



OIL AND GAS 4.0 DISRUPTING DIGITAL TRANSFORMATION

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THE CRITICAL NEED FOR OPERATIONAL EXCELLENCE

DIGITAL ADVANCEMENT

The pace of change in the last twelve months has been enough to give the oil and gas industry whiplash. The world has changed – and so too have the stakes for our sector.

Increasingly complex operating conditions threaten already squeezed margins. There's relentless pressure to cut costs while simultaneously increasing productivity. Hazardous events have led to more rigorous compliance requirements and amplified public scrutiny.

All these factors and more make the successful pursuit of Operational Excellence in oil and gas more critical than ever. This is not a management fad or a 'nice to have' goal; it is an absolute imperative. Companies must simultaneously reduce risk, increase productivity and cut costs.

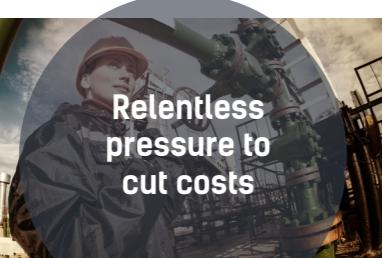
Achieving operational excellence requires everyone, from the boardroom to the frontline, to make the most effective decision every time. The risk-cost-productivity equation is a delicate balancing act. A decision made to increase productivity without considering the impact on risk is all too easy – and all too dangerous.

To succeed, companies must,

- ▶ Bring together disparate data and systems to create meaningful and actionable insight across the organisation
- ▶ Enable enterprise-wide access to a single, shared view of the operational reality
- ▶ Employ a holistic approach to visualise and manage risk and activity
- ▶ Simplify operations and risk management, and importantly, the routine integration of the two
- ▶ Provide everyone with the right information at the right time
- ▶ Close the gaps between engineering, maintenance, operations, safety and other functions and practices across the business



Increasingly complex operating conditions



Relentless pressure to cut costs



While simultaneously increasing productivity



With growing risk and ever more rigorous compliance & public scrutiny

Everywhere we look these days we hear that digitalisation will be the key enabler for operational excellence. Intelligent automation is not simply the deployment of digital tools. It's the smart combination of skilled people and a connected industrial workforce to capture the full benefits of emerging technologies.

The advancement of technologies like smart sensors, digital twins and threads, machine learning, AI, and cloud solutions to process it all are pillars of Industry 4.0. They promise greater IT/OT convergence, making the Industrial Internet of Things (IIoT) a reality for operators.

The current digitalisation of the industry offers huge potential for achieving and embedding operational excellence into the organisation. Consider what it requires: everyone has the context they need; everyone shares an integrated view of the operational reality; everyone is connected to the right data, at the right time.

Indeed, digitalisation can drive horizontal and vertical integration and successfully automate major processes. For example, the ability to produce, connect and process data and then apply advanced analytics enables predictive capabilities. Operators can forecast with great accuracy when equipment will need maintenance. It means real-time insight into what is happening on the plant, even predicting risk to enable better operating decisions.

In its 2016 Global Industry 4.0 Survey, PwC claimed:

"Industry 4.0 will be a huge boon to companies that fully understand what it means for how they do business. Change of this nature will transcend your company's boundaries and lead to a complete transformation of your organisation."

Consultants at Accenture agree. In their words:

"Digital technology brings more than incremental improvements to operations. It has the potential to transform plants, enable operational excellence and disrupt the competitive landscape in the industry."

But we need to be careful. There's a real danger here.

BEWARE THE TROUGH OF DISILLUSIONMENT

Digital transformation is not a technology issue. It's a critical business strategy that must be structured to drive business results, and most importantly, what skills, activities and processes are needed to achieve that vision.

For example, the Industrial Internet of Things (IIoT) makes it possible to capture significant amounts of data from devices, but that data has no value if your company lacks the digital thinking tools to evaluate it and make decisions.

It's true, noteworthy examples of digitalisation have delivered fast and significant business impact. These include improving the quality and lowering the cost of drilling; generating higher recovery rates for lower cost in operations; higher net margins and plant reliability in the refining space; and, optimised distribution and marketing downstream. As IT/OT convergence continues and we connect more and more machines and process equipment, we can expect more benefits around managing risk, cost, and productivity. But we are dangerously close to thinking that just integrating existing information is the answer.

However, it's a huge mistake to regard digitalisation as a silver bullet that immediately slays all problems. Simply throwing technology at a problem and expecting it to deliver results has not led to success in the past and won't lead to success now.

It could leave operators struggling to take advantage of the promise of digital transformation and all the new forms of data available while drowning in the hype and wondering if the benefits really do exist. The promise of success comes with an equally large potential for disappointment – and a one-way ticket to the trough of disillusionment.

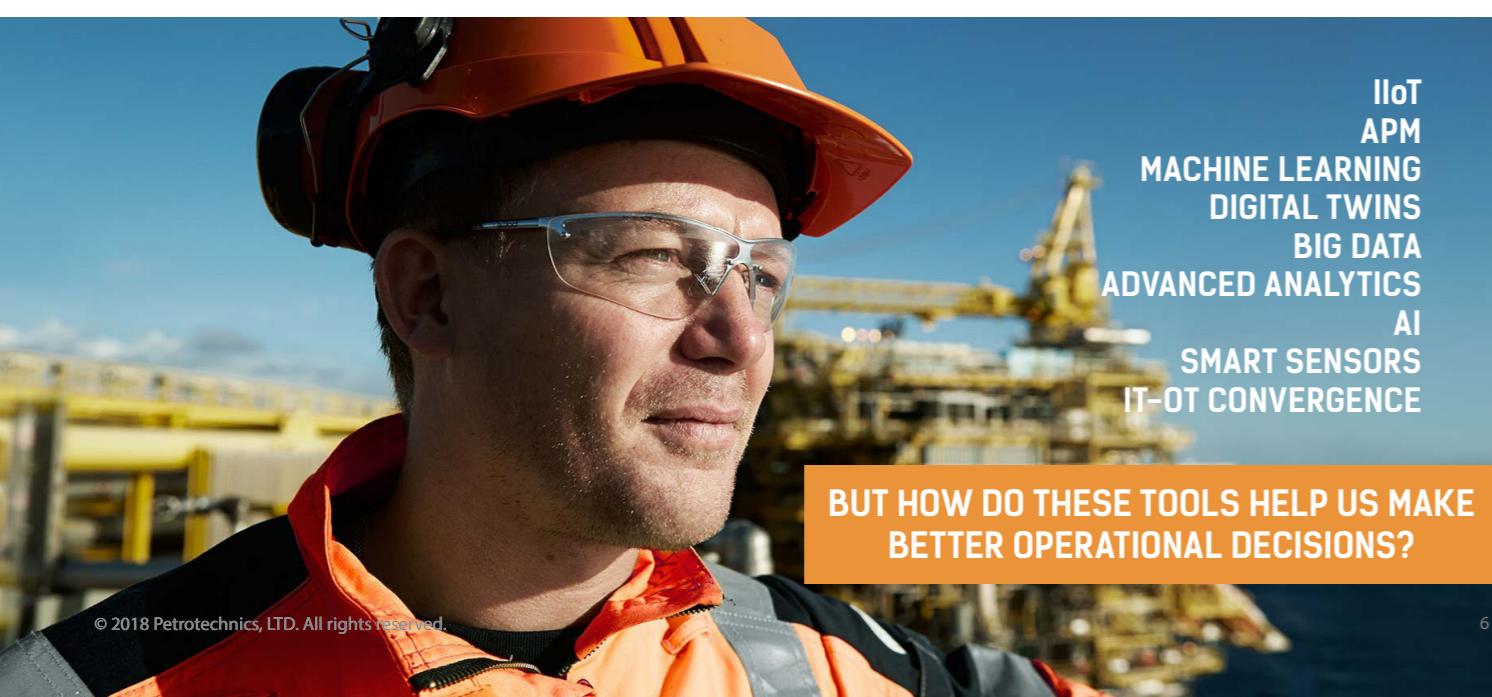
For example, in managing operations, we have achieved automation in some parts of our businesses, specifically machines and process equipment. Other business processes, such as operations, maintenance, and process safety rely heavily on human input. As a result, operators struggle to achieve efficiency and appropriately manage performance.

In these and other areas of industry, we are burdened with many sources of disparate data, often generated by vertical, functional silos. This results in messy, ill-defined data models that are difficult to access and understand. Attempts to resolve this challenge have led to ever-growing levels of complexity. Dashboards targeted at senior leadership are merely collating data which many find difficult to relate to the reality of their business - prompting the request for more insight and less data!

Also, we must find a way to manage the avalanche of data coming from a vast array of systems across our organisations, or we'll face information overload.

We need to start with business process - but not just individual processes within specific functions like operations, maintenance, planning, engineering or HSE. Polishing one part of an end-to-end process without addressing it in its entirety can only lead to unfulfilled promise.

If we don't, some parts of our organisations are going to be very shiny, and others will continue to do things the same way they always have. That means all of those big benefits we thought we were going to get from digitalisation won't materialise. We must think about business processes from an end-to-end standpoint.



BUT HOW DO THESE TOOLS HELP US MAKE BETTER OPERATIONAL DECISIONS?

IIoT
APM
MACHINE LEARNING
DIGITAL TWINS
BIG DATA
ADVANCED ANALYTICS
AI
SMART SENSORS
IT-OT CONVERGENCE

DATA IS THE NEW OIL
BUT WHAT WE NEED IS ACTIONABLE INSIGHT



LIKE OIL, DATA IS A RAW MATERIAL

DATA NEEDS TO BE REFINED TO TURN IT INTO SOMETHING USEFUL





BACK TO BASICS

Data is valuable when it delivers 'actionable insights,' a challenge that more and more companies recognise.

Forrester reports, 74% of firms say they want to be 'data-driven' – but only 29% are successful at connecting analytics to action.

Simply integrating existing data is not the answer to providing insight. We need to be able to connect the data to the operational reality of our businesses. We also need to understand where there are gaps in our data.

To ensure digitalisation delivers and operational excellence is achieved, operators need to go back to the basics of technology planning and implementation. We need to think about the people in our organisations and what we need to do to empower them to make better operational decisions. With that in mind, we can look at the data and the processes they need to support those decisions. What actionable insights do they need? What data or combination of data will deliver the insight? How is it connected in a meaningful way to the operational reality? When do they need it? Where do they need it? Who also needs it, and for what will they use it?

Once the parameters have been identified, operators can begin thinking about the value their digital strategy could deliver and how it should be integrated for maximum benefit.

This is where technology platforms that can support operational excellence come to the fore. They unlock the potential of data that's been hidden away in silos. They provide meaningful relationships between previously disparate data sources. These platforms translate, aggregate and publish once disparate and complex data sets in real-time – with the common currency of understanding that helps everyone across the organisation make better, more informed decisions.

of firms say they want to be 'data-driven'

74%

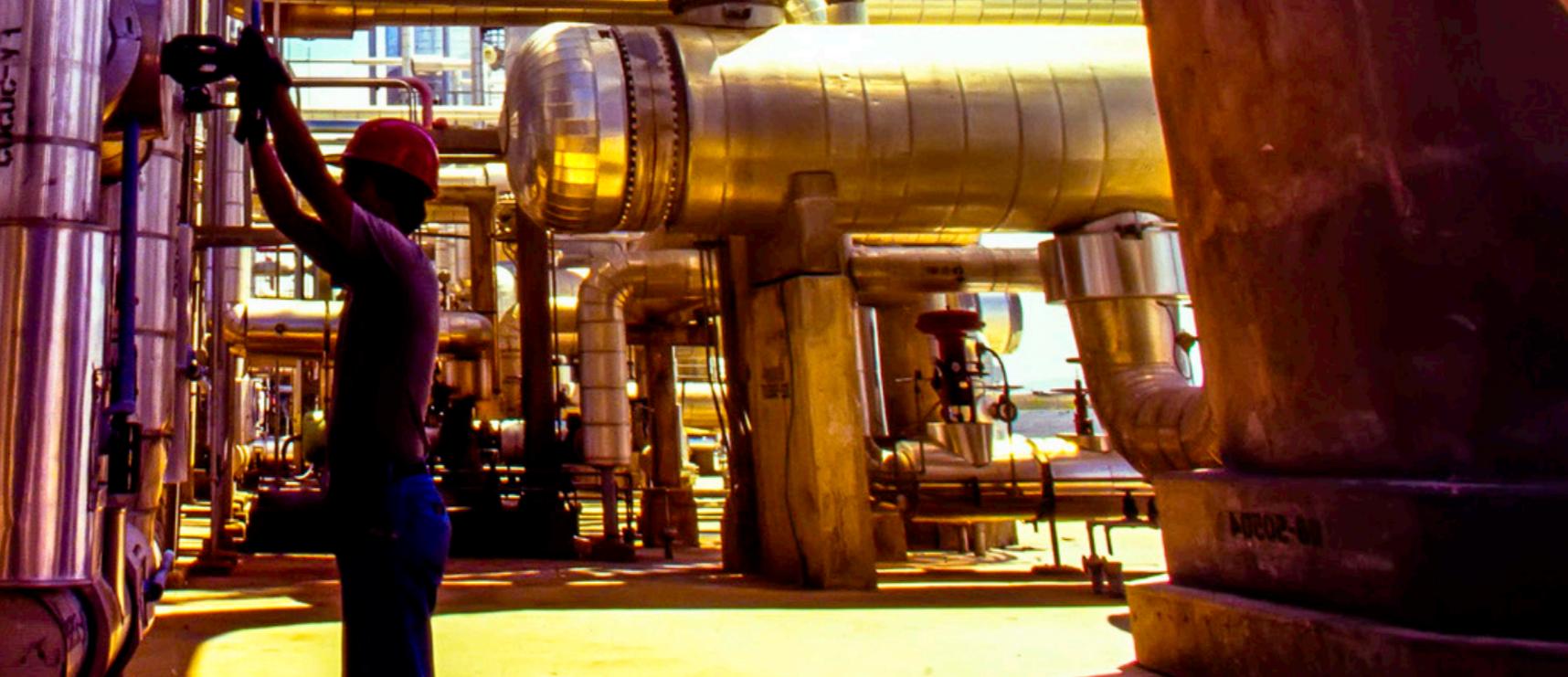
are successful at connecting analytics to action

29%



Operational Excellence ensures everyone is making well-informed operational decisions.





THE PATH TO DIGITAL TRANSFORMATION: THINK BIG, START SMALL, SCALE FAST

It's important to know which digitalisation path our organisation is on. There are two paths which are often dictated by an organisation's specific appetite for digitalisation and existing structure and leadership.

The first approach is a top-down, end-to-end journey that aims to close the gaps between functions within the organisation such as operations, engineering, maintenance, HSE, and others by using the power of digital technology to join up business processes and smart assets. Complex data can then be transformed into meaningful and actionable insight which can unlock a 21st-century approach to industrial operations.

The second approach is more incremental – and optimises in a function-by-function approach, where individual business organisations improve their processes and system by leveraging new digital technologies such as analytics, mobility, and integration for specific, functional improvement. While this will drive improved performance, it will have its limits.

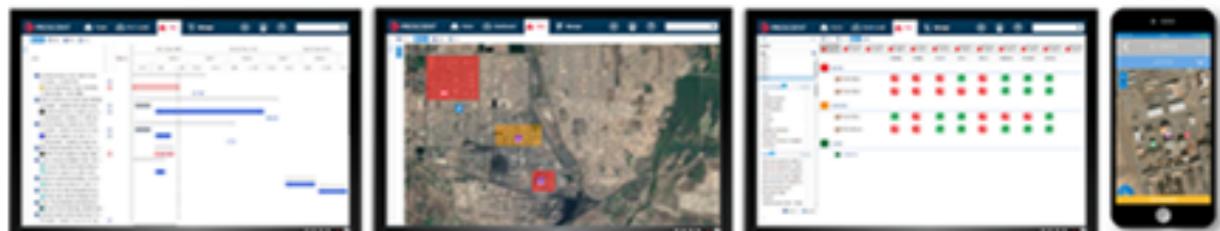
Regardless of the digital transformation approach, it's crucial companies think big, start small and scale fast. After all, the World has changed. Tomorrow's winners will be those who can smartly take advantage of the potential offered by technology today. New processes and operating models will be the baseline.

One of the most important things to keep in mind when looking at digital technology is how it is employed – either as a platform or a tool. Often organisations, especially our IT departments, are faced with the dilemma of "servicing" the business and consolidating the number of systems the business uses. When we look at a top-down, end-to-end approach to digitalisation, the platform approach becomes the natural focus. However, when we are trying to optimise function-by-function, it often leads the organisation to focus on acquiring many more new tools to get specific jobs done. This approach can overcomplicate matters.

Industrial organisations require the best of both worlds: a platform approach that allows access to the tools needed to solve individual problems and the ability to grow into the broader capabilities of the platform as requirements evolve.

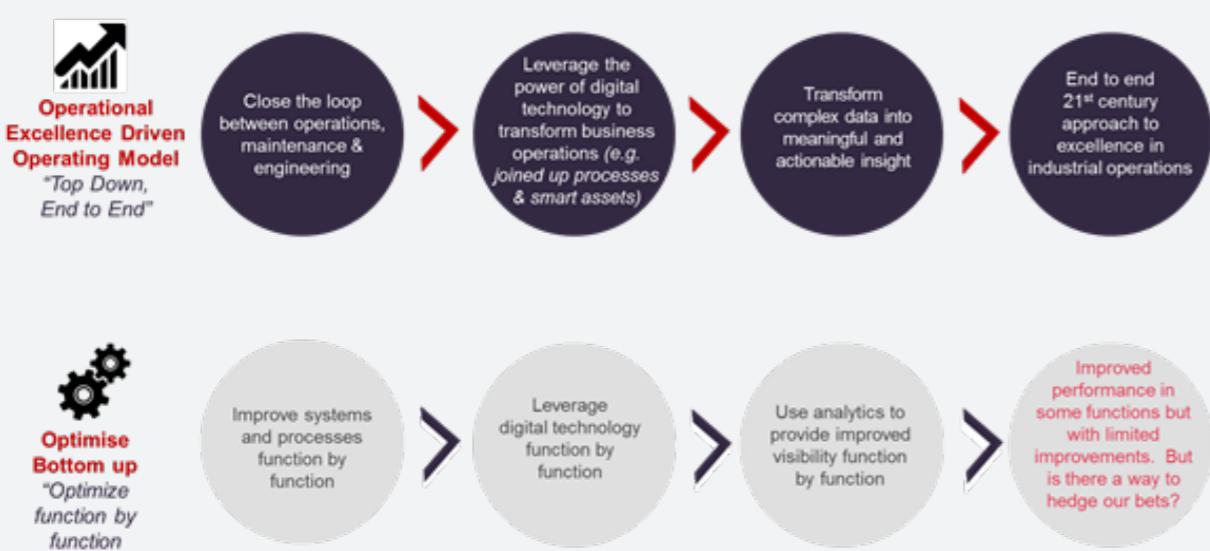
The power of an integrated platform provides operators with a practical way to share data and insights and build cross-functional business processes.

A SINGLE, SHARED VIEW OF THE OPERATIONAL REALITY



Everyone can see exactly what's happening, where and when – in real time.

Digitalisation's Two Paths





AGGREGATING RISKS FOR BETTER SAFETY PERFORMANCE

One of the fundamental areas in the oil and gas industry we have to “get right” is risk management. Accepting the reality of risk and understanding how to manage it effectively is key to operational excellence.

The trouble is an operator’s risk landscape changes as fast as its operational reality. Unavoidably, risks are managed in different parts of the organisation. Bringing them all together in a joined-up way is challenging enough for Process Safety experts – let alone the rest of the business.

What’s more, the indicators might look good, but the reality is different. Individual risk control systems, no matter how well defined, can display an incorrect picture of performance.

Industry operators need to make sure everyone understands and assesses risk by the same criteria and has a practical, real-time understanding of how their decisions can directly or indirectly influence risk and process safety barrier health. It starts by understanding the potential sources of risk and how they accumulate.

There is a perceptible shift in the industry, industry 4.0, where connected systems are changing how risk and safety are understood, measured and managed. In fact, LNS Research says,

“Process Safety is one of the most unheralded, transformative areas of digital transformation today.”

An integrated, platform approach is the only way industrial, asset-intensive organisations can access a single, shared view of their operational reality.

By bringing all of the risks and all of the activities together into one system, operators can know what’s happening, where it’s happening and what’s driving the risk – accessible in a single, central location.

Most organisations today operate their businesses based on an operational management system and/or a process safety management framework. Typically, they report compliance and performance against these systems.

What these systems don’t tell us is what compliance or performance means in terms of the risk on the plant today, tomorrow and beyond. These systems don’t uncover actionable insight that can be used to improve performance.

Operators cannot expect all staff to understand elaborate risk matrices, algorithms and from there abstract exact performance and behaviors. The workforce on the ground has only mere seconds to make a critical operation decision.

They do not have the time to go through years of incident investigations and guidance reports before reacting. Mind you, these decisions are made in the white heat of resource and productivity pressure.

As a priority, Operators must ensure enterprise-wide understanding of the potential sources of risk and how they can accumulate. With a common view of risk, the frontline can better understand how risk sources dynamically interact to create unexpected outcomes. It is then that an operator is in a place to standardise how everyone understands and mitigates risk.

What operators need to do is bring together deviations from performance standards, whether equipment, people or process-based and understand where, when and to what effect a major accident hazard may result, what barrier will be impaired and the anticipated residual risk.

By bringing these deviations together in a common way, everyone can compare concrete, meaningful risk information, necessary for making critical operating decisions. For example, a maintenance engineer can understand the impact of delaying valve work – not just based on his KPIs, his team’s schedule or his department’s workload for the next few days, but the likely consequences that will ripple across the organisation.

- ▶ It’s how everyone begins to understand that the short-term fix may create as many problems as it solves – and instead, it enables them to find the optimal solution
- ▶ It’s how everyone from frontline staff to the CEO understands the interrelated, interconnected nature of risk the organisation is undertaking. And it can assure their next activity stays within agreed risk parameters
- ▶ It’s how process safety and risk-control system performance remain connected to frontline operations – even through dynamic change. It’s practical, routine and improves situational awareness by making exposure to major accident hazard risk visible, prominent and available for everyone to see in real-time

This approach enables operators to identify which process safety barriers on the plant are impaired and could lead to a major accident hazard, like a fire or explosion. The pathway leading to these events can be highlighted to help operators understand the context of the environment - so they can plan and schedule work accordingly. And in terms of performance, operators can develop a new generation of leading indicators that answer the question as to whether the risk is increasing or diminishing.

HOLISTICALLY MANAGING OPERATIONAL RISK – IN PRACTICE

Most operators do not get a good picture of the aspects of their jobs that are most critical in managing process safety risk. Operators are responsible for 99% execution. And to do this, they rely on procedures. They simply aren't provided with the information they need to know where they are most important in managing risk for the long term, and we don't have the necessary information to give them scenarios for appropriately managing risks. The same is true for short-term and change management – when the facility is most at risk.

Operators need to know if there is a failure what they should do instead – when a layer of protection is disabled or risks being disabled.

Imagine an entire organisation, especially frontline operations, starting each shift with a clear picture of what's happening, where it's happening, when it's happening and what's driving the risk on the asset.

They would be able to see the risk in the context of their area of the plant and could drill down to see specifically what activities or performance deviations were elevating the risk levels.

They would be able to connect those performance deviations to impaired process safety barriers – and further to the potential resulting consequences.

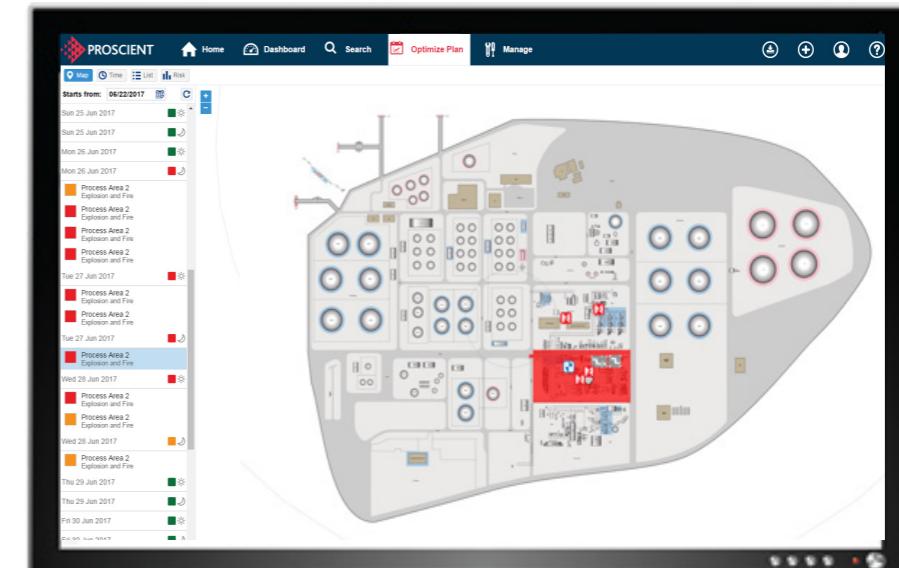
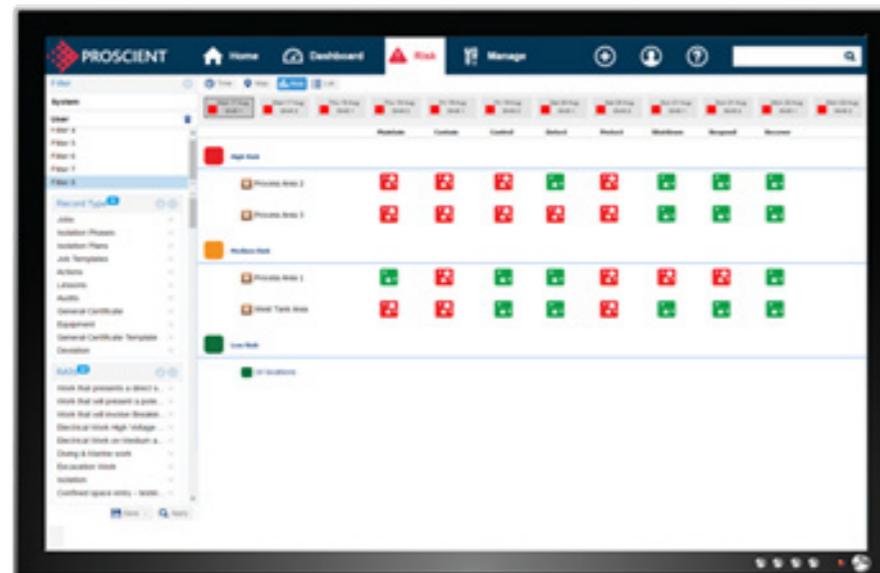
So hypothetically, in the case a potential fire and explosion, the operator could see how the major accident hazard pathway is developing. With this information, the operator on the frontline, the operations manager, and the maintenance, planning and cross-functional teams could make different decisions about how they prioritise work and operate the facility to proactively mitigate risk and any consequential impact.

We simply do not provide systems and solutions for Operations.

We have so much data, particularly with things like digital process control systems (DCS), safety instrumented systems (SIS), maintenance systems, etc. The necessary information is off somewhere – through inspections, the status of critical equipment and devices, the status of work permits, gas and leak detectors, etc. We need to be able to gather and see the picture of what is happening in the operating unit at any given time.

An integrated, platform approach can pull together information based on what is seen on the asset during the course of daily activities or operator rounds, and it can automate the retrieval of performance deviations. For example, critical process safety-related equipment can be identified in data historians along with a few equipment parameters and thresholds, like temperature, vibration, pressure levels and volume. When the equipment surpasses the threshold, the automatic creation of a deviation can be triggered.

The automatic process operationalises the vast array of data coming from the IIoT. It can create meaningful insight from edge data (equipment conditions) and translate those conditions into their potential risk impact on the asset. But in reality, the risk picture is much bigger.





A HOLISTIC APPROACH TO VISUALISING AND MANAGING OPERATIONAL ACTIVITIES

In today's challenging operating environment, operators must maximise their capabilities and get more of the right things done safely and efficiently. People work to operationalise the schedule based on all of the activities, risk (the state of the plant) and resources available, but they don't always have the tools they need.

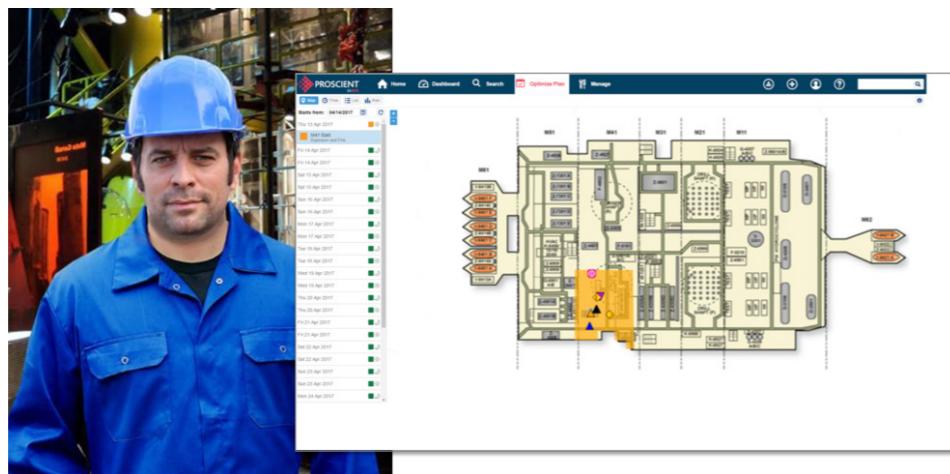
The sum of all of the activity usually does not equal the integrated plan. Often the plan misses a lot of key work details. The focus really must be on building an executable schedule that includes when and where an activity is taking place as well as critical safety dependencies, isolations, tasks and subtasks required to effectively execute the work. The executable plan must also include any operational constraints as well as details about how the activity impacts risk on the plant or asset. Typically this information is not stored in the maintenance management system, compromising the plan and the ability to execute. This is critical information during the risk assessment process.

It is necessary, and possible, to bring together "all of the jobs" and "all of the risk" so teams can better understand the effectiveness of the plan and schedule and make any necessary changes. This gives us the ability to ensure schedules are executable according to safety standards and the operators' ability to actually support the activity.

Furthermore, bringing all of this information together enables teams to manage the dynamic execution of the plan, as the schedule unfolds. It shows activity and the asset's operational risk levels in real-time. Any risk implications can be managed based on the dynamic of the day.

And, the next time work is repeated on the asset, we can include the historical details to improve plan accuracy and attainment.

Teams can develop new productivity indicators based on actual data, for example, which work path was effective and which led to delays and/or higher than acceptable risk. Now the details of the plan, the schedule, and the actuals can help teams improve how to plan, manage and execute work.



Just imagine having a joined-up view of all of the risks and all of the activities available in a single, central, shared location. Teams could visualise when any activity is taking place, where it is happening geographically and its potential risk impact on the plant or asset. The result is a truly integrated view of the operational reality – including all contingencies - that can be optimised at any given time.

Work orders can be imported directly into the system from maintenance management systems (MMS/CMMS). And they can be brought over with the full work breakdown structure in place.

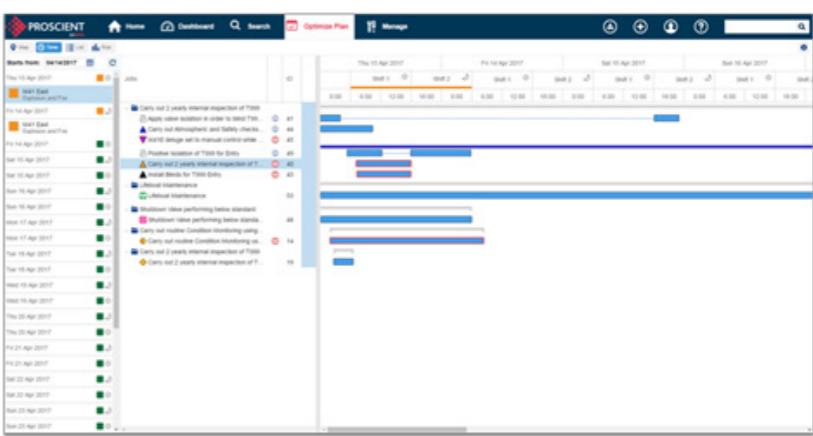
Certainly, the jobs will need to be risk assessed to determine, based on the type of work, the safety dependencies, required isolations, and all of the other tasks and sub-tasks needed to execute work safely. Integrated activity management solutions enable teams to assess activity for risk and create any additional work activity to support the safe execution of the plan.

Integrated systems pull together all activity – including the daily routine operational activities required to operate the plant. This critical element is recognised by senior executives. A Vice President of Global Reliability and Maintenance said, "If I knew Operations' capacity to support my plan, I would prioritise differently."

Typically the schedule comes as a result of the plan. It usually is not executable, and like the plan, as it does not always include the safety dependencies, tasks, sub-tasks, isolations and permits required to execute the work. It also cannot take into account all of the operational activity. To further complicate matters, historically there haven't been tools available to help Operations "operationalise" the schedule.

A retired chief process safety engineer said, "Consolidated information is vital to rational decision-making. The trouble is we don't provide consolidated systems for operations to effectively assess if they can take one more step in their procedure." And a process safety engineer said, "We often 'set the operators up to make errors.'"

Fortunately, there is a way to simplify the daily reality that many of our people face. With advanced, digital tools, operations can see, at any given time, the schedule of activity in a certain area of the plant and can easily see if there are any tasks in conflict with one another - because of safety dependencies.



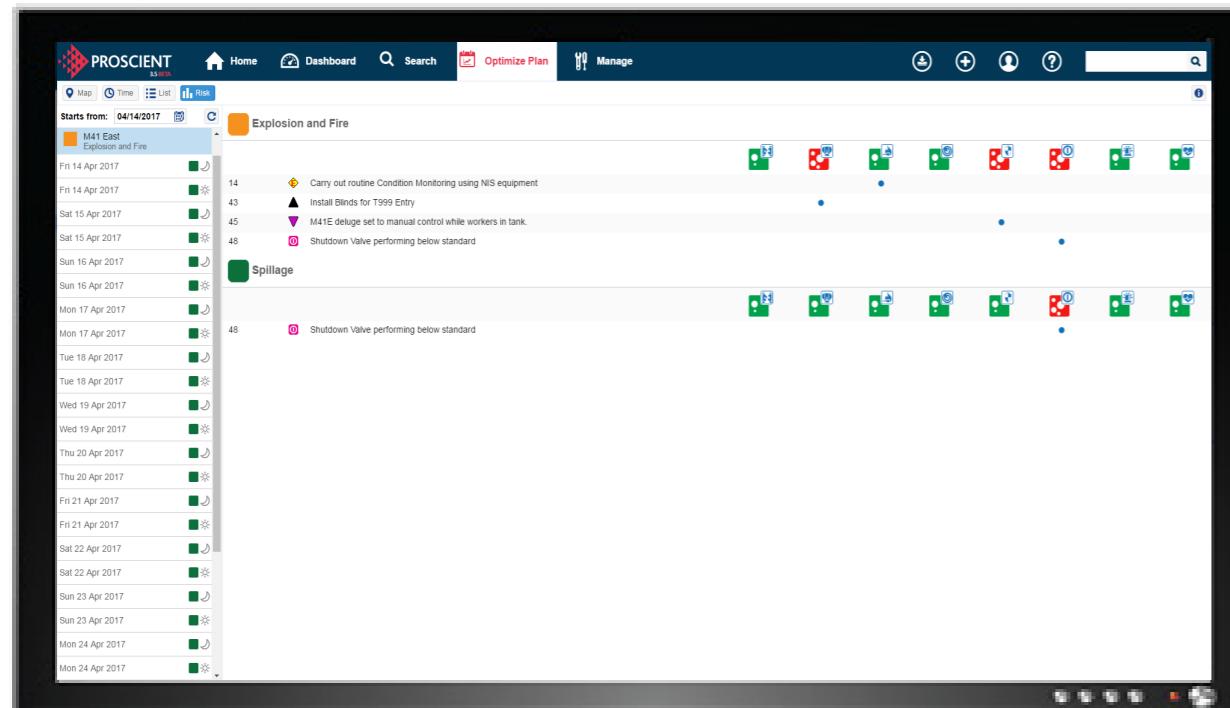
HOLISTICALLY MANAGING OPERATIONAL ACTIVITIES – IN PRACTICE

For example, if the plan is to carry out a vessel entry into tank T-999, the tank must be positively isolated from all sources. This is achieved by splitting the lines and installing blanking plates. During the installation of the blanking plates, the operator will need to break containment. Currently, other work is planned at the same time in this particular area, using non-IS inspection equipment. This poses an ignition hazard. In addition, the work will put the deluge valve on manual operation so to prevent inadvertent discharge with the ongoing inspection work, which could potentially trigger the fire and gas system and activate the deluge system.

An integrated system illuminates major accident hazard risk exposure based on where the work is taking place and the combination of planned activities and deviations.

Due to the initial set of concurrent work, a potential MAH pathway exists. In one area of the plant, the plan is to break containment at the same time a potential ignition source is present, with a degraded emergency response system.

After reviewing the potential risk, a decision is made that the positive isolation phase of the tank should only be carried out after the inspection work is completed. This reduces the overall risk to the installation.



With an integrated platform approach to digitalisation, hydrocarbon operators can make serious strides towards increasing productivity, reducing risk and cutting costs – and thus practically drive operational excellence as everyday routine.

PROSCIENT – THE HYDROCARBON INDUSTRY'S FIRST INTEGRATED SOFTWARE PLATFORM FOR OPERATIONAL EXCELLENCE

Petrotechnics' Proscient platform is a simple, elegant way of connecting disparate processes and people. It allows everyone to visualise and manage risk and activity in a new way. Whether deployed from a top-down, end-to-end platform approach or a functional tool-based approach, hydrocarbon operators can have the tools they need to support evolving operational requirements and work dynamics.

- ▶ Brings together disparate data and systems to create meaningful and actionable insight across the organisation
- ▶ Delivers enterprise-wide access to a single, shared view of the operational reality
- ▶ Offers a holistic approach to visualise and manage risk and activity
- ▶ Simplifies operations and risk management, and importantly, the routine integration of the two
- ▶ Provides everyone with the right information at the right time
- ▶ Closes the gaps between engineering, maintenance, operations, safety and other functions and practices across the business



Data generated by vertical, functional silos and systems

- Overdue Maintenance
- Overdue Inspections
- Planned Maintenance
- High Risk Jobs
- Failed Inspections
- Field Observations
- Management of Change
- Emergency Critical Equipment Status
- PSM Critical Equipment Status
- IOW Deviations



INDUSTRY 4.0 – REIMAGINING OIL & GAS OPERATIONS

When data is presented in a user-focused way that accurately informs decisions and improves prioritisation of facility operations, the value is clear.

- ▶ Frontline operations have immediate access to easy-to-read, data-rich information on equipment and activity status, with context to make better-informed, risk-dependent decisions during each shift
- ▶ Site management and planners have access to tools that show the risk implications of scheduling decisions, protracted deviations, and planned activities, as well as what-if scenarios for enhanced future planning
- ▶ Asset leadership can see accurate levels of risk and productivity as well as trends for plan-attainment. This kind of data enables them to compare asset performance and see what is generating the highest levels of risk
- ▶ Executives can take an enterprise-wide view to compare asset performance, securing for themselves greater insight into how risk is managed across the whole organisation

Technology cannot do all of the heavy lifting, but it can enable a business and provide the support for a more collaborative culture, in which a disciplined approach to everyday decision-making enables key business objectives – including risk, productivity, and cost management.

The truth is if the hydrocarbon industry wants to achieve operational excellence through effective management of risk, productivity, and costs, operators need to know what's happening, when it's happening, and where it's happening in real-time.

The digital revolution has the promise to radically change the way people work. It can give an operator a full, three-dimensional view of every asset and facility. To achieve this, we need to convert the ever-growing sources of data provided by the Industrial Internet of Things into actionable insights. This requires a simpler approach that creates common currencies from disparate sources of data.

And when that information is made accessible to the entire organisation and in a way that makes sense to the entire organisation, everyone makes better choices. Everyone can actively participate in driving improvements to the business.

And everyone contributes to Operational Excellence.

For more than 25 years, we've been keeping loads of people safe in hazardous industries.

25+
MILLION
operational hours

>700
installations worldwide

80,000+
users everyday

150+
MILLION
hazards mitigated
26
countries worldwide

 PETROTECHNICS
Excellence is now operational