Preparing for the future now

Rethinking the oil and gas workforce in 2040

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PetroLMI
DIVISION OF ENERGY SAFETY CANADA

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As a leader in this technological era, have you thought about how your organization will react to changes that evolve in the blink of an eye? If you haven't, it's time to introduce transformative thinking and reimagine how work gets executed in your organization to remain competitive.

The reality is that technologies such as robotic process automation (RPA), artificial intelligence (AI), natural language processing (NLP) and machine learning (ML) could reduce your staff by up to 30% and automate 50% of job competencies in upstream oil and gas in the next 20 years. These numbers should encourage you to think beyond, stay informed and prepare your organization for this evolution. Have you thought about how new technologies will impact not only your profits but the organizational structure, operating model, corporate culture and governance? These considerations should be on top of mind when developing a strategy.

These are some of the crucial questions and considerations that EY can help your organization answer. From strategy formulation to implementation, our team can lead transformational change across your organization. Identifying areas where automation, AI and other technologies can support your strategic goals and recognizing hurdles to enabling those technologies, such as reskilling employees, should become a primary focus for organizations — and we can help you through this journey.

PetroLMI

Foreword from PetroLMI

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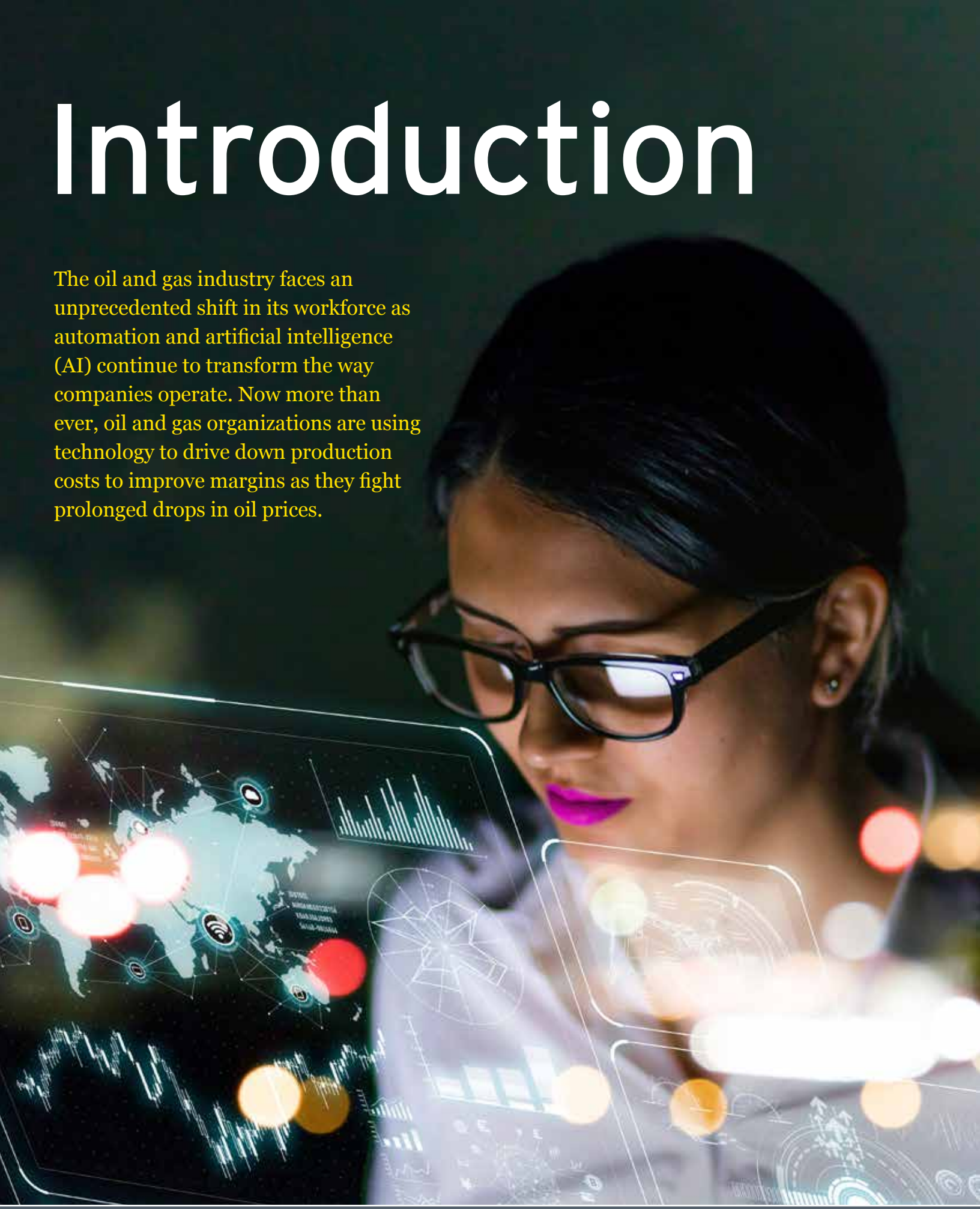
Over the next 20 years, the pace at which Canada's oil and gas industry will adopt new technologies to improve productivity, safety and profitability will only accelerate. The use of automation is already becoming more widespread in the industry and, as this report's findings show, will gradually continue to replace routine, repetitive or dangerous tasks – freeing up workers to focus on higher value activities. Along with it, there will be challenges and opportunities for Canadians working in the oil and gas industry and those looking to become a part of it.

With the adoption of more technologies, new and interesting careers are evolving and changing; some occupations will decline and may be eliminated entirely. Many of the new and emerging job opportunities will be appealing to those seeking challenging, technology-driven occupations. Workers will need to be digitally literate, innovative, creative and flexible, along with having more technical and problem-solving aptitudes than traditionally required.

By fully understanding the impacts these new technologies will have on the oil and gas industry over the next two decades, governments and educational institutions can help the workforce prepare. Upskilling and reskilling need to be promoted and encouraged. The industry will need to not only adapt the way it conducts its business, but also who it employs.

Introduction

The oil and gas industry faces an unprecedented shift in its workforce as automation and artificial intelligence (AI) continue to transform the way companies operate. Now more than ever, oil and gas organizations are using technology to drive down production costs to improve margins as they fight prolonged drops in oil prices.



Increasing the use of technology will do more than just improve margins. It will change activities and even displace jobs. These trends and the rise in the adoption of automation and AI in the oil and gas industry requires organizations to examine how the sector's jobs will evolve over the next 20 years. Oil and gas organizations have already started using technology to increase optimization and reduce costs, but what does this efficiency-driven change mean for the industry, companies and workers longer term? How does the oil and gas industry need to prepare for the job changes that these technologies bring? This report examines the impact of automation and AI on upstream oil and gas jobs and investigates how prone upstream oil and gas jobs are to technology by analyzing how likely role competencies are to be automated. By evaluating how prone these competencies are to automation, we can infer the future impact on upstream oil and gas jobs.

This report was written in partnership with the *Petroleum Labour Market Information (PetroLMI) Division of Energy Safety Canada*, which has validated all findings. Funded in part by the Government of Canada's Sectoral Initiatives Program, PetroLMI's mandate is to "collaborate with industry, government, educators and training agencies to support and advance the development of a sustainable, skilled and productive workforce."

Together, EY and PetroLMI explore a new job landscape and help those in oil and gas understand what they should be doing to prepare for the future. Looking ahead, the organizations and workers who take time now to imagine the oil and gas industry of 2040 will have a better chance of surviving the accelerating rate of change we anticipate.

What do automation and AI mean? While the terms are related and often used interchangeably, there are distinct differences between the two.

Automation focuses on automating systems and enables machines to follow programmed orders or instructions without human intervention.

AI focuses on intelligent machines and is a collection of technologies that includes machine learning, natural language processing and robotics that allow machines to sense, interpret, act and learn from data to aid decision-making.

COVID-19 response

The research and development of this report began months before COVID-19 was declared a pandemic and caused global economic upheaval. While we don't currently believe the pandemic will change our findings and impacts in the long term, we think it's prudent to address the changes we have seen and may continue to see in the short term.

Most notably, in response to the economic climate, spending has been significantly reduced among upstream oil and gas organizations. Operating expenditures have been cut and non-essential capital projects have been slashed from many budgets in an effort to reduce costs across the industry. We've specifically seen these cuts impact technology projects, likely slowing the short-term implementation and adoption of automation and AI in oil and gas.

These cost reduction efforts have resulted in thousands of layoffs and there are likely more to come. As we look to the future, a jobless recovery is becoming a real possibility, whereby companies look for ways to add capacity and capability not through hiring more people, but through using technology and automation. In the longer term this increased use of technology will be recognized by the markets.

Although governments will be pushing different sectors to create jobs to support the economy, the private sector will continue to be rewarded based on traditional metrics, such as the cost to operate and will turn to technology to help drive efficiency over the next two decades.

While it's hard to predict when the pandemic will end or how long it will take for the economy and oil and gas spending to rebound, we do believe that the adoption of automation and AI will resume its pre-pandemic trajectory and ramp back up in the long term. Companies will be looking to drive efficiency through automation like never before and those that continue to produce energy will only be able to do so because of their scale and low costs.

Methodology

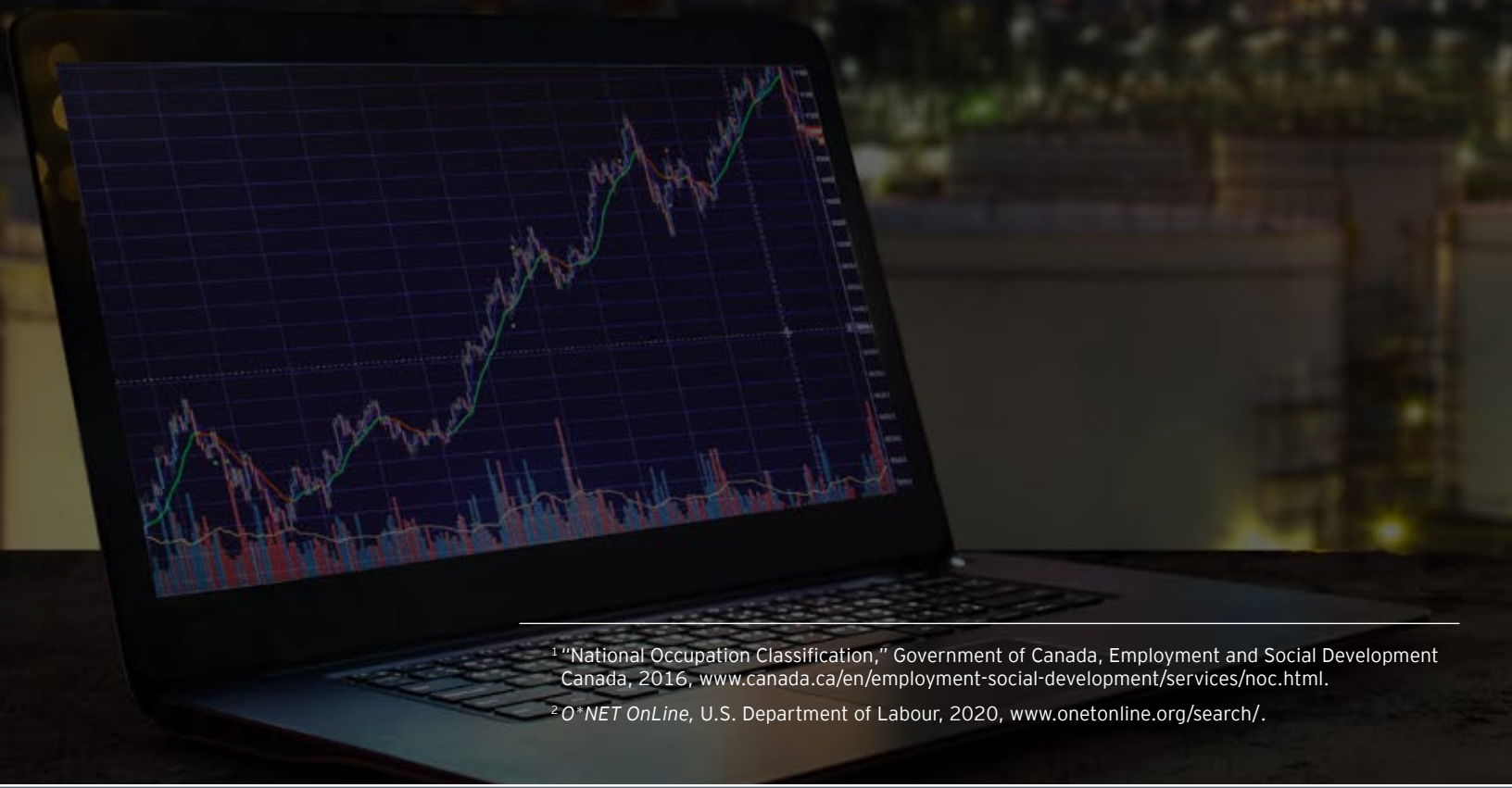
Before reviewing the report's findings, it's important to understand the methodology behind the research and analysis. The steps followed are described below:

1 Narrowed the focus in the Canadian oil and gas industry

It was determined that due to the availability of industry job information this report would focus on only the upstream segment of oil and gas. Exploration and production and oil sands jobs are considered part of the upstream segment and are included in this analysis.

2 Identified jobs in the upstream oil and gas industry

Research was conducted to understand the different jobs in upstream oil and gas. As a result, 124 discrete jobs were identified. This information was primarily captured from previous research done by PetroLMI and was further validated using National Occupational Classification (NOC) codes[1] and O*Net[2].



[1] "National Occupation Classification," Government of Canada, Employment and Social Development Canada, 2016, www.canada.ca/en/employment-social-development/services/noc.html.

[2] *O*NET OnLine*, U.S. Department of Labour, 2020, www.onetonline.org/search/.

3 Developed the criteria for assessing automation potential

Seven criteria categories were defined and assigned weighting. "Economic feasibility" was assigned heavier weighting relative to the other criteria factors, as industry leaders expressed this to be a key decision factor during recent interviews conducted by PetroLMI.

Table 1. Criteria for determining probability of job automation.

Category	Description	Weighting
Predictability/ repeatability	The degree to which a competency is routine, repetitive and takes place in a controlled environment. For example, driving heavy haul trucks.	12.50% 
Data availability	The degree to which labeled datasets are accessible or available to support a competency's automation. Since systems are "trained" rather than programmed, various processes often require huge amounts of labeled data to perform complex tasks accurately. For example, companies developing self-driving car technologies are hiring hundreds of people to manually annotate hours of video feeds from prototype vehicles to help train these systems.	12.50% 
Technical feasibility	The degree to which existing technology enables automation of a competency. For any benefits from automation to materialize, it must be technically feasible to adopt the technology. For example, basic communications infrastructure needed to implement new technologies; some businesses may have legacy systems that do not mesh easily with new technologies such as AI.	12.50% 
Social feasibility	The degree to which humans accept the automation of a competency. People may not be willing to have robots or other smart machines replace humans for all their day-to-day interactions, especially for risky fields such as operating heavy equipment.	12.50% 
Economic feasibility	The degree to which an economic benefit exists for automating a competency. In many companies the upfront cost of advanced automation technologies such as AI and robotics may make this a significantly higher risk option than just expanding by using additional labor, particularly where this is relatively flexible or low cost.	25.00% 
Risk reduction	The degree to which automation reduces risk or improves safety. In the oil and gas industry, companies are looking to automate dangerous or high-risk activities. So, the more dangerous/risky the activity, the higher priority for automation, i.e., rig inspection, particularly offshore or in remote, northern locations.	12.50% 
Traceability/ explainability	The degree to which a competency's actions or decisions need to be understood and traced. It can be difficult to discern how a mathematical model arrives at a particular prediction, recommendation or decision.	12.50% 

Thresholds ranging from 0% to 100% were defined to assess the degree of automation for the criteria.
As reflected in Table 2, 0% indicates a negligible probability of automation and 100% indicates a high probability of automation.

Table 2. Criteria scale for probability of job automation.

	Probability of automation					
	High	Medium-high	Medium	Low-medium	Low	Negligible
Category	100%	80%	60%	40%	20%	0%
Predictability/ repeatability	The competency is highly predictable or repeatable; the competency is performed in a controlled environment and is not prone to changes.	The competency is predictable or repeatable; the competency is performed in a controlled environment with a few variants to each process.	The competency is moderately predictable or repeatable; the competency is performed in a somewhat controlled environment and potential changes do not impact the activity significantly.	The competency has limited predictability or repeatability; the competency is performed in a somewhat controlled environment and potential changes have limited impact to the competency.	The competency has limited predictability or repeatability; the competency is not performed in a controlled environment and is prone to frequent or significant change.	The competency has no predictability or repeatability; the competency occurs in an uncontrolled environment and will require adjusting to unforeseen changes in the external environment.
Data availability	Complete labeled datasets are accessible or already available to automate the competency with little or no additional data mining required.	Labeled datasets are accessible or already available but are subject to change and additional data mining.	Partial labeled datasets are accessible or already available to automate the competency; some additional data mining required.	Limited labeled datasets to automate the competency exist; significant data mining would be required.	Labeled datasets are not available to automate the competency; significant data mining would be required.	Labeled datasets are unavailable and data mining for the competency provides limited value/ connectivity to the rest of the business or is not possible.
Technical feasibility	The technology needed to automate the competency exists and little to no new technology would need to be implemented.	The technology needed to automate the competency exists but is subject to change and improvements or new technology will be required.	Some of the technology needed to automate the competency exists and some new technology would need to be implemented.	The technology to automate the competency is limited but there have been demonstrated improvements.	The technology to automate the competency is limited and significant amounts of development will be required.	The technology required to automate the competency does not exist or is conceptual only and innovation will be required to automate.
Social feasibility	Humans are very receptive to the competency being automated and are interested in changing the impacted interactions.	Humans are receptive to the competency being automated and have been accepting of changing impacted interactions.	Humans are somewhat receptive to the competency being automated and are open to changing the impacted interactions.	Humans have demonstrated some receptivity to the competency being automated, but changing the impacted interactions requires significant change.	Humans have limited receptivity to the competency being automated and demonstrate resistance to changing the impacted interactions.	Humans are not receptive to the competency being automated and are likely to resist changing interactions for the foreseeable future.
Economic feasibility	Significant economic benefits would be obtained by automating the competency; the long-term cost of automation is less than the cost of labor or technology over the same time period.	Economic benefits will be obtained by automating the competency; however, significant improvements are expected to drive costs lower than labor.	Some economic benefits may be obtained by automating the competency; the long-term cost of automation will likely break even with the cost of labor or technology over the same time period.	Limited economic benefit would be obtained by automating the competency; however, cost improvements are expected to bring automation closer to par with the cost of labor.	Limited economic benefit would be obtained by automating the competency; the long-term cost of automation is currently greater than the cost of labor or technology over the same time period.	Currently, no economic benefit would be obtained by automating the competency.
Risk reduction	Risk would be negligible or eliminated by automating this competency.	A significant reduction in risk would be realized by automating the competency.	A moderate reduction in risk would be realized by automating the competency.	Limited reduction in risk would be realized by automating the competency.	Negligible reduction in risk would be realized by automating the competency.	No risk reduction, or an increase in risk, would be realized by automating the competency.
Traceability/ explainability	Automated decisions are easily understood and there is little to no need to explain in human terms how the automated competency reached a certain decision or outcome.	Automated decisions are mostly understood and the need to explain how the automated competency reached a certain decision or outcome in human terms is infrequent.	Automated decisions can be traced and there is some need to explain in human terms how the automated competency reached a certain decision or outcome.	Automated decisions can be traced by highly skilled users and there is a regular need to explain in human terms how the automated competency reached a certain decision or outcome.	Automated decisions cannot be traced.	The competency is entirely manual and thus traceability is not relevant.

4 Evaluated competencies

A total of 65 competencies (defined as a skill that enables the performance of a job) were identified across all 124 jobs included in this analysis. These competencies were grouped into five categories: knowledge, technical, leadership, behavioral and foundational. For each individual job, several core competencies were identified from the list of 65 competencies. The jobs were grouped into families based on how similar the competency profiles were (70% match or greater) and then competencies were assessed against the criteria and assigned a probability of automation score.

5 Ranked probability of automation

Using the criteria and competency scoring, the 124 jobs evaluated in this analysis were ranked based on the probability of being automated. Future changes — such as the evolution of human acceptance to automation and AI and heightened safety regulations — could cause the weighting on the criteria to shift.

Findings

The automation and AI impact on an oil and gas organization can be considered from multiple perspectives. Understanding the impact on competency types can help individuals, organizations and educators retool skillsets as the shift gradually takes place. Understanding the impact on individual jobs and job families provides valuable insight into planning the workforce of the future.

Findings overview

As discussed, competencies have been grouped into five broad categories based on their characteristics: Leadership, Foundational, Behavior, Knowledge and Technical. Individual roles have been grouped into one of 14 families based on multiple factors, including competency profiles, American Petroleum Institute groupings and groupings that are commonly accepted in industry.

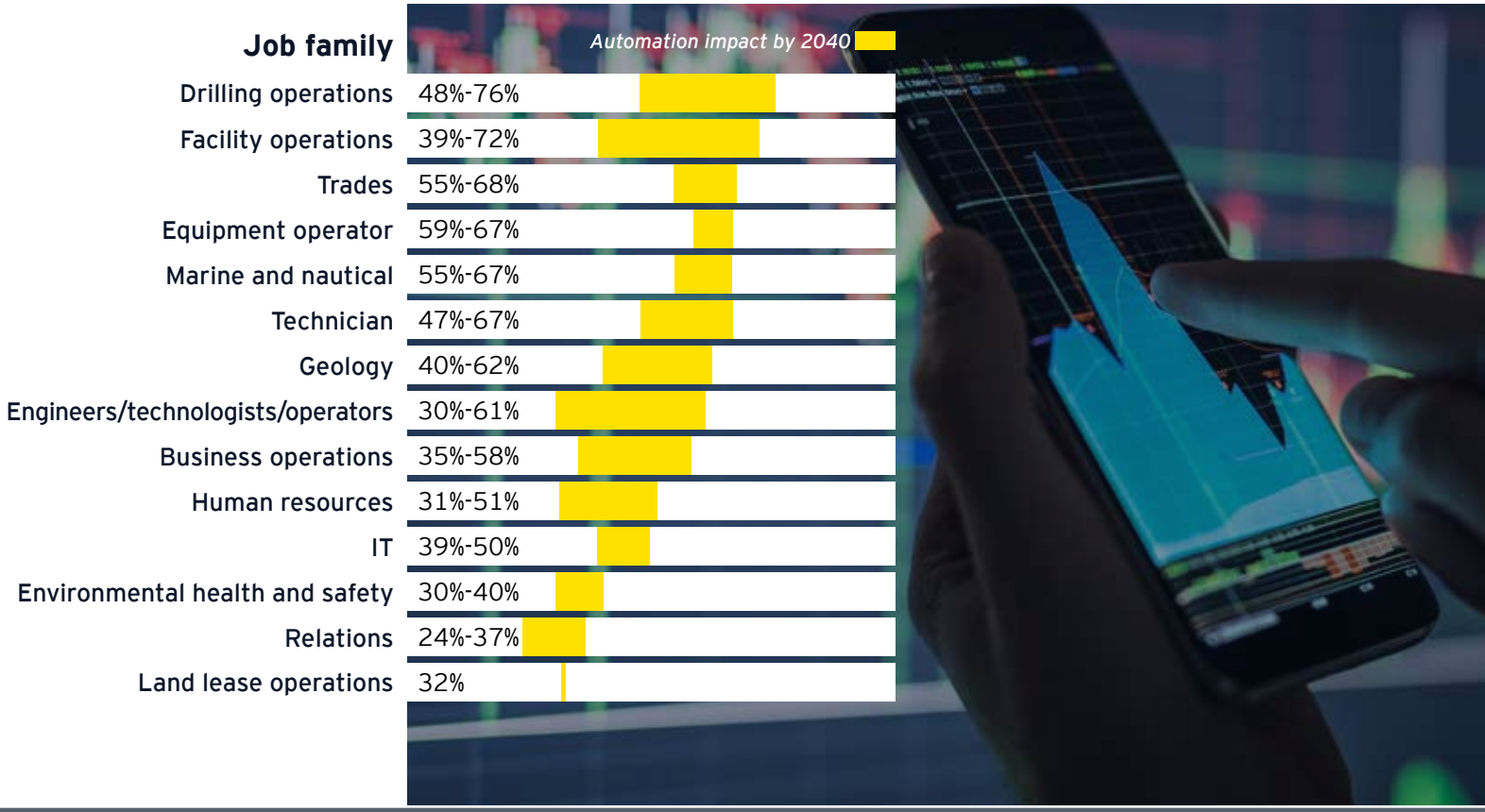
Our competency analysis shows the expected impact on competencies by the year 2040. Technical competencies have the most potential for automation due to the high level of predictability and social feasibility. Additionally, many organizations have already begun digitizing technical competencies and the economic feasibility is expected to improve in the coming years. On the other end of the spectrum, leadership competencies have the least potential for automation. A common characteristic of leadership competencies is that their automation is unlikely to be socially feasible for the foreseeable future.

Table 3. Competency categories.

Competency type	Leadership	Foundational	Behavior	Knowledge	Technical
Example competency	Instructing	Interpreting	Collaborative	Clerical	Equipment selection
# of competencies	11	4	5	29	16
Average potential for automation by 2040	30%	43%	43%	44%	60%

Analysis into individual roles and groupings of job families resulted in a noticeable difference in the potential for automation by the year 2040. The broad range in each individual job family reflects the differences individual roles can have that change their susceptibility to automation. The expected impact of automation and AI is likely to be felt differently across the organization, as some job families are significantly more susceptible to having jobs replaced.

Figure 1. Potential for job family automation.



Findings part 1

In each of the competency types, there are competencies that were assessed using the automation criteria previously discussed on pages 5 and 6. Each competency type has a different number of total competencies. Table 4 lists the competencies that have the highest potential for automation.

Table 4. Probability of automating competencies.

Competency type	Description	Competencies	Probability of automation by year 2040
Leadership	Leadership competencies are related to the management of people, teams and divisions. The potential for automation for these competencies is hindered by the requirement to act in ambiguous, unpredictable, and complex environments.	Planning and organizing	65%
		Coordinating	50%
		Troubleshooting	43%
		Instructing	35%
		Building a successful team	28%
		Complex problem solving	23%
		Professional judgment and decision-making	23%
		Persuasion	18%
		Managing conflict	18%
		Negotiation	13%
Foundational	Foundational competencies can be considered baseline requirements. High proficiency in foundational competencies is unlikely to be a differentiator among colleagues. As automation replaces employees, these competencies will persist in those who remain.	Data entry	100%
		Interpreting	48%
		Writing, technical writing, document production	18%
		Public speaking	8%
Behavioral	Behavioral competencies are baseline requirements of an employee in the industry. Proficiency in these competencies is extremely important for working in complex and unpredictable environments and for working with colleagues. While these competencies are unlikely to be automated in the foreseeable future, automation can provide assistance, negating some of the human requirement.	Attention to detail	68%
		Stress tolerance	45%
		Collaborative	20%
		Leading/living vision and values	18%
		Innovative	10%
Knowledge	Knowledge competencies pertain to having the necessary subject matter information for the area of the business that an employee works in and being able to apply that knowledge on a day-to-day basis. The potential for automation for these competencies will largely depend on the subject area, as some require making decisions in highly complex and unpredictable environments.	Production and processing	95%
		Transportation	85%
		Customer and personal service	80%
		Clerical	70%
		Cost-benefit analysis	70%
		Works safely	68%
		Understanding risk	60%
		Education and training	58%
		Promotion of occupational health and safety	58%
		Communications and media	58%
Technical	A significant portion of technical competencies involve adhering to fixed guidelines with limited subjectivity, creating a work environment that is predictable. Additionally, these competencies involve a significant portion of work with machines as opposed to interfacing with teams.	Preventative maintenance	95%
		Managing finances	88%
		Operation and control	78%
		Operation monitoring	78%
		Equipment selection	68%
		Equipment maintenance	65%
		Mechanical operation	65%
		Quality control analysis	63%
		Making or manufacturing	60%
		Managing material resources	53%

Findings part 2

A job family is a broad grouping of jobs in a career emphasis. Using competency profiles, job activities, American Petroleum Institute groupings[3], and commonly accepted industry groupings, 14 job families were established to group roles and understand impacts on different parts of an organization. To understand the range of automation potential for each job family, individual competency scores were applied to every role in the industry and roles were then grouped into families.

Table 5. Job family potential for automation.

Job family	Potential for automation by year 2040	Roles most impacted	Description
Drilling operations	0 100 48%-76%	Drilling and service laborer	This group includes field positions such as a well test operator and drilling and service laborer. This job family is at high risk of automation, as many competencies have high predictability and social feasibility. Individuals in this group require a high school diploma or higher.
Facility operations	0 100 39%-72%	Control center operator	This group includes roles such as a Control Center Operator and Quality Control and Inspection Professional. The broad range in potential for automation is due to the different competencies required. Individuals in this group require a high school diploma or higher.
Trades	0 100 55%-68%	Machinist	This group includes roles such as a Carpenter and Machinist. It has a higher range of potential for automation, as there is a high proportion of competencies around adhering to procedure and working safely. These characteristics have more predictability, which also decreases risks involved with human error. Individuals in this group require an apprenticeship or post-secondary certificate.
Equipment operator	0 100 59%-67%	Heavy equipment operator	This group includes roles such as a Crane Operator or Heavy Equipment Operator. The grouping shares many competencies that have higher potential for automation such as operation monitoring. A high school diploma with an apprenticeship program or heavy equipment courses is required for positions within this family.
Marine and nautical	0 100 55%-67%	Marine engine room crew	This group includes positions such as Offshore Oil and Gas Marine Specialist and Marine Deck Officer and Crew. The potential for automation has a higher range, as it requires competencies around adhering to procedure and working safely, which are more likely to be automated. Educational requirements vary depending on the role. Non-certified crew members require a high-school diploma or equivalent, certified crew members require a certification from Transport Canada and leadership positions require a technology diploma or bachelor's degree.
Technician	0 100 47%-67%	Warehouse technician	This group includes roles such as a Wastewater and Electrical Technician. Similar to Marine and Nautical, these roles have a high need for adhering to procedure and working safely, which are going to be assisted by automation as time progresses. Individuals in this group require a high school diploma or associate's degree.
Geology	0 100 40%-62%	Seismic laborer and seismic operator	This group includes roles that specialize in geosciences, engineering, seismic and technical support. The potential for automation varies by level of seniority in the industry. More senior levels are required to apply knowledge in complex environments, making their capabilities less susceptible to automation. The range in education requirements spans from not completing high school to having a bachelor's degree or higher.

...Continued on the next page

[3] "Career Opportunities in the Natural Gas and Oil Industry,"*Career Opportunities in the Natural Gas and Oil Industry*, American Petroleum Institute, 2018, https://www.api.org/~/media/files/policy/jobs/oil-and-gas-career-guide.pdf.

Table 5. Job family potential for automation. (Cont'd)

Job family	Potential for automation by year 2040	Roles most impacted	Description
Engineers/ technologists/ operators	0 100 30%-61%	Power engineering technologist and stationary steam engineer	This group includes positions that can be found at both corporate headquarters and in the field. Many of these roles are in the 30%–40% range for automation potential, as the require a high degree of knowledge application in complex environments. The majority of the jobs within this family require a bachelor's degree or higher; however, some can be attained with a two year post-secondary diploma or a high school diploma and certificate.
Business operations	0 100 35%-58%	Purchasing agent and records management technician	This group includes jobs that would typically be found at a corporate headquarters. The range in automation is due to this job family, including roles such as administrative assistant and records management technician–both of which are more prone to automation. Most jobs in the family require a bachelor's degree or higher; however, some can be attained with a high school or post-secondary diploma.
Human resources	0 100 31%-51%	Human resources analyst	This group includes all human resources-related roles. The range in potential for automation in this grouping is due to more junior roles having competencies that are more susceptible to automation than senior roles. Individuals in this group should have a post-secondary diploma or bachelor's degree.
IT	0 100 39%-50%	Database administrator	This group includes roles such as a Data Scientist and Technology Architect. While the grouping is highly technical in nature, it is not as susceptible to automation, as it is highly complex and requires competencies that are less susceptible to automation such as "innovative" and "complex problem solving." Individuals in this group require a bachelor's degree or higher.
Environmental health and safety	0 100 30%-40%	Environment technician	This group includes roles such as an Environmental Advisor and Reclamations Specialist and are likely to be found in the field. This family is required to apply their expertise in highly complex environments, making it difficult to automate the entire function. Roles in this family require a post-secondary diploma or a bachelor's degree.
Relations	0 100 24%-37%	Investor relations specialist	This job group includes roles such as an Indigenous Relations Specialist and Investor Relations. It holds the lowest potential for automation as roles typically deal in complex and highly personal environments. Competencies include "managing conflict" and "laws and regulations." Individuals in this group require a bachelor's degree or higher.
Land lease operations	0 100 32%	Mineral land and surface land professional	This group includes two Land Profession roles. While the level of technical skills in the role is unsubstantial, they require interpersonal competencies such as "negotiation" and "collaboration." Individuals in this group require a high school diploma or associate's degree.

Impact on oil and gas

The mining, quarrying and oil and gas extraction industry is one of the main contributors to Canada's GDP[4].
We understand that even during times of greater stability, oil and gas companies are slower than some other industries in investing and adopting new technologies and with current economic and operating environments, this is being perpetuated.

However, several factors – such as higher operating costs compared with other markets, low commodity prices and the energy transition – are forcing Canadian producers to find efficiencies. Automated technologies will be even more critical in remaining competitive and it is important for organizations to be prepared for the operational changes.

Based on our analysis, there are very few, if any, jobs and competencies that will not be impacted by automation in the future, signaling to the oil and gas industry the importance of preparing for the shift now.

[4] Duffin, Erin. "Canada: Gross Domestic Product (GDP) by Industry February 2020," Statista, 2020, www.statista.com/statistics/594293/gross-domestic-product-of-canada-by-industry-monthly/.

Industry impacts

The primary benefit of adopting new technologies is the cost savings achieved through greater efficiency, increased quality and control, improved predictability, safety and continuous operations. As more activities shift toward being completed by a machine rather than a human, we can expect there will be workforce impacts across the oil and gas industry.

Workforce reduction

It's estimated that in 2019, approximately 86,000 individuals were employed in *these* exploration and production and oil sands positions in Canada[5]. Applying our impact analysis results, we can see that a significant portion of work activities can be automated, thereby reducing workforce demand. These reductions will most likely occur through natural attrition rather than mass layoffs.

Table 6. Job number changes by job family.

Job family	2019 Job Numbers	2040 job numbers	% decrease
Equipment operator	9,679	3,342	65%
Drilling operations	7,066	2,631	63%
Trades	12,878	5,002	61%
Marine and nautical	2,928	1,151	61%
Technician	4,767	1,920	60%
Facility operations	13,986	5,976	57%
Geology	5,395	2,725	49%
Business operations	7,641	3,947	48%
Engineers/technologists/ operators	10,347	5,588	46%
IT	1,970	1,088	45%
Human resources	3,858	2,390	38%
Environmental health and safety	1,382	885	36%
Land lease operations	1,072	733	32%
Relations	1,809	1,292	29%

Roles not included in the analyses due to inconsistent data are as follows: Managers in Natural Resources Production, Construction Managers, Drilling and Well Servicing, Shippers and Receivers, and Purchasing and Inventory Control Workers.

Industry appeal

Findings from the 2017 EY Oil and Gas US Perceptions Study found that 62% of Generation Z and 44% of Millennials are not attracted to careers in the industry[6]. The use of advanced technologies could help increase the appeal to the upcoming tech-savvy workforce. Technologies can also be used to fill in talent gaps associated with the reduced appeal.

Talent pipeline

With the rise of the Fourth Industrial Revolution, there will be a higher demand for certain professions such as data scientists and software developers and the industry will find itself having to compete outside its walls for this talent. To develop the highly skilled and educated workforce it will need in the future, the oil and gas industry would be wise to programs and partner with institutions to educational programs and institutions to begin building its talent pipeline now.

Knowledge retention

Automation will also reduce the effects of the "brain drain." As the older generation retires, the industry is at considerable risk of losing institutional knowledge gained through decades of experience. New tools and technologies will be able to retain this knowledge and data, ensuring consistent operations and performance.

[5] "2019 Oil and Gas Labour Market Update," PetroLMI, 2019.

[6] "How Do We Regenerate This Generation's View of Oil and Gas?" What We Think, EY, 2017, assets.ey.com/content/dam/ey-sites/ey-com/en_us/topics/oil-and-gas/ey-how-do-we-regenerate-this-generations-view-of-oil-and-gas.pdf.

Company impacts

Realizing the complete benefits of these new technologies will only be achieved if oil and gas organizations shift their operations to support adoption. Virtually every type of job will change as a result of automation, from corporate functions such as Finance and IT, to field work such as maintenance and facility operations. The current ways of working may no longer be possible and companies need to start considering the impacts to operating models.

HR strategy

HR departments will play a key role in driving successful adoption and sustainment of new technologies. If not there already, HR leaders should have a seat at the executive level table, helping to define organizational strategies. HR teams will also need to relook at optimal workforce mix as the type of work and alternative work arrangements, are more easily managed remotely. Companies may also need to readjust strategies to consider outsourcing what doesn't fit with their core capabilities.

Talent acquisition

The need for digitally fluent, multidisciplinary employees will require significant upskilling of the current workforce, as well as a focus on acquiring new talent to supplement what can't be taught in-house. The acquisition of different talent will cause a shift from traditional hiring processes to ones such as the use of online platforms to attract highly skilled people who comprise the gig economy. Technology can also be employed to support these efforts by automatically scrolling through talent data to find optimal skillsets.

Talent retention

This new labor pool will be motivated differently than today's current workforce, requiring organizations to shift their performance management and reward systems to optimize retention. Many highly skilled individuals are motivated by the opportunity for diverse and intriguing work, the flexibility stemming from working remotely and the ability to find an employer that matches their value system.

Leadership development

Proper leadership development will be a requirement for success. Leaders will need to be equipped to handle unprecedented change and uncertainty, to navigate through the rapid shift in technologies and to manage a new and diverse workforce, all while still driving achievement of traditional business objectives.

Worker impacts

The impacts to individual workers will vary depending on profession, aptitude for change and degree of digital literacy. But, as previously mentioned, virtually no job will be untouched by this change. This means that workers will be required to reskill and upskill to remain employed in upstream oil and gas.

Skill development

A focus on developing skills in emotional intelligence, critical thinking, data analysis and managing the interface between human and machine will be important in staying competitive in the job market. As found in our analysis, there are some competencies that will be less likely to be impacted by automation and will be critical attributes of the future worker.

Job selection

Younger generations not currently part of the labor market will need to look forward and position themselves to be successful in the future workforce, as certain jobs will undoubtedly be completely replaced by technology. It will also be important to develop a cross-functional skill set that allows people to contribute to multiple areas of an organization, thereby making themselves more agile and valuable.

How to respond

These impacts may seem overwhelming, but they are not insurmountable. With the right outlook and preparation, oil and gas organizations can position themselves to take full advantage of the changes associated with automation. A key component will be to build a workforce that thrives in the new environment. Companies can begin that journey by taking a few key steps now.

Step 1

Assess your current state and identify gaps

Understanding your current workforce knowledge and skill set will help identify where your strengths lie and where there are gaps that need to be filled. This will help determine what is required in the form of upskilling or reskilling of employees, acquiring new talent and potentially outsourcing to another party.

Automated technologies aren't just for the business, either. They can also help optimize HR processes and obtain data-driven insights. Optimizing HR processes will highlight how operating models need to shift to manage human and non-human workforces.

Some key items for consideration include:

- What are the key skills and capabilities needed in your workforce?
- What are the capabilities of your leaders in driving transformation?
- Will you need additional instructors to support upskilling?

Step 2

Define your strategy and future objectives

Automation is an enabling capability that can automate and enhance business processes. Knowing what you'd like to achieve through automation is the first step in defining your organization's digital strategy.

A strategy should encompass what your organization wants to be and how to achieve it, its overarching direction and a clear mandate. The strategic objectives establish a course of action that balances the organization's immediate needs with a longer-term outlook. Defining your strategy requires setting the direction, examining capital and resource allocation, integrating the long-range business plan and setting targets.

Some key items for consideration include:

- What are the areas where automation can contribute to your strategy?
- How can you improve productivity and reduce costs without compromising quality and safety?
- What can you do to differentiate yourself against your competitors? Or for your clients?

Step 3

Define your target operating model and organizational design

By identifying operational focus areas for deploying automated solutions, you can then define the organization's operating model for implementing and managing new technologies in an integrated manner. This will not only dictate the types of skills required, but also the number of workers required for sustainment.

Operating model options run on a scale from centralized operations to federated at scale, with varying degrees of costs and benefits. Choosing the right model for your organization is key to a successful transformation.

Some key items for consideration include:

- Will your organizational hierarchy still function?
- What will drive automation in your organization?
- How will you be successful driving automation?

Step 4

Adjust behaviors to support the change

As with any change, ensuring your workforce is prepared to adopt the new way of operating is critical to success and there are behavioral shifts that you can begin today in preparation.

Leaders can instill confidence by providing a clear vision of the end state, highlighting opportunities for career development and reducing the fear of job displacement. Increasing empathetic behaviors with others has shown to improve teaming and collaboration, which will be crucial for the effectiveness of cross-functional teams (think business, IT and HR working together).

Adopting automation will also require a shift in organizational mindset. It's not a "one and done" deal. Leaders will need to monitor external changes in the market and continuously stay ahead of the latest technologies.

Some key questions to consider:

- What is your current culture like? What needs to change in your culture to successfully transform and adopt the new way of working?
- Is the organization agile and fluid enough to quickly and effectively adopt new technologies?

Success factors

Transforming an organization and its workforce is no small feat and there are several factors that need to be considered to improve the probability of success.

- Focus on the problem the company is trying to solve and not on the technologies themselves.
- Create a diverse mix of teams and skillsets.
- Assess the current workforce regularly as the landscape continuously evolves.
- Consider the role of HR in the future and how HR itself will need to evolve.
- Work with educators to identify the types of graduates needed to build a future workforce with the required skills.
- Identify the types of learning opportunities companies can offer internally to employees right now.
- Create workforce plans that can flex with evolving crude prices and global supply and demand.
- Refocus the "employee experience" to improve morale, engagement and loyalty levels.

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