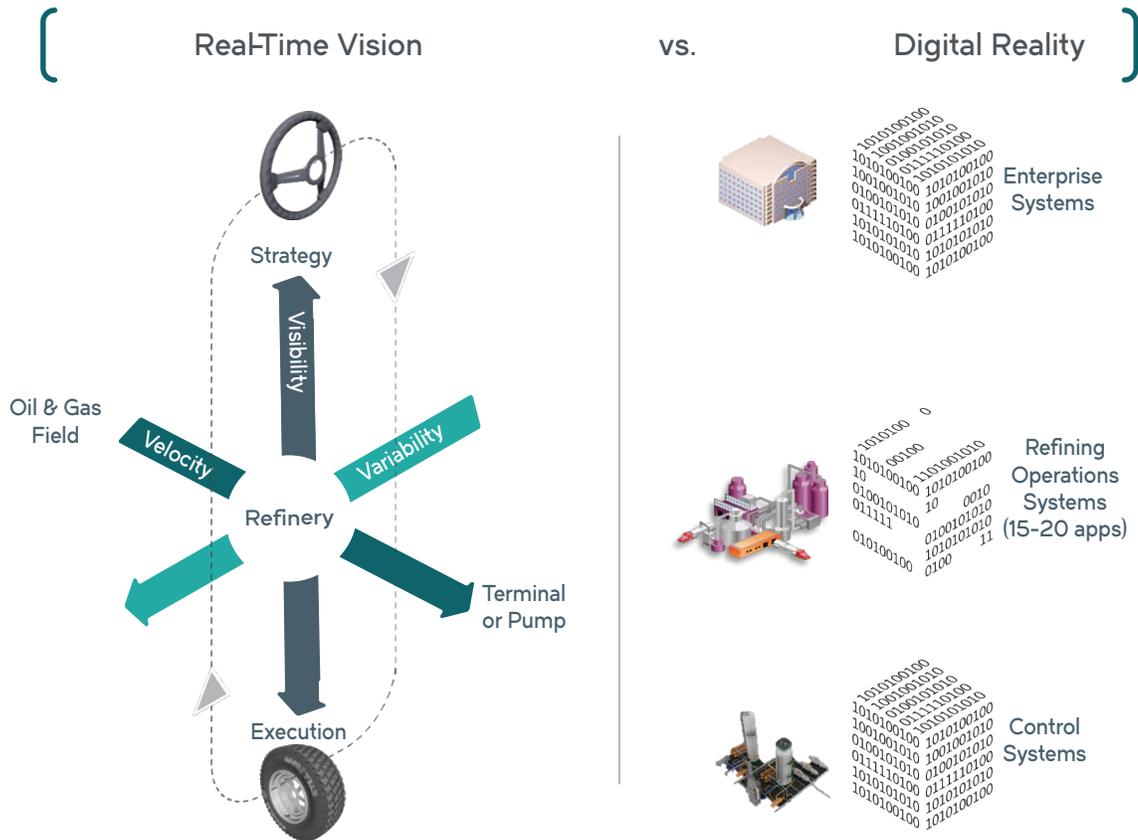


Closing the Digital Gap in Operations

In the ongoing quest for value creation, businesses are seeing a new wave of technology-enabled productivity growth. While this wave has different names ("digital", "internet of things", "4th wave of industrialisation", etc.), they all reflect an interconnected world of real-time information that is aimed at addressing the challenges of managing the end-to-end business value chain. Credible sources have researched this topic and found traction across both private and public sectors, and at the highest levels in the organisation. Key findings include:

- McKinsey & Company's research on "**Digitising the Value Chain**" found the following about executive priorities:
 - 80% agree that digital operations are a critical driver of competitiveness
 - 61% agree that digital is a senior leadership priority
- Cisco's estimates on the captive value from the **Internet of Things (IoT)** showed:
 - Manufacturing (production) is the #1 vertical with over \$1 Billion in captive value estimated to be realised in 2016
- PWC's estimate on the benefit to Germany's economy from **Industry 4.0**:
 - 18% average improvement in productivity growth through the integration of cyber-physical systems
- Accenture's **Digital Density Index** on digital's impact on the global economy:
 - \$1.36 trillion in additional output in the world's Top 10 economies by 2020

As an early adopter of both enterprise and real-time control systems, the petroleum refining industry is well into the digitisation journey. Despite these investments, the operational systems that connect these two worlds remain fragmented and partially digitised, as illustrated below:

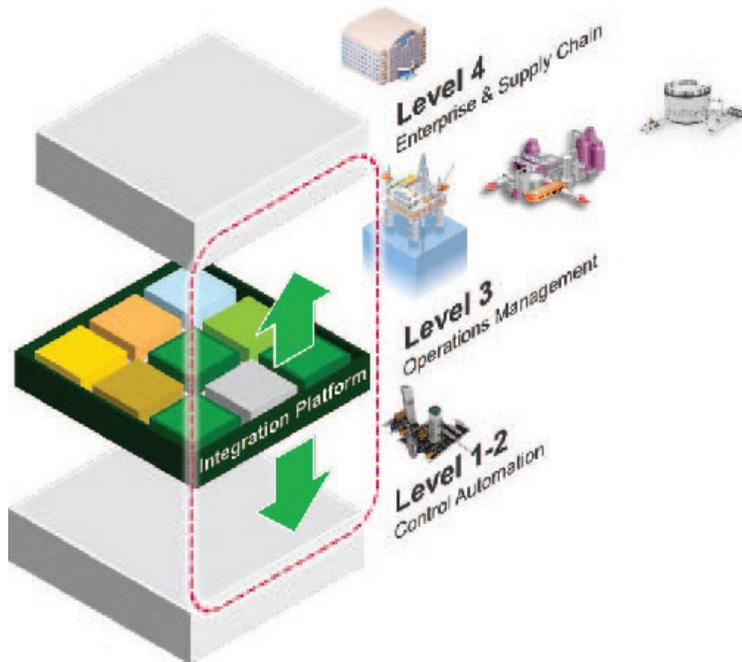


Most operational applications were designed for reporting as opposed to real-time decision making (never mind executing on the decisions.) As a result, the strategy-to-execution linkage is weak, preventing real-time visibility and agility.

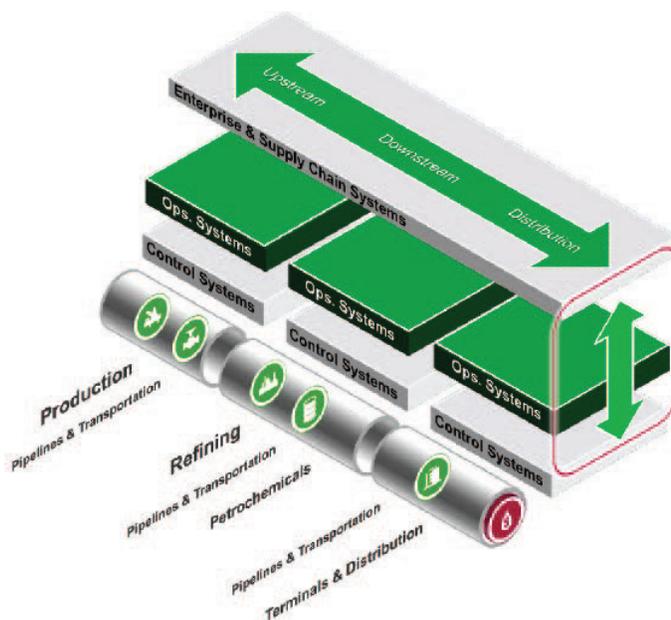
The current reality for operational users in refining is that users do not have time to coordinate closely or take advantage of available data; especially data that could provide appropriate insight into upcoming refinery behaviors (provided it is appropriately transformed and presented in the business processes and their workflows.) The negative impact of the digital operations gap (and the value of an integrated system like Refining Operations Management in closing this gap) can be explained as follows:

- In principle, increasing the velocity of product moving through the internal value chain (from the crude logistics to the product shipments) creates the opportunity to increase asset efficiency (utilisation) and responsiveness to customer demand
- Unfortunately, variability acts like a counter-force that reduces the velocity or speed of the value chain

- To manage variability without loss of velocity requires agility – which can only come through better integration at the operations management level
- Refining Operations Management enables operational agility by integrating the silos of operations management systems (Level 3) as well as the between the control (Level 1-2) and enterprise/office (Level 4) layers to provide real-time visibility and operational control for the business (as illustrated below)



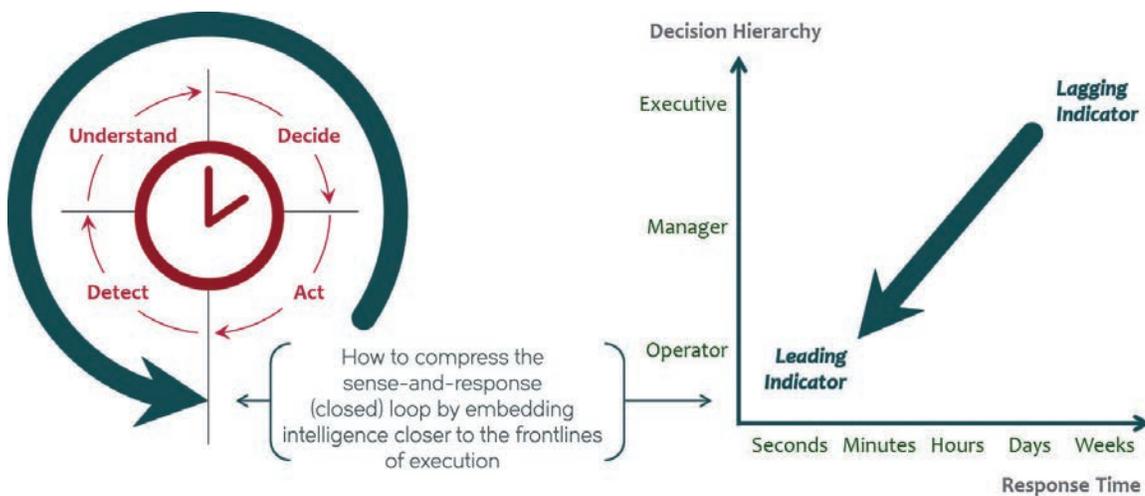
To understand the full scope and importance of business process digitisation, it is important to understand that every activity of refining is a stage within the broader value chain context, and many operational decisions have to be made with regards to events upstream and downstream from the refinery (as illustrated below) to operate at maximum velocity.



Managing Performance in Real time

As the studies of Solomon Associates have shown during the last few years, the highly competitive nature of the refining industry has required higher levels of Operational Excellence. But with no relief in sight for margin pressure, there is a general recognition that sustaining the refining business under this "new normal" requires that we change the operational mindset. In other words, businesses need a step change in performance to be able to survive for the long term.

The key to managing performance in real time is that relevant information reaches the appropriate approval level quickly so that the decision can be made while the opportunity still exists or before the issue becomes a problem. All too often, the decision cycle takes too long and/or the action fails to impact the Key Performance Indicators that matter to the business.



As illustrated on the previous page, what is needed is to compress the time within the decision loop (and hence making impact felt sooner) while at the same time enabling informed decisions along the management hierarchy where the business KPIs are linked to operational KPIs to ensure timely and effective actions at the execution level.

This approach enables operations to deal with events closer to real time – in particular, the many minor performance deviations that occur on a daily basis. These minor deviations or "value leaks", when undetected and left unchecked, slowly but surely erode profitability over time.

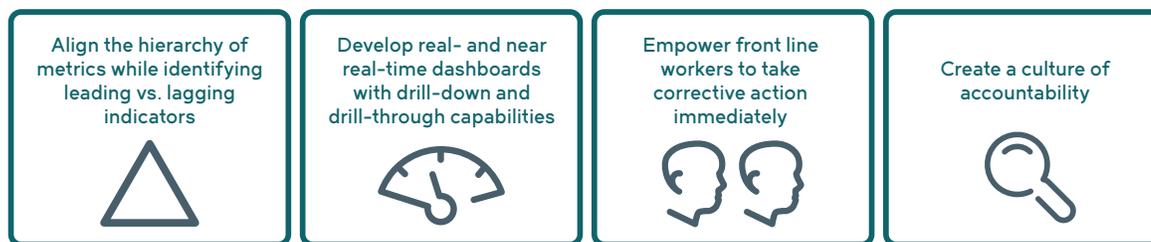
Fixing these value leaks is not always simple – in fact, there are many hurdles to closing the loop between knowing and acting, and the table below summarises many of the reasons why organisations struggle to respond in real time:

Hurdles	Reasons
You do not even realise you have a leak	<ul style="list-style-type: none"> Detection mechanisms are not sophisticated enough
You get an alert but are unable to make a decision because...	<ul style="list-style-type: none"> You do not have all the information You are overwhelmed and cannot tell what data is relevant You perceive you lack the authority to do anything about it You are not sure about the action you want to take You were not alerted in time – and now it is too late
You get an alert but are unable to make a decision because...	<ul style="list-style-type: none"> The instruction was not given to the right person The instruction was received but was ignored The instruction was not clearly understood by the receiver
Action was taken but there is no way to learn from it	<ul style="list-style-type: none"> There is no historical record to analyse patterns There is no means for continuous improvement

What the summary table highlights is the need for an integrated approach to managing performance in real time. AVEVA's approach is called Real-time Performance Management (RTPM), which is based on the principle of systematically compressing the closed loop (Detect-Understand-Decide-Act) decision-making process by increasingly embedding or shifting more of the business rules and policies closer to the front lines of execution. This is a key element of Refining Operations Management and to achieving further improvements.

Putting RTPM into Practice

While technology is a critical enabler, successful transformation requires a holistic approach that includes the people- and process-related aspects. These are addressed by the four key pillars of AVEVA's approach to Real-time Performance Management, which have to work together as follows:



Aligning the Hierarchy of Metrics: A key aspect of a real-time performance management strategy is the measurement of the operation in a business as well as operational context. Traditional operational measures, i.e. key performance indicators (KPI), have been determined on a daily or longer basis for most production facilities, and business measures on a monthly basis. Neither time frame is adequate to the challenge of a real-time business environment. The real-time business measurement system necessary to underpin an operations and business measurement incorporates both real-time KPIs and real-time accounting measures to provide a comprehensive view of the value of the operation.

Closing the contextual gap means that operators and shift supervisors must be able to understand the real-time financial impact and strategic alignment of decisions and issues. Conversely, upper management needs a direct line of sight into the leading indicators and how they are performing in real time at the execution level.

Developing Near-Real-time Dashboards: Once the KPI hierarchy has been decomposed through to the operator level (including the financial view), it is embedded in the dashboard to ensure that at every level there is a real-time view of execution in an integrated, strategic context, combining operational and financial KPIs for all stakeholders.

A hierarchy of dashboards and scorecards is developed from the plant floor to the executive levels of the company to ensure that, not only is every person empowered to perform their activities more effectively, but that all levels in the organisation are aligned to a single mission – maximising the business value from the operations. There are many dashboard providers who are able to display operating information (mostly from the process historian). However, Real-time Performance Management is more than a digital dashboard. It requires structuring and linking KPIs, standardising and embedding business processes, having a solid operations management software foundation, and a robust architecture that can facilitate data and application integration.

Empowering the Edge: In order for corrective action to be taken in a timely manner (including ahead of “real time”), those closest to the frontlines, or the “edge of execution,” must be empowered to act in a way that is consistent with the operational procedures defined. Every person in the operation may perform activities that add or reduce the business value produced by the operation.

Unfortunately, in most cases most people have no idea whether what they are doing is adding or subtracting value because they have no view into value generation. The real-time business empowerment function provides every person in the operation with the exact information they require to determine what value they are generating for the company. This is accomplished by combining the real time KPIs and accounting measures and prioritising the combined set of measures to the production strategy and the responsibilities of each person. These prioritised measures are provided to the employees who impact the performance of the operation via real time dashboards or scorecards as indicated above.

Creating a Culture of Accountability: In a culture of accountability, people at every level of the organisation are not only personally committed to achieving key results set by the organisation, but also act proactively where they never wait to be asked for a progress report or a follow-up plan. Instead, they report proactively and follow-up constantly, diligently measuring their own progress.

Once key business variables are under direct control, a new opportunity arises in industrial operations, the opportunity to optimise the value of key business measures across the operation by fostering the development of a cooperative organisation. Traditionally industrial organisations have been highly disjointed due to separation of experience and expertise, resulting in organisational silos that do not work together very well to meet the business objectives.

Success Stories

- 1. Refining Operation in Saudi Arabia:** AVEVA has successfully delivered a multimillion dollar integrated Refining Operations Management system for a large Refiner in Saudi Arabia. The system, designed and implemented under a project initiated in June 2011, is helping the refiner automate its refinery business processes to improve real-time efficiency, reporting and decision making. The solution encompasses total supply chain management; refinery planning and scheduling; operations management; health, safety and environmental management; quality assurance; and performance control and management. Schneider will also provide data validation and reconciliation, mass energy balance, utilities optimisation, electronic logbooks and control performance solutions to help the refiner achieve operational excellence. The system will support more than 50 refinery business processes and consists of 15 core refinery applications integrated across all four ISA-95 levels, as well as a business process integration that seamlessly integrated all the applications based on an enterprise service bus.
- 2. Refining Operation in Saudi Arabia:** AVEVA has implemented a Plant Information Management system fully integrated with SAP and other applications in advance of commissioning the expansion of another refinery in Saudi Arabia. The solution improves performance management by tightly integrating control systems with production and corporate business functions. The Schneider solution covers the entire refinery and petrochemical complex comprising of 23 units. Best-in-class applications from several vendors, including Schneider and SAP, were integrated through the Integration platform. The enterprise receives continuous, accurate performance feedback, which is driving consistent execution of business processes.
- 3. Refining Operation in Canada:** A Canadian downstream refining company consolidated into a single organisation which highlighted the need for and presented the opportunity to integrate and enhance the business processes, practices and technologies across their entire Hydrocarbon Value Chain (HCVC). The first step in the process was the development of a roadmap to guide the organisation through the overall program of work required to deliver the HCVC vision.

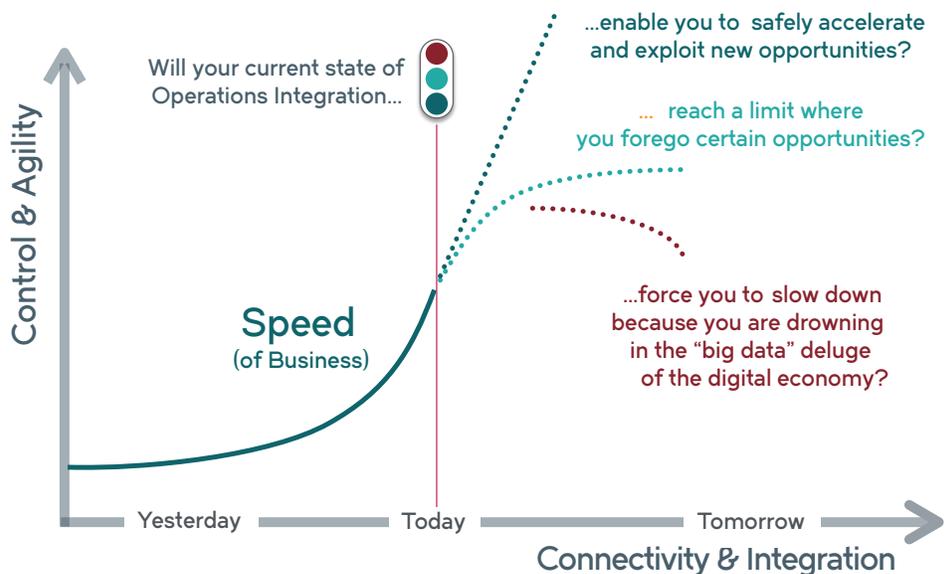


Conclusion

Why implement Refining Operations Management now? Early adopters of Refining Operations Management have gained a number of key insights and lessons learned including the following:

- **Making optimal decisions based on an integrated business context:** The need for intelligent decision management tools that consider an end-to-end, integrated value chain view of the business (enabled by Refining Operations Management) to drive performance improvements along the value chain.
- **Doing it right from the beginning:** Implementing Refining Operations Management as a part of refinery construction phases allows optimum business process to be built simultaneously as the refinery is build and commissioned.
- **Do not (inadvertently) institutionalise outdated practices:** If adoption of Refining Operations Management is left too late in the plant life cycle, it allows non-optimised business processes, based on discrete and uncontrolled spreadsheets to proliferate. And once this spreadsheet culture takes root, it is difficult to replace.
- **Minimise resistance to change:** Implementation during green field or major expansion allows minimum resistance to change (as there is no or much less user affinity to any as-is process) and drives significantly improved ownership and adoption, thus mitigating change management challenges.
- **Worker readiness for new generation of information user:** Last but not least, companies are realising that a digital operations environment is critical to attract and retain talent as part of their millennial workforce strategy.

In the context of digital operations, the value of a system like Refining Operations Management should be framed in the following terms: What is the right level of operational integration required to enable the desired level of agility where the business can adapt to changing business conditions and exploit new opportunities (as shown below):



Why AVEVA? AVEVA's Refining Operations Management offering is based on the lessons learned by working closely with leading companies in the petroleum refining industry. With innovative capabilities to manage performance in real time, Refining Operations Management helps these industry leaders gain greater agility and control over their operations. In essence, AVEVA's unique value proposition to Refining clients is the following:

- Right product and technology
- Right experience (Successes: SATORP, Petro Rabigh, KOC – in progress)
- Right team (capability, capacity etc.)
- Right methodology and approach
 - Business process led implementation
 - Ability to engage customer stakeholders and work as one team
 - Strong project management and governance methodology
 - Ability to manage vendors
- Right business improvements

Ultimately, the adoption of Refining Operations Management is a journey about value creation where we work with clients to uncover the hidden opportunities and the value leaks. It requires a partner who can offer deep domain expertise from years of experience on the plant floor and help you to extract that value quickly.





@avevagroup



linkedin.com/company/aveva

About the Author

Stanley DeVries brings more than 40 years of experience in systems architecture, embedded business processes and KPI user psychology for the heavy process industries.

Dr. Stuart Parker brings more than 28 years of experience in business consulting, engineering design and project management. His expertise is in business process design, refinery and petrochemicals operations management, and process optimisation.

Sree Hameed brings over 17 years of experience in supporting global solutions across ERP, supply chain and manufacturing technologies.

About AVEVA

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

The company's engineering, planning and operations, asset performance, and monitoring and control solutions deliver proven results to over 16,000 customers across the globe. Its customers are supported by the largest industrial software ecosystem, including 4,200 partners and 5,700 certified developers. AVEVA is headquartered in Cambridge, UK, with over 4,400 employees at 80 locations in over 40 countries.

www.aveva.com

AVEVA believes the information in this publication is correct as of its publication date. As part of continued product development, such information is subject to change without prior notice and is related to the current software release. AVEVA is not responsible for any inadvertent errors. All product names mentioned are the trademarks of their respective holders.

© 2018 AVEVA Group plc and its subsidiaries. All rights reserved.

The AVEVA logo is positioned in the bottom right corner of the page. It consists of the word "AVEVA" in a bold, white, sans-serif font, set against a dark teal background that forms part of a large, abstract triangular graphic on the right side of the page.