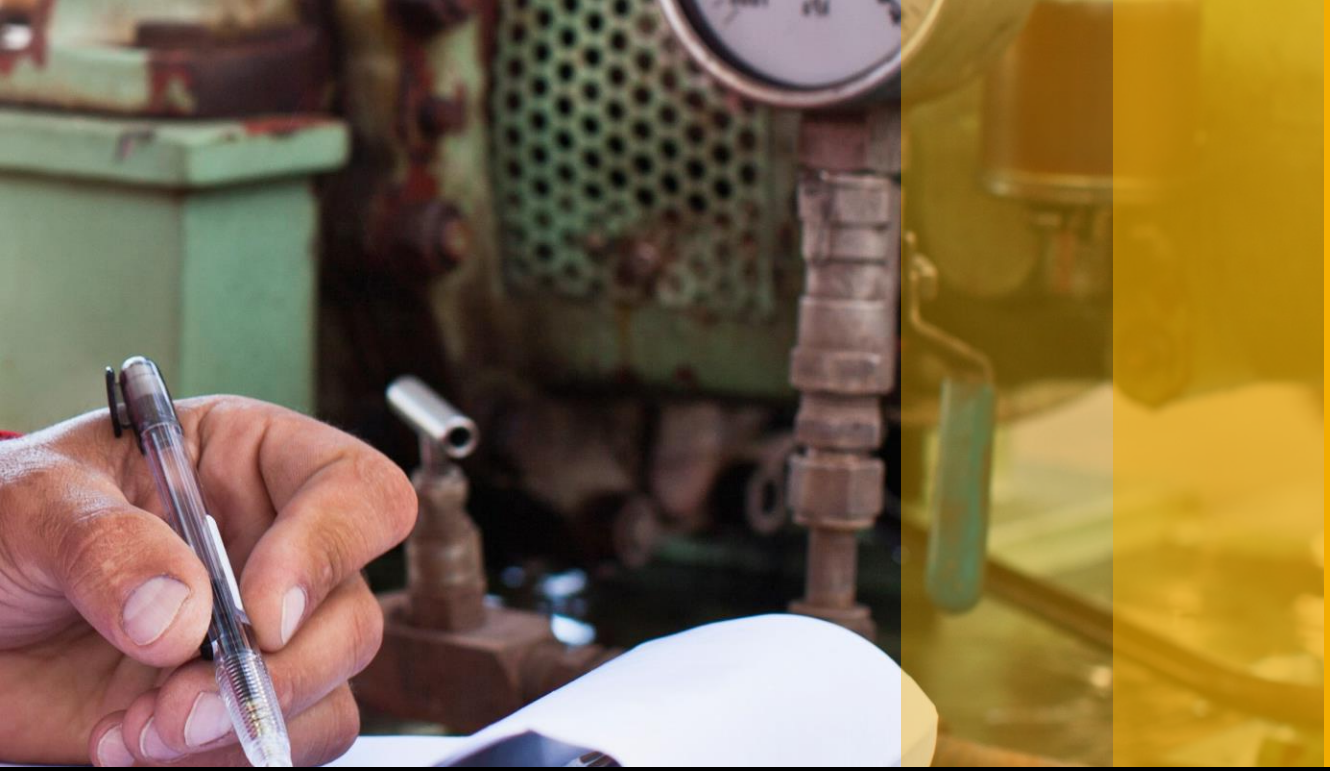


Digital Oil and Gas

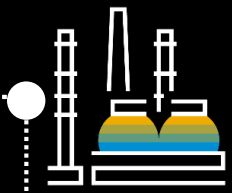
Volume IV
Automation

SAP Run Simple

Digital Oil and Gas

Volume IV
Automation

Commodity prices remain low and are not expected to dramatically increase



Oil and gas organizations must sustainably reduce cost structures

The industry is facing disruption from multiple sources – regulation, alternative energy, global demographics and more

The industry has already extracted as much value as possible from three main areas of cost

1

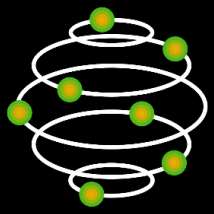
Reducing organizational headcount

2

Increasing pressure on supplier pricing

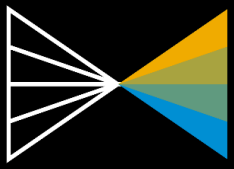
3

Redesigning processes for incremental efficiencies



Connecting things to outcomes with the industrial internet of things

Improving – and automating – decision-making with machine learning



The next wave of innovation will not be easy - it will require the thoughtful adoption of digital technology

Enhancing efficiency and effectiveness with automation

Transforming the way transactions are performed and documented with blockchain

INTRODUCTION

Automation is a familiar concept growing into unfamiliar territory

Automation is taking the human element out of a process, interaction or calculation[1]. It is a familiar concept - we are accustomed to programming machines to perform manual labor for us. We typically think about automation in the context of hardware used in operations settings such as assembly lines. We have also seen automation in the corporate office, with photocopiers automating copying and Excel macros showing how software can simplify a process.

Digital technology trends have drastically changed this traditional automation landscape. We now have:

- Significantly smarter devices, enabling more accurate readings and providing their location
- Increased computing power, enabling faster processing and interpretation of data
- Cloud computing, enabling these processes to happen almost anywhere while reducing the infrastructure barrier to entry
- Simultaneous innovations in machine learning, leading the way to adaptive performance

With the proliferation of new technology, we are seeing automation expand in several ways:

1. More complex: We once could only automate the most repeatable and structured tasks. Now, we can automate tasks end-to-end with significantly greater complexity
2. More abstract: We are seeing automation expand from hardware-based operations activities. Software-only automation is become more prevalent for both operations and for corporate functions
3. More remote: robots are no longer plugged into a wall or need to be in a controlled plant setting. Through smarter, connected devices automation can cover a much broader area

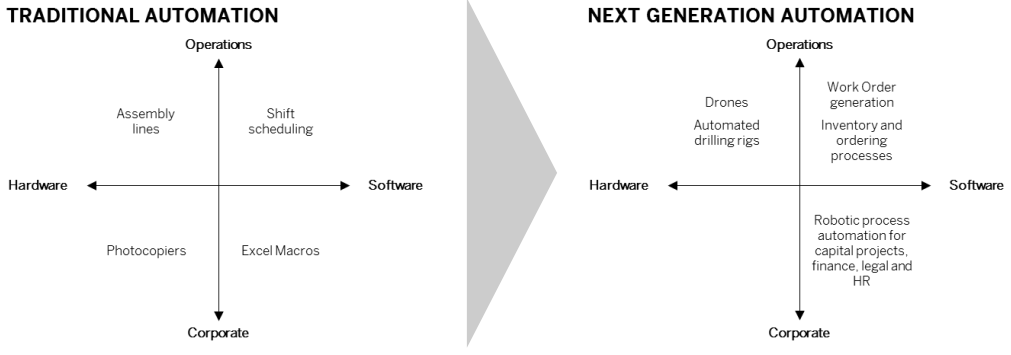


Figure 1 – Moving from Traditional to Next Generation Automation

Automation will continue to enhance effectiveness and efficiency in new areas of the industry

The value of automation continues to be what it has always been – enhanced effectiveness, decreased costs, and increased safety. For the oil and gas industry, the key transformation is to fully adopt this technology.

Oil and gas organizations will see significant value from greater application of automation. In addition to operations in widespread, remote locations, oil and gas organizations have a constant focus on low cost structures and zero tolerance for safety issues[2]. Automation maximizes operations in both of these areas. "A truly digital oilfield could lead to a 20 percent cut in primary preventative maintenance costs and a 2.5 percent boost to production volumes, according to GE estimates. With production in the U.S. is at 10 million barrels a day, that could mean a 231,000 barrel-a-day boost[3]."

The critical key outcomes of automation is the execution of efficient and safe end-to-end processes. Automation improves the actions and connection points between the steps in a process (e.g., the application of the IIoT) and leverages machine learning to do so in an intelligent manner.

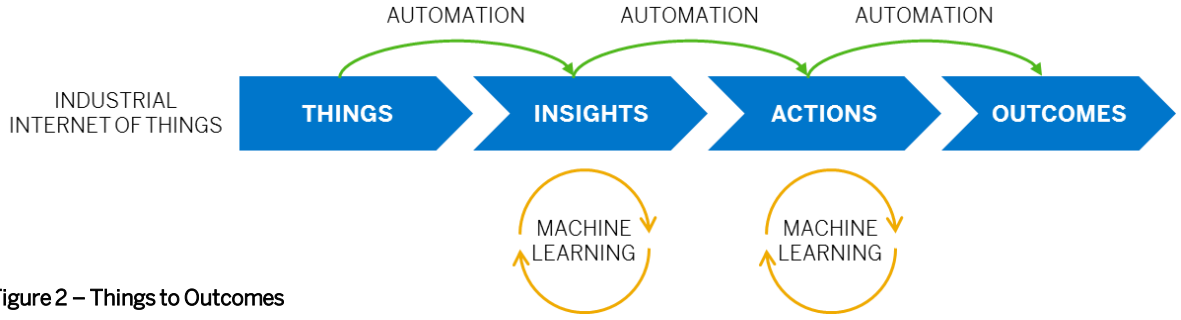


Figure 2 – Things to Outcomes

Machine Learning vs. Automation

Machine learning and automation are closely tied, but they have an important distinction. Machine learning takes the human element out of the information processing and prediction, but it does not take action. Automation takes the human element out of the action

BUSINESS CHALLENGES

The oil and gas industry can address several business challenges using next generation automation

With benchmark oil prices under pressure and a relatively flat forward curve (as of March, 2017[4]), every organization in the industry is compelled to find ways to sustainably reduce their cost structures. To do this, there are three main levers: headcount reduction, pressure on supplier prices, and process efficiency. The first two levers have been used as much as possible; the industry must now focus on process. Simple process redesign has provided some cost savings, but further innovation is required.

Here are five challenges across the hydrocarbon value chain where automation will have an impact:

1. Operating in remote locations in a low-cost, safe manner
2. Executing corporate processes with the maximum amount of efficiency
3. Delivering on capital projects in oil and gas are on-time and on-budget
4. Drilling wells efficiently, safely and with minimal cost[5]
5. Monitoring pipeline integrity across a broad geographical area

Applying automation will improve organizational efficiency, effectiveness and safety

Automation removes the human element from potentially dangerous, remote or time consuming tasks, which will increase efficiency and effectiveness as well as safety.

AUTOMATED PROCESSES

ENHANCED EFFECTIVENESS	DECREASED COSTS	ENHANCED SAFETY & SECURITY
Faster processing • Decrease resources and length of time to complete end-to-end corporate processes (i.e. financial close) **More effective resource scheduling** • Reduce number of rig hands required for operations and provide greater visibility into logistics for more control in scheduling and execution **More streamlined reporting** • Enhance visibility into critical performance KPIs, thereby improving operational decision-making	**Reduced number of errors** • Reduce human error in operations tasks **Reduced human involvement** • Require fewer resources to monitor and complete tasks • Reduced spend on remote accommodations and operations	**Reduced human exposure to unfavourable environments** • Automated vehicles monitor remote or dangerous locations **Enhanced site security** • Use computer vision to predict potential security threats **Increased equipment safety** • Improve consistency, coverage and accuracy of equipment integrity monitoring

Figure 3 – The Value of Automation

Automation can reduce the number of rig hands required to drill a well

AUTOMATED DRILLING RIGS

BUSINESS CHALLENGE

Drilling a new well can require anywhere from 5-30 rig hands[5] to complete a new drill from start to finish. These wells are typically located in remote and distributed areas, creating significant resource costs for work in remote areas as well as increased safety risks

SOLUTION DESCRIPTION

- The drilling rig is outfitted with sensors which are fully integrated into an operations management system and connected to the control van
- A much smaller workforce (2-5 people) are positioned in the control van with full visibility into all drilling rig operations (pipe handling, casing handling, mud chemistry, sample collection etc.)
- Using appropriate human-computer interfaces (joy stick, touch screen etc.) the reduced crew can control the automated drilling rig from within the control van

POTENTIAL VALUE

- Increased safety
- Increased efficiency and production

Automation can reduce project management costs and cost overruns for capital projects

CAPITAL PROJECTS MONITORING

BUSINESS CHALLENGE

Ongoing hydrocarbon megaprojects are a significant source of cost – 64% of megaprojects face cost overruns[6]. This is frequently due to project management issues such as inadequate planning, procurement of materials and delivery of contractors, ineffective project management, poor contract management[7]

SOLUTION DESCRIPTION

- Project planning software used to build a plan and share it across all involved parties – internal and contingent labour
- Digital twin technology including unmanned vehicles and computer vision are used to monitor construction progress by visually comparing current state to planned state in the project plan
- Digital twin technology performs quality assurance checks on materials before they are shipped to site
- Project planning software combines inputs from digital twin technology and the project plan to generate project reporting, instead of manual updates
- Project financials are calculating on a daily basis, comparing spend to data with projected spend and forecasting spend to complete. Decision-makers receive reports directly to their mobile devices to enhance visibility, highlight dependencies and key areas to focus attention to address gaps

POTENTIAL VALUE

- Reduce PMO resources required
- Reduce spend on transportation and re-work on faulty materials
- Increase effectiveness of decision-making with better information visibility

Automation can connect major corporate process together without manual intervention

CORPORATE PROCESS AUTOMATION

BUSINESS CHALLENGE

Corporate processes still require significant manual work to complete (e.g. batch jobs, data entry, system comparison), particularly in sub-processes that connect major process. In addition, corporate resources tend to be expensive

SOLUTION DESCRIPTION

- The goal of process redesign is to automate all rule-based actions, facilitated through a series of platforms and tools
- A real-time enterprise resource planning (ERP) system sets the foundation by holding a large amount of automation, as the real-time nature eliminates the need for batch jobs
- The ERP system is augmented with robotic process automation (RPA) solutions to close any remaining process gaps to connect sub-process in major processes and maximize transaction automation
- A real-time analytics platform is used to eliminate manual reporting efforts by integrated with the ERP and generating required reports according to automated processes

POTENTIAL VALUE

- Reduced cost
- Increased efficiency
- Increased effectiveness of decision-making

Automation can help monitor a vast network of assets with significantly lower resource cost

PIPELINE MONITORING AND INSPECTION

BUSINESS CHALLENGE

Oil and gas organizations, especially midstream players, own and operate a significant number of heavy assets, which are typically distributed across geographies or located in remote or unfavourable conditions. Monitoring these assets is accomplished through some control systems, but also requires physical inspections by human agents

SOLUTION DESCRIPTION

- Remote vehicles can be deployed across a wide geographic area to inspect assets. These vehicles can be equipped with machine learning capabilities to support visual inspection, issue identification, and any security threats
- Information from the remote visual inspection can be fed into another machine learning model which will automatically classify the inputs it receives according to required features, and consistently improve it's accuracy as it completes more inspections
- Results can then be provided to another automated machine or to a human agent for action

POTENTIAL VALUE

- Increased safety
- Increased efficiency and production

FOUNDATIONAL TECHNOLOGY

Implementing the next wave of automation requires a strong foundation with specific requirements

To take advantage of automation, organizations must have a strong foundation of standardized tools, processes and data, supported by the right competencies, platform and data base structures as well as a clear and effective governance model for each.

MASTER DATA MANAGEMENT	ENTERPRISE DIGITAL CORE	REAL TIME TRANSACTION PLATFORM	REAL TIME ANALYTICAL PLATFORM
Simplified, standardized, complete, and cleansed data; master data governance structure	Single source of enterprise truth for all transactions related to finance, supply chain, logistics, maintenance, and projects	Transactional platform must have the computational power to allow for real time posting and analytics (no batch jobs)	Analytical platform must have the computational power to allow for real time replication of relevant data, with appropriate data tiering
WORKFORCE MANAGEMENT PLATFORM	**STANDARD PROCESSES AND TOOLS**	**ENTERPRISE CLOUD STRATEGY**	**ENTERPRISE INTEGRATION STRATEGY**
Single platform to capture hire to retire processes for both employees and contractors	Standardization across business units allows for scalability of technology solutions, simplifying deployment and maximizing value	A clearly defined cloud strategy helps make deployment decisions easier, avoiding the distraction of having to discuss it for each selected technology	A clear approach to integration can simplify

In addition to the foundational technology, the next generation of automation will require the following:

- Infrastructure to gather data inputs across the organization, including sensors across assets an a network to connect them together
- Specialized hardware where appropriate such as robots and drones
- An agile platform on which to build, prototype and execution robotic process automation algorithms
- Niche technology required for machine vision and human machine interaction (e.g. digital twin software, machine learning algorithms to process data inputs)

WHAT YOU CAN DO NOW

Oil and gas organizations must take action to advance in next generation automation

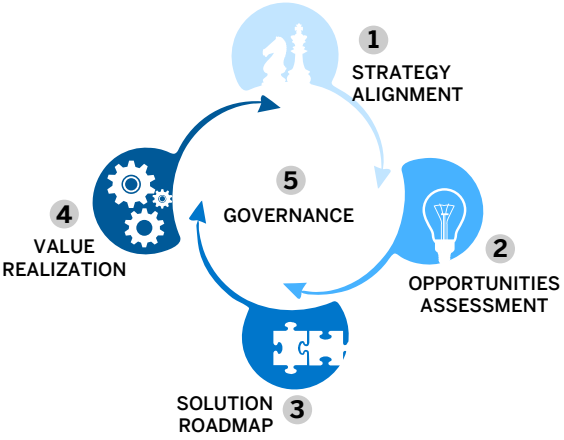


Figure 4 – Technology Transformation Methodology

1. **Strategy Alignment:** Translate corporate priorities and initiatives into technology priorities
2. **Opportunities Assessment:** Explore opportunities based on strategic initiatives and prioritize based on value
3. **Solution Roadmap:** Document end-state solution, qualitative and quantitative benefits, and strategic roadmap
4. **Value Realization:** Measure value delivered through transformation
5. **Governance:** Maximize and accelerate value from investments with governance based on executive engagement, value delivery and continuous innovation

Here's how you get started with next generation automation:

1. Look beyond traditional automation – think of areas where software, not just hardware, can automate processes; consider how corporate activities can be automated just the same as operations
2. Develop a baseline infrastructure from a hardware and software perspective – sensors, networks and real-time platforms
3. Inventory your end-to-end processes and map them to the task level of detail; identify the value-added instances for automation; select manual processes that should be automated
4. Ensure you are capturing and storing data in an efficient and accessible manner; a significant volume of clean, standardized data is a pre-requisite for automation
5. Identify the right problems to solve based on your inventory and classification along with an understanding of time to value and return on investment

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IDEATION CENTRE AT SAP CANADA

The Ideation Centre's mission is to help Canadian leaders of business, academia, government and non-government organizations develop a deeper understanding of the digital forces driving the economy today. Ideation Centre members strive to bring forward made-in-Canada fact-based arguments that challenge decision makers to think about the potential of organizational shifts that were not possible in the past.

The Ideation Centre is fueled by thought leaders from the Industry Value Engineering team at SAP Canada. This diverse team of industry and value advisors helps organizations of all sizes and industries take advantage of technological innovations to create incremental economic value by adopting new business models and optimizing business processes, from the back office to the boardroom, farm to storefront, mine to operating room.

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