



Digital Operations

Automating the Petroleum Industry, from Wells to Wheels

Crude oil price pressures and the Great Crew Change drive automation to lubricate nearly every link of the petroleum supply chain. An automation capability framework that is defined by nine core capabilities advances a company's ability to become digital.

Executive Summary

Since 2014, oil prices have remained relatively low, and the loss of institutional knowledge (known as the Great Crew Change) has required the U.S. petroleum industry to scrutinize its operations and associated costs. The Great Crew Change is a demographic phenomenon where a roughly 20-year period of cyclical hiring freezes and layoffs in the industry created a knowledge gap between late baby boomers and early millennials. As baby boomers retire, the gen x-ers whose careers survived this period are too few to fully train the

generation of millennial workers who have succeeded them. In our view, intelligent automation can help fill the knowledge gap by capturing the expertise of experienced workers before they leave, and minimize business opportunity losses due to lack of experience.

Furthermore, the automation of repetitive processes can help these companies to better manage their resources and data and improve safety and collaboration as well as increase productivity and profitability.

The complete supply chain of petroleum extends from its origins as an extracted natural resource to a manufactured product for end-user consumption – thus the term “wells to wheels” in the title. This white paper discusses automation’s potential in each link of the supply chain, from the crude oil and gas wells in upstream exploration and production, through midstream distribution and transportation,

to downstream refining, and finally to the wheels at retail gasoline stations. In doing so, the paper defines frameworks for identifying and prioritizing potential automation use cases. It also defines nine core capabilities that allow an enterprise to deploy automation capabilities to efficiently run its business operations.



Keeping pace with ever-changing industry dynamics

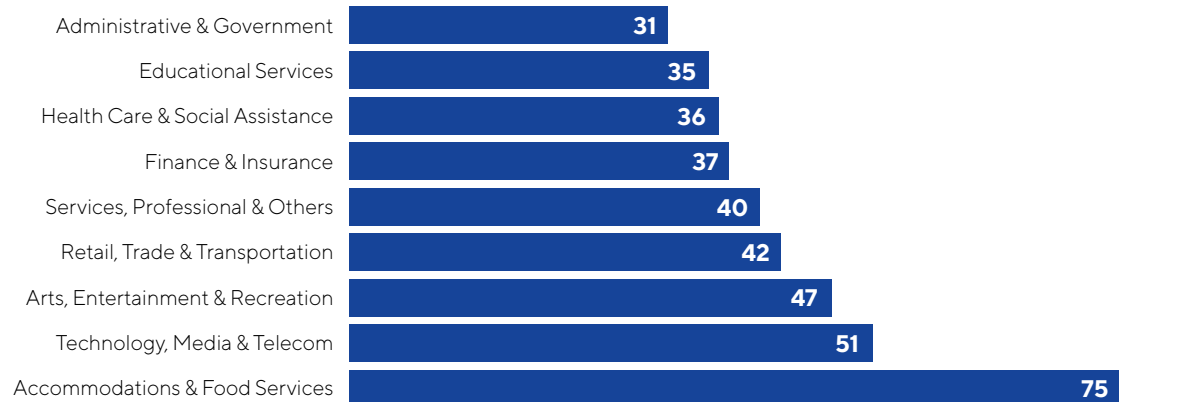
- | Price volatility, rising production costs and diminishing skilled labor resources have created serious operational challenges for petroleum companies. The lack of timely, continuous information has many players struggling to effectively leverage their people and material assets, which is negatively impacting their bottom lines. The chief challenge: How can professionals access information when it is needed?
- | How can workers focus on strategic issues rather than spending time on repetitive tasks?
- | How can companies improve operations and reduce costs?

Automation is a technology priority in most manufacturing sectors, including petroleum. As in other industries, energy companies are focused on what automation solutions – coupled with cloud services and analytics – can do for their organizations.

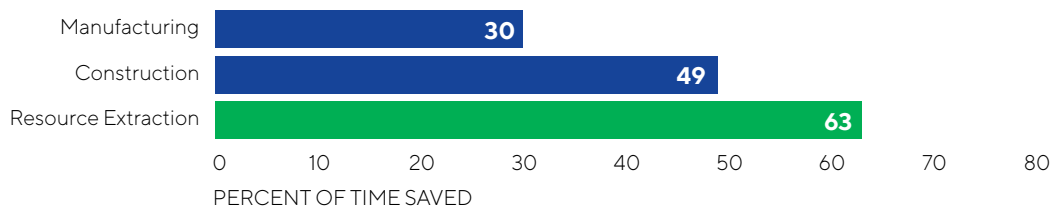
A recent study¹ by McKinsey shows that the resource extraction industries can apply technologies to automate 63% of their processes, and time thus saved can be used to drive other growth factors (see Figure 1).

Automation potential: percentage of time saved

Service Providing Industries



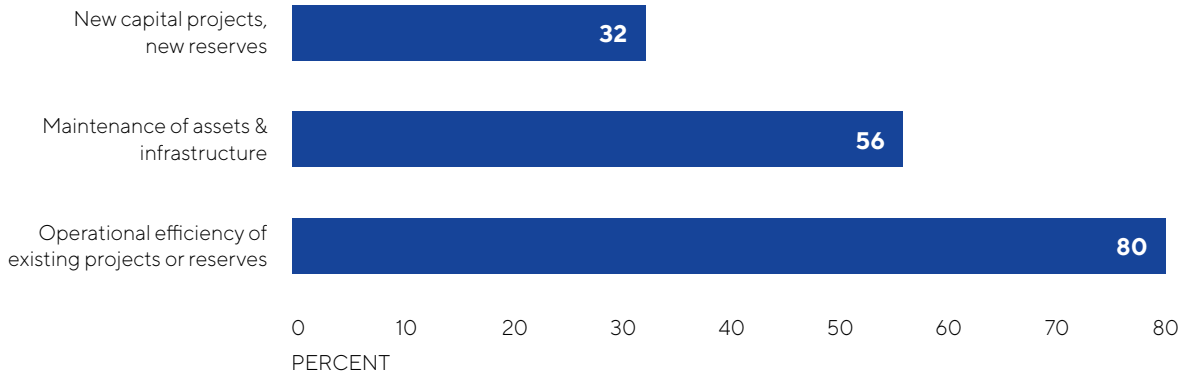
Goods Producing Industries



Source: McKinsey Global Institute
Figure 1

Investment priorities

In which area do you see the industry increasing investments the most in upcoming years?



Source: Cisco
Figure 2

Another survey², conducted by Cisco, on top industry priorities for investments in upcoming years also reveals that energy companies are focusing more on technologies that deliver increased operational efficiencies (see Figure 2). Hence, automation technologies have huge potential as they become more applicable, more powerful and smarter.

A wide variety of automation applications and autonomous systems are available for engineering, maintenance and operations – not just functions that are usually outsourced like back office and other administrative support. AI technologies transcend mere automated data gathering and entry, as newer capacities include data analysis.

Since workforces are increasingly geographically dispersed, information (not just raw data) must flow seamlessly to employees and customers – whenever and wherever they need it most. AI technologies are increasingly used to track individual field workers to help automate resource scheduling and to support safety monitoring. With intelligent automation and other emerging technologies disrupting legacy business processes and systems in the energy industry, proactive organizations are realizing the benefits from this change. Figure 3 (next page) compares the past, present and future of the industry's automation-driven evolution.

AI technologies are increasingly used to track individual field workers to help automate resource scheduling and to support safety monitoring. With intelligent automation and other emerging technologies disrupting legacy business processes and systems in the energy industry, proactive organizations are realizing the benefits from this change.

Automation’s progression throughout the sector

	THE PAST AND THE PRESENT				THE FUTURE			
PEOPLE	Workforce Burdened with Rote Manual Work	Outsource Repetitive and Standardized Jobs	IT-Led Development	Limited Manpower Capacity	Skilled Resources Freed for High Value Strategic Work	Re-shoring and Localization (RPA Solutions)	Business-Led Automation Solution	24x7 Capacity Augmentation
PROCESS	Excel/Macro-Based Manual Processes	Long Innovation Cycles	Slow & Error- Prone Processes	Disparate Processes	Automated Solutions with Minimal Manual Intervention	Agile Response to Changing Business Environment	Highly Efficient and Accurate Processes	Highly Standardized Processes
TECHNOLOGY	Integrated Legacy Systems	Distributed Financial Data Management	Large-Scale Upgrades/ Integration	Analytics and Reporting	Intelligent Digital Systems	Cloud-Based Centralized Financial Data Management	Bolt-On RPA Solution Implementation	Big Data & Predictive Analytics

Figure 3

This underlines the dramatic shift and advancements in how companies can and will use automation technologies. Until recently, automation has primarily been used to improve the performance of siloed functions and to merely “get information out.” Now, however, companies are attaching far greater importance to the

integration of data-driven enterprise systems such as enterprise resource planning (ERP), enterprise asset management (EAM) and supply chain management (SCM). Many petroleum companies are setting up dedicated automation competency centers to research opportunities in newer business functions.

A differential automation play

Automation is a force multiplier that increases the impact of individuals on the business and presents opportunities for structural business change.

Figure 4 shows the evolution of technology initiatives that span operations improvement, revenue enhancement and, eventually, fundamental business model reinvention.

The evolution of technology-powered change

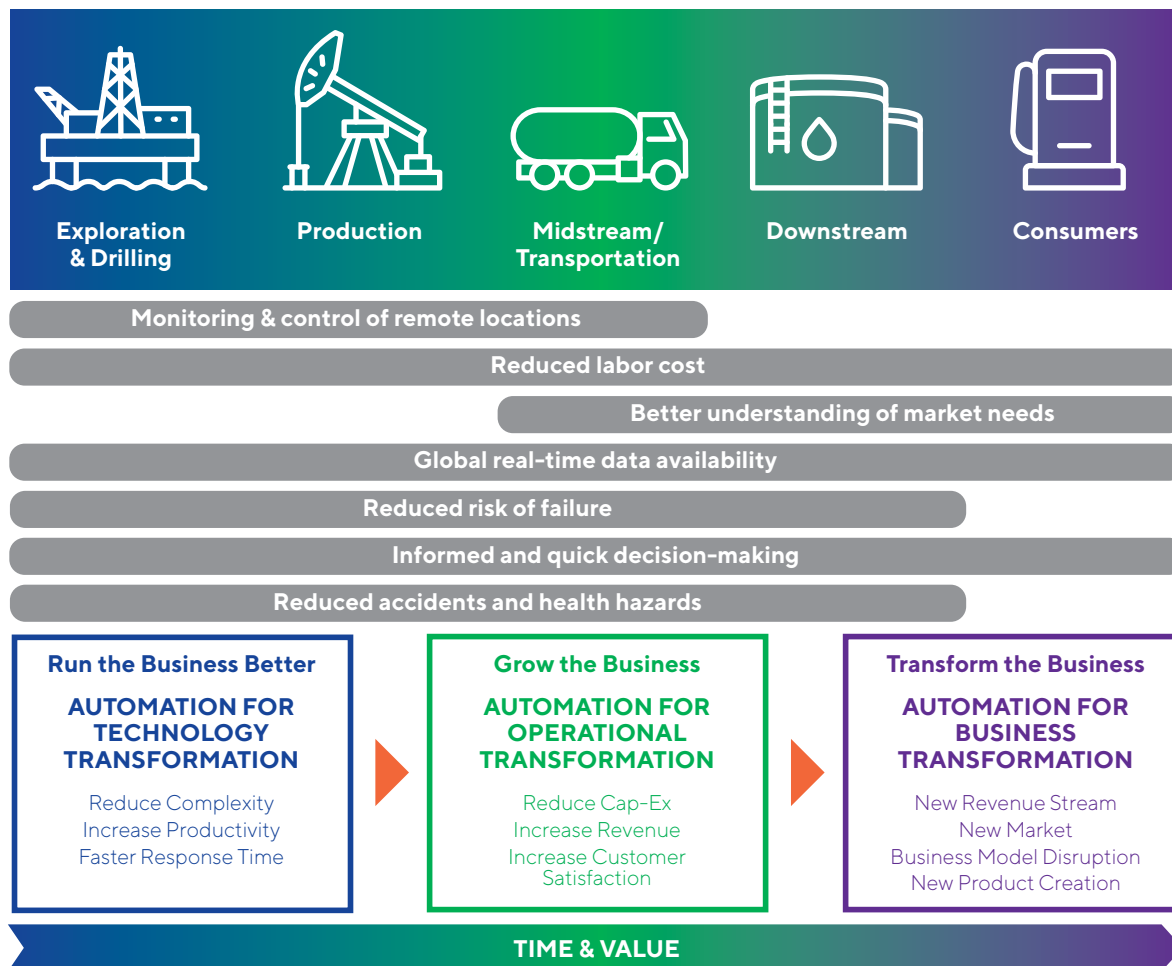


Figure 4

Automation’s potential

The petroleum industry’s primary automation challenges revolve around the complexity of selecting appropriate focal areas and the difficult decisions regarding who will lead the initiative. The reason: the hazardous conditions that pervade the industry (i.e., potentially toxic, flammable

or explosive environments), the remote and harsh environment of field locations in upstream operations and the significant gaps in the experienced, mid-career range among the offshore workforce. Figure 5 depicts automation’s potential benefits across various functions; in the subsequent subsections we will cover some of the possible applications in different sectors.

Automation’s potential across key functions



Source: McKinsey Global Institute
Figure 5

Algorithms trained to interpret petabytes of unmigrated cubes of raw seismic data reduce the need for visual representation and identify by exception the formations of interest for further analysis by geoscientists. The exceptions will be smaller volumes of the raw seismic data that need to be migrated for visualization.



1) Exploration

Exploration is a costly operation, due to risks both tangible, such as environmental and safety impacts, and intangible, including geopolitical instability. Add to this the uncertainties of finding oil and gas, starting with indirect means of exploration, including seismic processing, followed by more expensive direct means, (e.g., drilling exploratory wells). Simplifying processes can significantly reduce exploration costs and, with the proper application of analytics, enable more informed and timely decisions.

Discerning subsurface geological formations is the key to identifying potential drill sites. Since different materials in formations transmit acoustic vibrations at different speeds, some elements of the formations can be indirectly identified seismically. Seismic data is gathered by sending impulses of acoustic vibrations into the subsurface onshore or subsea offshore at intervals over a given area. The delineation of this space is called a seismic volume. The speeds of the signals transmitting through the formations and reflecting back to the surface are measured and recorded.

A computationally intensive and time-consuming process known as migration transforms the speeds into the depths and thicknesses of subsurface formations. A visualization of the data is the conventional way to interpret the stack of the

formations making up the geological record and subsurface features such as faults and salt domes. Exploration is already highly advanced with 4-D, full immersion data visualization.

Algorithms trained to interpret petabytes of unmigrated cubes of raw seismic data reduce the need for visual representation and identify by exception the formations of interest for further analysis by geoscientists. The exceptions will be smaller volumes of the raw seismic data that need to be migrated for visualization.

Smaller seismic volumes are migrated faster than larger ones. Alternatively, AI machine vision can be applied to the visual representations of the migrated seismic data and identify by exception the formations needing further analysis.

If the seismic data points to a promising reservoir, exploratory wells are drilled to recover well-log data and core samples. Microfossils, or the remains of microscopic organisms that became trapped in the geological strata, are critical markers. Since certain species of these organisms lived during specific periods of the geological record, their microscopic fossil remains indicate which geological layers are in the core sample. AI machine vision algorithms can be trained to recognize specific microfossils in magnified images of slices of the core samples and thus identify the corresponding geological layers. Machine-vision algorithms can also be trained

to discern pores in cross-sectional slices of core samples and classify the rock formations based on images of the core samples. The porosity of the rock also factors into how much oil can potentially be recovered from the reservoir.



2) Production

Upstream profitability largely depends upon production and surface operations efficiency. With the substantial number

of offshore production platforms, incremental improvements in operational efficiency yield meaningful financial gains. Additional throughput translates directly into greater revenues when oil prices are high enough to justify the production costs. Carefully targeted automation can cut costs and, more importantly, can also improve the reliability of production equipment, which in turn extends an asset's economic life and improves profitability.

A typical offshore production platform can have a number of data tags and numerous repetitive processes, not all of which are connected or used. Converting this complex flood of data into better business and operating decisions requires new, carefully designed capabilities for data manipulation, analysis and presentation, as well as tools to support decision-making. Among the highest-impact automation opportunities in production operations are process control automation (e.g., automation of a continuous process), reliability and preventive maintenance (e.g., equipment-condition monitoring, maintenance-operations planning), and production optimization.

Automation, sensors and analytics all play a role in upstream operations. Remote and autonomous operations optimize production as collecting well performance data from various geographies becomes feasible. Oil-field services chemicals, equipment, and transport can be optimized with

inventory control, journey management and predictive maintenance. The Industrial Internet of Things (IIoT) — as represented by sensors placed on oil-field services trucks, chemical additive totes and other equipment — provides the infrastructure needed to facilitate the automation of truck logs, delivery manifests and invoices.

As a result, safety incidents can be analyzed for systemic root causes and mitigated. Automatic work order creation and the allocation of routine and periodic maintenance tasks controlled from a central control room for multiple operating sites can also be implemented.

Supply-chain software can curate lists of acceptable oil-field services and chemical suppliers and manage the procurement and invoicing process. Back-office production and revenue accounting can be streamlined by automating revenue bookings and distributions, revenue receivables, production taxes, state royalties, federal and state regulatory reporting, and gas balancing.



3) Downstream Refining

Downstream operations have largely been automated since digital process control networks were implemented in the 1990s.

Linear programs are used to select the crude diet that maximizes the value of the refined products within the constraints of the refinery's operating limits. Event-based scheduling and planning software for hydrocarbon movements are quite mature in this part of the petroleum industry.

The parts of the downstream business that could benefit most from more automation are in back-office work processes, predictive maintenance, drone inspections of vessel internals, tanks and flare stacks, and discerning systemic root causes from safety incidents.

Other targets for automation include general accounting and general ledger processing,

AI systems assign tasks to staff with all the relevant information dispatched to workers' mobile phones. Once workers return to their offices, control room or living quarters, they can check the day's work schedules.

computation of joint interest accounting, and accounts payable and accounts receivable, thus reducing computational and human errors.

During normal operating periods, workforce scheduling is fairly routine. However, the contractor work force onsite increases exponentially during turnarounds. Workforce scheduling, job allocation and progress monitoring become cumbersome as the scale increases. Within the limits of applicable labor union rules, efficient utilization of available resources is achieved by applying AI to support the reallocation of work and automatic roster creation.

AI systems assign tasks to staff with all the relevant information dispatched to workers' mobile phones. Once workers return to their offices, control room or living quarters, they can check the day's work schedules.

In recent years, intrinsically safe mobile devices for industrial use have provided vital information to field techs and engineers in either upstream or downstream facilities. This data comprises static equipment specification sheets, schematics or material safety data sheets (MSDS). Intrinsically safe mobile devices loaded with augmented reality software can display repair instructions.

The heavy concentration of steel can block cell phone signals inside a refinery's processing unit or the top sides of a production platform at sea. To counter the lack of cell service, static data is downloaded into the employee device's portable memory before entering the processing units. Technicians and engineers step out of the

processing areas and upload data to the company's intranet.

In less congested areas such as the tank farms of refineries or the area around onshore rigs, live trends of data from the control room or corporate headquarters can stream into a mobile device's screen wherever there is cell service. Offshore rigs are composed of steel infrastructure that blocks cell service and Wi-Fi signals. Intermittent satellite coverage is the rule. Thus, the available bandwidth offshore is very limited.

Leading companies use intrinsically safe mobiles to troubleshoot problems with remote subject matter experts (SMEs) by showing them the equipment through a GoPro-like camera, the cellphone's camera or a captured still photo uploaded later from an open area. Then, the field engineers and SMEs talk through the problem to resolution with a hearing protection padded headset on the cellphone. In less congested areas where signals are not blocked, the site crew can be guided by service specialists via live personal video feeds and area video feeds.

As part of the predictive maintenance protocol, matching unstructured operator logs with time-stamped historical plant data, inspection and repair records, and equipment design specifications and schematics creates a holistic view of the maintained assets. Over time, the curation of this data becomes the basis for a lifecycle asset maintenance program. This type of program includes automatic work order creation and allocation for routine and periodic maintenance tasks controlled from a central control

room for multiple sites within the refinery. Refinery process units are designed to operate for decades. The individual pieces of equipment constituting the units need consistent, quality maintenance to meet design objectives.

Based on consumption patterns or seasonality of consumables, requests for proactive material procurement can be initiated via automatic notifications or by automatically raising purchase orders. Voice recognition and synthesis technology can facilitate warehouse functions such as pre-receipting, receipting, inspections, package sorting, picking orders, tracking containers in the yard and issuing alerts with respect to high-cost rental materials, certificate expiry, etc.

During regular refinery meetings, such as those every morning, a voice-activated virtual assistant can be invoked to schedule tasks on participants' calendars, fetch digital documents from an engineering design archive or display a process history trend on a conference room screen.



4) Midstream Logistics

Autonomous drones for site surveillance greatly reduce the dependence on the physical presence of personnel in the field, thus saving on cost and work hours. Pipelines, terminal tankage, truck racks, rail yards and docks are prime candidates for drone surveillance and machine-vision algorithms for determining the need for repairing infrastructure and other human interventions.

Autonomous vehicles and vessels are more likely to adhere to planned routes, thus optimizing the trip with few diversions. Control over this aspect of the supply chain has to be balanced against the safety and environmental risks of unmanned vehicles encountering unexpected hazards.

Both crude and finished products can be moved by pipeline, rail, barge or tanker ships. Trucks generally deliver only finished products to retail outlets. Planning and scheduling software for optimizing loading volume and transportation routes for individual distribution channels is quite mature. However, optimizing the integration of different distribution channels — pipeline, rail and shipping — with supply sources (refineries or wells) and target markets (petrochemical plants, refineries or gas stations) is still relatively uncharted territory. A combination of linear programs of the distribution model, refinery unit models and machine learning could potentially optimize sizeable portions of the supply chain from wells to wheels.

A proof of work (PoW) can be defined as when a document is created and approved. A characteristic of blockchain technology is that as it attaches an indelible ID to an approved document (i.e., PoW), an auditable trail is created. The trail or chain ends when the final documentation for a given set of transactions is completed. An example could be the set of transactions from a booking order to the receipt for a final payment on a delivery. The blockchain ID confirms that each step in the transaction process is completed before moving

During regular refinery meetings, such as those every morning, a voice-activated virtual assistant can be invoked to schedule tasks on participants' calendars, fetch digital documents from an engineering design archive or display a process history trend on a conference room screen.

Dynamic pricing algorithms can set the fuel prices relative to competitors within visual range and the likely demand at particular locations and times of day.

onto the next step. The distributed ledger informs all parties of each transaction step.

An auditable document trail can streamline the regulatory documentation and approvals needed for moving materials through the distribution channels. Ocean-going vessels and river/coastal barges require manifests, docking approvals, etc. Rail also requires similar documentation for loading and delivering materials.

Crude oil is pumped through a vast network of pipelines. Contracted barrels of crude are pumped through pipelines where the barrels intended for one customer mix at the intersections with the barrels intended for another customer. High-quality crude is degraded from contacting lower-quality crude, and the opposite is true for lower quality crude that is improved from the intermixing. A crude bank at each mix point is a contractual legal entity that keeps track of changes in quality and compensates or penalizes crude shippers for those changes. The penalties equal the compensation among all the shippers at one mix point at one point in time. However, each shipper can accrue penalties or compensation over time that do not cancel each other out over multiple mix points in the pipeline network or through the same mix point over time. This is because each individual crude bank operates independently of the others in the pipeline system, and each shipper's movement through a crude bank's mix point is assessed independently of the shipper's past and future movements through that node.

Blockchain could help track and certify monetary exchanges that accrue over time in the crude banks

for each crude shipper. The blockchain record is quantifiable proof of accruals for reimbursing or penalizing the shippers when their crudes reach their final destination. Crude shippers can also apply game theory to minimize penalties accrued over multiple mix points over time.



5) Supply and Trading

The supply and trading functions of the petroleum industry are closely related to the midstream supply chain. Blockchain

technology could trigger smart contracts resulting from the final commodity trades. Price-forecasting algorithms based on curated histories of flat prices and pricing arbitrages can help traders create strategies. Trading-desk analysts can bring order to the chaos of quickly evolving deals with natural language processing (NLP) algorithms that aggregate and present focused news and weather events affecting the industry.



6) Retail

Supply-chain-optimization software can help retail franchise owners determine how much fuel to order from branded and

unbranded suppliers. Similarly, the same supply-chain software can help the convenience store owner manage replenishment requirements. Simulations of the consumer journey can help store owners choose marketing campaign strategies. Dynamic pricing algorithms can set the fuel prices relative to competitors within visual range and the likely demand at particular locations and times of day.

Loyalty programs can be implemented on mobile devices to guide drivers to the desired service stations. In particular, many late model cars now have built-in displays for GPS navigation and car function controls. Partnerships with car manufacturers and oil companies could move increasingly ubiquitous loyalty-program applications from the driver's cell phone to the car's built-in device. The fuel pump could wirelessly ping a loyalty-program-enabled car to update the assigned driver's profile and automatically award points or discounts for fuel, car washes or the convenience store.



7) Safety

Safety deserves a category all its own, given its importance in most links of the supply chain.

Analytics can be used to predict and prevent failures through simulation (a.k.a. **digital twins**) and historical performance. Tie the operator's log to the plant history through time stamps to add context to any data that appears to be outlying, based on process unit operations alone. Then apply the results to create predictive maintenance models to preemptively schedule inspections. Similarly, analytics can unearth systemic causes for certain safety incidents. Addressing systemic root causes can mitigate entire classes of safety incidents.

In the event of a loss of containment, the leak detection of flammable, toxic or asphyxiating gases via chemical sensing devices and fire through infrared/thermal imaging cameras generates an early warning to stop hot work, sound an alarm for evacuation and secure areas from entry. In the near future, workers may wear intrinsically safe locators and sensors during an evacuation so that safety and emergency staff immediately know who has and has not reached the assembly point during an emergency.

Finally, address cybersecurity through automated security measures to set monitoring rules, connectivity, access control, event log management, patch/software upgrades, threats and alarms, etc.



8) RPA/IPA/AI/ML Use Cases

This section highlights other potential use cases that can be applied across the petroleum supply chain.

- Production and revenue accounting:** Automate computation of revenue bookings and distribution, revenue receivables, production taxes, state royalty, federal and state regulatory reporting, and gas balancing.
- Advanced personnel scheduling:** Use artificial intelligence (AI) to support work reallocation to ensure all assigned jobs are completed on time with the right skill sets. Automatically create the roster with assigned tasks and all relevant information (what/when/where/how) that can be dispatched to workers' mobiles for viewing in a safe location.
- Routine reporting:** Prepare routine reports based on multiple operations parameters such as local indicator readings and valve and lever position readings, etc.
- Auditing:** Automate reports and documentation requirements for financial and safety audits such that compliance becomes integral to the business process. This renders the business audit-ready, with minimal preparation before the audit and minimal gap resolution efforts afterwards.
- Training and knowledge management:** Deploy augmented and virtual reality to create training environments and on-the-job assistance and support.

- Data migration and management:** Robotic process automation (RPA) can be deployed to transfer, manipulate and migrate application and system data quickly, reliably and with a full audit trail. This will avoid manual rekeying and reentry and vastly reduce the high instances of human error.
- Operations cost accounting:** Automate general accounting and general ledger processing and computation of joint interest accounting, accounts payable and accounts receivable.
- Customer service:** RPA can be used as a force multiplier to automate many of the common tasks in a customer service or support desk — such as incident management, billing queries, user administration and updating records — and to automatically set up and run processes.
- HR:** Automate many of the human resource functions such as talent management, training, payroll, documentation, data validations, access management, etc. Use blockchain to track and audit credentials and certifications.
- Crisis management feedback:** Use natural language processing (NLP) and sentiment analysis on social media posts to determine the effectiveness of public relations statements during a crisis.

Making automation real

Automation sounds good, but how does it yield concrete benefits for a petroleum company?

Petroleum companies that seek to efficiently mobilize their business operations through automation must assess their maturity level and develop an effective strategy and roadmap. Additionally, companies should ensure that governance is in place for scaling, deploying and monitoring, and for implementing clear rules and logic. Security needs, bots, platform and software strategies, and automation capability management must all be taken into account when defining and planning an automation infrastructure. A final prerequisite for success is data consistency.

We believe that organizations need an automation capability framework that is defined by nine core capabilities (see Figure 6, next page). An effective framework offers the following:

- Business strategy:** Business goals and objectives tied to broader corporate and business unit strategies that automation can enable.
- Governance:** Definition of automation strategy, processes, policies and standards across the organization.
- Operations management:** Execution of automation processes, operating model, policies and standards across the organization.

An automation capability framework



Figure 6

- Automation capability development:** Deliver automation capability based on a plan or roadmap. The steps follow the typical analyze, design, develop, test, deploy and maintain methodology.
- Automation solution management:** Solutions management and expansion.
- Bots, platforms and software:** Tools and technological infrastructure for developing solutions and managing code.
- Security and architecture:** Design and components to support and secure solutions.
- Infrastructure:** Data connectivity components and physical structures needed to support automation solutions.
- Support services:** User and technical support for automation solutions, integration and connectivity.

An identification & prioritization framework for process automation

To identify automation use cases, a process-led methodology is useful. In the business process modeling approach, the processes that underlie key petroleum industry functions are identified and drilled down to subprocess levels for mapping processes that can be automated. Once the potential processes are defined, the next step is to define one or more use cases corresponding to the identified business areas and prioritize them based on the value that automation can offer (see Figure 7).

Benefit vs. complexity: creating an automation use case

To ensure an effective automation strategy and to accrue real benefits, organizations must prioritize their use cases by examining the impact, business direction, ease and value that automation can bring.

Ideally, an organization should start by selecting a process that is stable, easy and active. Figure 8 (next page) describes an approach that we use for prioritizing use cases.

Processes with the highest automation-associated benefits should be prioritized. For example, those that are:

- **Expensive**, where even slight improvements lead to large cost savings.
- **Manually intensive, and large-scale**, where automation significantly reduces human effort.
- **Error-prone and readily improvable** by the consistency of automation.
- **Slow, and readily accelerated** with automation to increase the cadence of going through each step. The frequency of cyclical processes is increased when each process cycle is faster.

A framework for identifying & prioritizing process automation

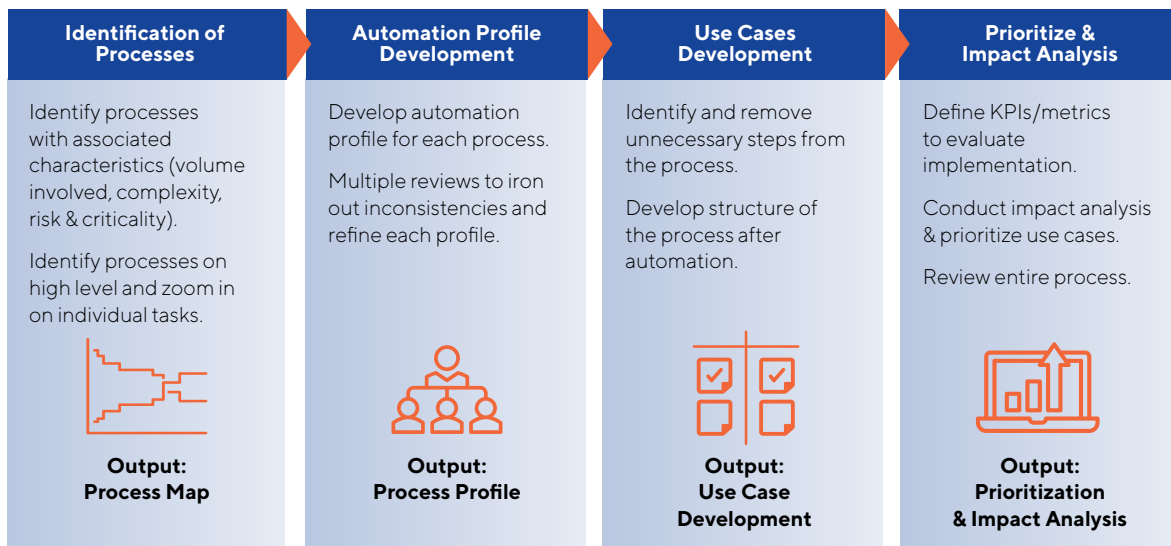


Figure 7

We also believe other factors should be considered when building use cases. Processes that are:

- Well-defined**, with a set of predefined constraints: Some processes have so many undocumented rules that even if they are rules-based, it is time-consuming to identify all rules via interviews with domain experts. Such processes are not good candidates for automation.
- Unique**: Common processes in the industry are cheaper and easier to tackle using prebuilt solutions rather than automation. In contrast, unique processes are automated with custom code or configuration. In many cases, even the common processes have wide variation due to the varying nature of the oil field.

- Mature**: Continually evolving processes are not good candidates for automation, as their process flow changes with time which requires a dedicated team to update the automation with those changes. Stagnant processes typically do not require frequent maintenance.

Our framework allows organizations to critically analyze the benefits associated with process automation and then test the nature of the process for automation feasibility. Our automation prioritization framework is used after the processes have been identified, when it helps to compare the benefits and the complexity of the process. A specific methodology is followed for prioritizing the processes for automation (see Figure 8).

Automation prioritization framework

BENEFITS	PROCESS IDENTIFICATION		COMPLEXITY
Impact	Involve high volume of transaction or high frequency of occurrence.	Has fewer uniform repeatable steps. Low stability and consistency of process. Involves variations or relies on human judgement. Simultaneous configuration of multiple factors.	Process Complexity
Suitability of Process	Repeatable in nature. Involves manual intervention frequently. Involves higher number of defined rules.	Controlled from multiple regions instead of one.	Geographical Footprint
Level of Control	Guided by high number of control, regulations and compliance standards where automation will reduce errors.	Process may cause data privacy issues.	Privacy Concerns
Financials	Process when automated would lead to reduction of operational costs, additional growth in revenue and improve overall financials of the organization.	Varying data inputs (structure or type) in the process with large number of sources. Nonstandardized & conducted across multiple practices.	Operational Complexity

Figure 8

Scoring is as follows:

- Every process considered for automation is evaluated for all four factors in the benefits column and given a score.
- Then the factors are given relative weightages, which results in a single benefits score for each process.

- The same process is repeated for the complexity.
- The resulting benefit and complexity scores of processes are plotted on a benefit vs. complexity quadrant (see Figure 9).

The processes lying in the first quadrant receive the highest priority for automation, followed by the processes lying in the second quadrant, and so on.

Benefit vs. complexity

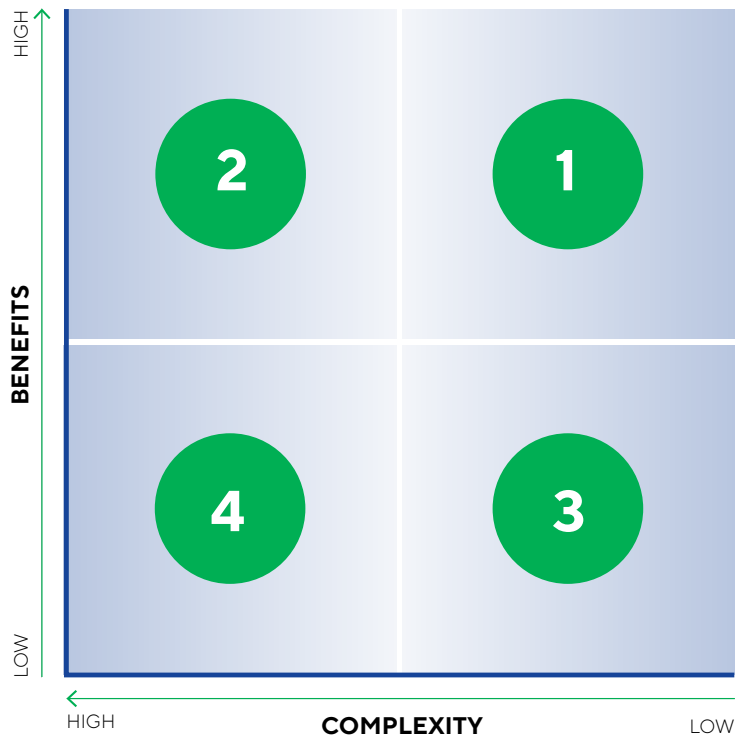


Figure 9

Looking forward

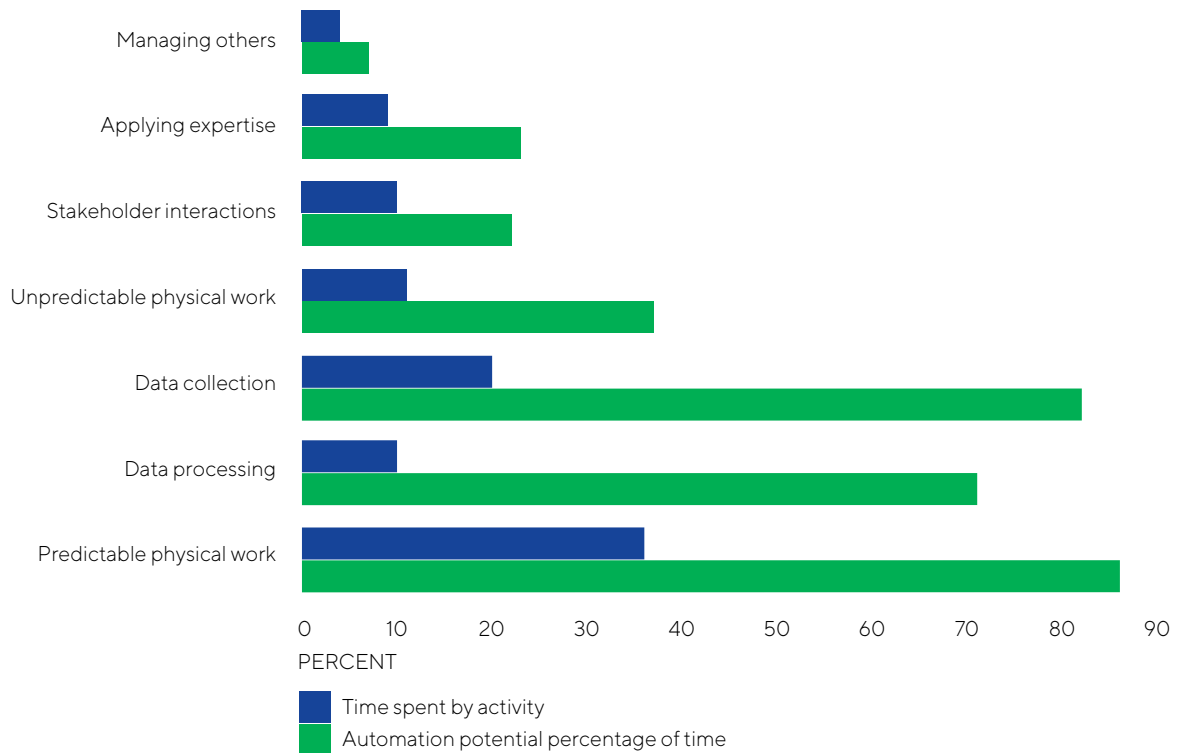
This white paper describes a range of opportunities that automation can deliver to companies in the petroleum sector. Automation allows large amounts of data to be collected and analyzed relatively quickly. Meanwhile, the workforce can minimize or even eliminate their exposure to hazardous conditions when retrieving data. Further, automation can remotely access assets in different locations. This geographic independence comes without business case impact. When identical processes and tasks are automated, variance is eliminated in process execution. Even with the industry’s enormous scale, compliance and logs can be maintained automatically without reliance

on worker input and this can integrate the entire company into a single functioning unit.

Among automation’s other benefits are error reduction and more informed decision-making, the results of applying real-time information and analysis. Proper, informed integration of automation leads to reductions in operating costs and labor.

The results of a study³ conducted by the McKinsey Global Institute reveals the potential for the industry’s business performance improvement by measuring time spent by activity against the automation effort applied (see Figure 10).

Work activity summary: resource industry



Source: McKinsey Global Institute
Figure 10

A call to action

The gradual introduction of automation represents significant additional business potential for the petroleum industry and hence companies are planning significant investments into automation technologies over the upcoming years.⁴ Our experience shows that those organizations which build a vision for automation across all key business functions are most likely to benefit from the opportunity. Gaining buy-in across the business, understanding how automation enables new operating practices and adopting a structured approach to implementation are all key for driving increased efficiency and productivity.

Most importantly, business leaders need a framework showcasing the key business process impact areas, automation enablement for these areas and strategic alliances for addressing the energy industry gaps. Developing industry-specific services will open up new markets and create competitive advantage.

To create a strong market position and market advantage for the medium to long term, petroleum companies will depend heavily on innovation and digital technology. Challenges still remain in quantifying the impact of automation on the petroleum industry. Primarily, organizations should focus on two KPIs for evaluating processes – cost



reduction and process cycle time reduction. The benefits realized on these KPIs will be most sustainable in the long run.

Thinking big, piloting small projects and scaling fast are the best ways that organizations with successful programs proceed, taking into consideration total lifecycle costs and economics. Organizations should build a digitization team and make automation part of a corporate digitization program as a best practice. Automation programs should be integrated with all aspects of complex organizations, work processes and human behaviors. Industry experience and prudent risk

management dictate that this level of complexity be thoroughly tested and proven in small-scale pilot implementations.

Once the concept is proven, rapid scaling is needed to secure the payoff. Such a scale-up requires tools, capabilities and a multidisciplinary team with experience ranging from process automation, domain expertise (e.g., plant maintenance), data management and cybersecurity, through interface design. These multidisciplinary teams should include representatives from every area of the organization's IT function.

Endnotes

- ¹ "AI, Jobs and Workforce Automation," McKinsey & Company, May 2017, www.cloudave.com/57719/mckinsey-ai-jobs-workforce-automation/.
- ² Robert Moriarty et al., "A New Reality for Oil & Gas," April 2015, <https://connectedfutures.cisco.com/report/a-new-reality-for-oil-gas/>.
- ³ "AI, Jobs and Workforce Automation," McKinsey & Company, May 2017, www.cloudave.com/57719/mckinsey-ai-jobs-workforce-automation/.
- ⁴ "Automation in Oil and Gas Industry," Frost & Sullivan, April 2018, <https://ww2.frost.com/frost-perspectives/automation-oil-and-gas-industry/>.

References

- I Robert Moriarty et al., "A New Reality for Oil & Gas," April 2015, <https://connectedfutures.cisco.com/report/a-new-reality-for-oil-gas/>.
- I James Manyika et al., "A Future that Works," January 2017, www.mckinsey.com/~/media/mckinsey/featured%20insights/Digital%20Disruption/Harnessing%20automation%20for%20a%20future%20that%20works/MGI-A-future-that-works-Executive-summary.ashx.

About the authors

Janet Blancett

Director, Energy & Utilities Practice, Cognizant

Janet Blancett is a Practice Director in Cognizant's Energy & Utilities Practice. She has over 30 years of experience in the petroleum industry and has served in various design, operating and consulting roles in petroleum refining, midstream logistics, supply and distribution, oil market analysis and technical process safety. She received her bachelor's degree in chemical engineering from the University of Oklahoma and is a professionally registered engineer in Oklahoma. Janet can be reached at Janet.Blancett@cognizant.com | www.linkedin.com/in/janet-blancett-p-e-24a889/.

Dr. Shabeer Pocker

Senior Manager, Energy & Utilities Consulting Practice, Cognizant

Dr. Shabeer Pocker is a Senior Manager in Cognizant's Energy & Utilities Consulting Practice. He has over 15 years of experience in strategy, products and technology consulting and innovation across the petroleum industry value chain. He has worked with international oil and gas services companies and leading IT/consulting organizations. Shabeer has significant domain, business and technology skills, and deep techno-functional understanding of a range of digital and automation technologies and how they integrate to deliver business solutions. He has a PhD in geochemistry from Osaka City University, Japan. Shabeer can be reached at Shabeer.Pocker@cognizant.com | <https://in.linkedin.com/in/dr-shabeer-pocker-47343712>.

Ashutosh Ranjan

Consultant, Energy & Utilities Practice, Cognizant

Ashutosh Ranjan is a Consultant in Cognizant's Energy & Utilities Practice. Leveraging his experience in operations and consulting, Ashutosh consults clients on optimizing digital strategies that prioritize application of technologies for enhancing operations across the energy sector. His work focuses on harnessing the power of new technologies and the information it creates to build capabilities for the energy industry that transform their businesses. Ashutosh is actively working on developing AI technology for oil and gas retail businesses. He has an MBA from Indian Institute of Management, Kozhikode and an undergraduate degree in petroleum engineering from School of Petroleum Technology, PDPU. Ashutosh can be reached at Ashutosh.Ranjan@cognizant.com | www.linkedin.com/in/ashutosh-ranjan.

About Cognizant

Cognizant (Nasdaq-100: CTSH) is one of the world's leading professional services companies, transforming clients' business, operating and technology models for the digital era. Our unique industry-based, consultative approach helps clients envision, build and run more innovative and efficient businesses. Headquartered in the U.S., Cognizant is ranked 195 on the Fortune 500 and is consistently listed among the most admired companies in the world. Learn how Cognizant helps clients lead with digital at www.cognizant.com or follow us [@Cognizant](https://twitter.com/Cognizant).

Cognizant

World Headquarters

500 Frank W. Burr Blvd.
Teaneck, NJ 07666 USA
Phone: +1 201 801 0233
Fax: +1 201 801 0243
Toll Free: +1 888 937 3277

European Headquarters

1 Kingdom Street
Paddington Central
London W2 6BD England
Phone: +44 (0) 20 7297 7600
Fax: +44 (0) 20 7121 0102

India Operations Headquarters

#5/535 Old Mahabalipuram Road
Okkiyam Pettai, Thoraipakkam
Chennai, 600 096 India
Phone: +91 (0) 44 4209 6000
Fax: +91 (0) 44 4209 6060

© Copyright 2019, Cognizant. All rights reserved. No part of this document may be reproduced, stored in a retrieval system, transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the express written permission from Cognizant. The information contained herein is subject to change without notice. All other trademarks mentioned herein are the property of their respective owners.