Digital Technologies Drive Automation Systems of the Future

Digital technologies are enabling companies to improve efficiencies.

By Dan Overly
ABB

Upstream sector digitalization varies greatly, ranging from unmanned, automated drilling platforms with robotic crawlers inspecting dangerous flare stacks to oil fields where sensors are rare. However, while digitalization has been making inroads, it primarily has been at an asset level or via inconsistent, piece-meal implementation split by function and/or geography.

An obstacle to wider deployment has been the time it takes for digital initiatives to deliver results. And given the earlier oil price boom, there was little incentive to change.

However, following the 2014 crash, companies need to make such massive cost reductions that traditional measures, like layoffs and rig shutdowns, will struggle to deliver. Considering that between 2014 and 2015 the revenues of upstream, midstream and oilfield services companies declined 40% while opex only fell 9%, a new approach is required.

COLLABORATIVE OPERATIONS: A FULLY INTEGRATED APPROACH TO DIGITALIZATION

Intelligent Engineering	Intelligent Infrastructure	Intelligent Services	Intelligent Applications
Provides a proven, integrated approach to project execution to:	Integrates systems like automation, electrical and telecoms into one collaborative environment to:	Promote planned and predictive interventions to:	Offer software solutions and system components that help optimize performance by:
- Improve flexibility	- Reduce costs	- Avoid costly reactive or time-based maintenance	- Enhancing efficiency
- Hasten completion	- Refine operations	- Act based on actual equipment need	- Leveraging industry best practice
- Ensure faster start-up with fewer issues	- Improve performance	- Extend life cycles	- Promoting safe, secure production
- Reduce man-hours and costs			

TABLE 1. The four activities—infrastructure, engineering, services and applications—become "intelligent" as they are integrated together to uncover value for projects and operations. *(Source: ABB)*

With better telecommunications and computer-processing capabilities now available and sensor prices at an all-time low, digitalization—properly executed—can transform operations, making it easier for companies to keep production online with fewer workers and increased safety even during tough times.

Digitalization and the upstream sector

In an era of low-priced oil and burgeoning unconventional sources, companies are decreasing capex in favor of sweating existing assets.

Upstream players are reviewing their large-scale projects and need to seriously consider the benefits of more fully integrated approaches, which use standard, leaner designs that are easier, less expensive and quicker to deploy during downturns and can be quickly replicated when conditions improve.

To understand how digital technologies can optimize new or existing installations, it is important to consider the four activities upon which they add intelligence. These are infrastructure, engineering, services and applications (Table 1). The four activities become "intelligent" as they are integrated together to uncover value for projects and operations.

Intelligent projects: digitalizing new installations

Digitalization can shorten the installation and commissioning time of instrumentation and control systems while removing cost overruns, often experienced by late-stage changes.

Intelligent projects integrate the first two elements of Table 1 and can reduce capex and opex costs by 20% to 30% while halving the time from design to commissioning to about 50,000 hours.

Looking at these elements in greater detail:

- Intelligent engineering: covers the processes, tools and standards that take project execution from a traditional multivendor approach to one that streamlines equipment to minimize human error, risks and labor costs by exploiting the benefits of single-source accountability. It improves flexibility, reduces dependencies and increases efficiencies while lowering costs and accelerating projects.
- Intelligent infrastructure: comprises a wide range of products and systems for power, automation and telecommunications, such as closed circuit television, instrumentation, drives, power management and control systems. The intelligence of these devices refers to the fact that many have Ethernet IP interfaces and can easily join the industrial internet of things (IIOT). However, frequently the infrastructure chosen is far from intelligent—often a patchwork of disparate systems and interfaces that have little chance of being effectively integrated to optimize overall performance.

Combining the above elements uses digital technologies such as virtualization, emulation, simulation and cloud computing to remove the need for hardware in the factory, making projects faster and more cost-effective.

Virtualization provides the perfect environment for distributed engineering to meet the demands for today's modular process plant construction using several engineering, procurement and construction (EPC) contractors in different locations around the world.

The development of emulators such as Soft FF, Soft IEC 61850 and the development of software-based simulation applications such as Soft I/O and Sim I/O are successfully lowering engineering costs, risk and delivery times associated with functional testing. This is achieved by removing the need for hardware staging and replacing expensive, manually driven testing, with software-based testing.

By providing more realistic testing feedback through simulation, vendors are able to provide additional value to the functional testing conducted in the cloud. Virtual commissioning, using simulation models, leads to reduced costs and time during commissioning and an earlier startup.

Additionally, there are many ways cloud computing can be used to cut costs and accelerate completion, ranging from facilitating global standardization to lowering the costs associated with staging IT infrastructures and transferring engineering artifacts between vendor and customer.

An example where bringing together intelligent infrastructure and intelligent engineering has resulted in significant savings is in the development of ENI Norge's *Goliat* FPSO, a processing plant, oil storage capacity and accommodation facility located in the Barents Sea within the Arctic Circle—the first-ever project there. This intelligent project required 50% less commissioning time and saw a 30% reduction in engineering costs. Overall system complexity and footprint were reduced up to 60%. And, as there was single-source accountability, *Goliat* came online with less risk as there were signifcantly fewer integration challenges than normal.

Post-completion *Goliat*'s ongoing costs are being streamlined through a diverse range of intelligent applications and intelligent services, which are optimizing production and profitability.

There is a revolution underway that will define how future projects are executed. However, acceptance and adoption will depend on the end users, EPC contracts and vendors adopting this new way of thinking. As today's professionals retire, these new concepts are sure to become increasingly accepted.

Collaborative operations: digitalizing existing installations

With sites that already are operational, the focus is on optimizing processes by analyzing diverse datasets to gain enhanced operational insights. Some have projected that leveraging the IIOT could save integrated oil and gas companies with an annual production of 270 MMbbl more than $500 million in production and lifting costs.

The ABB 800xA distributed control system technology enables collaboration and remote operations in a central location. *(Photos courtesy of ABB)*

Collaborative operations use Big Data and data analytics to realize the potential of the IIOT and deploy all four elements of Table 1. Daunting reams of data are consolidated into manageable levels whereby people can take decisions, helping to improve coordination between functional silos by providing greater visibility and real-time system integration.

To bring to life how a fully integrated approach to digitali-

The ENI Norge's *Goliat* FPSO is the oil and gas industry's first project in the Barents Sea located within the Arctic Circle.

zation can improve performance, consider the case of Norske Shell where it has doubled the lifetime of aging topside and subsea assets while delivering 99% uptime, ensuring high levels of safety and managing energy consumption more effectively.

The use of intelligent services extended the life of Draugen and Ormen Lange safety and automation systems by an additional 20 years by developing an upgrade or replacement path for each item of hardware and software. The plan minimizes risk and expenditure while safeguarding Shell's existing high availability.

Furthermore, thousands of hours of work are performed annually by authorized ABB personnel from remote monitoring and operations rooms at ABB locations in Norway. This remote access enables ABB to safely implement changes, troubleshoot, provide support and carry out health checks, reducing the burden on Shell.

A range of intelligent applications continually analyze data to find new ways to increase productivity. For instance, an automatic choke control application has reduced the startup time of Ormen Lange's 16 low-pressure wells from 9 hours to 2 hours. High-pressure wells have seen startup times fall by 18 hours. Previously, the wells had been started using slow preset speeds to prevent gravel and sand incursion from destroying the wells. Now critical well variables are managed in real time, matching ramp-up speed adjustments to actual process dynamics.

Another example is how dynamic speed control of the onshore pumps responsible for pushing monoethylene glycol through the pipelines to the well has cut costs for Shell by enabling it retire one of its regeneration trains and decrease overall energy consumption. Shell also is able to ship more gas since less space is taken up by the monoethylene glycol in the pipelines.

In terms of intelligent engineering and intelligent infrastructure, ABB has integrated Shell's process control and process safety systems into a "single yet separate" entity, which would more traditionally have been supplied by two different vendors. Any change has to be approved, first by the ABB technical account manager and then by Shell. The outcome has been an exceptional safety record and a vast bank of information that can then be analyzed to improve further.

Transitioning to a more digitalized OGC environment is exciting but not easy. Winners will use the current downturn to reimagine their entire business model and take a long-term, holistic view that deploys digitalization, not in a few isolated pockets but across their whole operation as discussed in the above case studies. ■

Dan Overly is the global head of products, oil, gas and chemicals for ABB.