

Whitepaper



The Future of Work & Work of the Future in 4th Industrial Revolution?

Oman Energy Master Plan 2040



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EXECUTIVE SUMMARY

A New Professional Dawn**WINNERS
& LOSERS?**

Data Science. Mobile supercomputing. Intelligent robots. Automation. Data Harvesting and mining. Self-driving cars and so much more. We stand on the brink of a technological revolution that will fundamentally alter the way we work and how labor markets are structured. In its scale, scope and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know how it will unfold. But one thing is clear: the response must be integrated and comprehensive, involving all stakeholders from the public and private sectors, stretching from academia and society. Opportunities abound.

Deloitte found that technology has created far more jobs than it has destroyed, describing it as a “great job-creating machine”. And there’s 140 years of data to prove it. Plus, 79% of respondents to a Gulf Intelligence Survey in late-2017 disagreed with the motion that technology will destroy more jobs than it creates in the Middle East’s energy industry over the next decade. The main role of technology has been helping disruptors to improve and innovate established models across a host of sectors and industries. This reflects how technology has empowered generations of innovators, as they search for new and efficient ways to reshape the status quo.

Vast waves of technological advancements have also been a major contributor to increased prosperity, productivity and job creation. Inevitably, each industrial transformation triggers custom-made challenges. With the 4th Industrial Revolution, it has become imperative to ensure that the skills and attitudes of talent and the job market evolve. In many industries worldwide, the most in-demand occupations and specialties did not exist even five years ago. Popular estimates suggest that up to 60% of children entering school around the world now will have job titles that do not yet exist, with the velocity of change only accelerating. Understanding what skills will be required and employment trends will be critical for businesses, governments and individuals to provide energy and job security – both cornerstones of the sultanate’s prosperity.

This Whitepaper details the key trends that emerged from the Oman Energy Forum in Muscat last November. Brain power amounting to approximately 1,000 years of higher education gathered under one roof during the event to map out the most efficient and affordable route for the Sultanate’s energy future. ■

INDUSTRY FEATURE INTERVIEW

Work of the Future as PDO Transforms?

RAOUL RESTUCCI, MANAGING DIRECTOR, PETROLEUM DEVELOPMENT OMAN



Sean Evers: Let's begin with an outlook for PDO's production.

Raoul Restucci: I have the privilege to work in a company that in a difficult and challenging price environment has continued to grow. The 550,000 barrels per day (b/d) in 2005 reached 600,000 b/d recently and we'll be growing to 650,000 b/d and 700,000 b/d over the next 5 to 10 years. There's a need and there's an opportunity in Oman for employment creation. It's about delivering new value streams and from an opportunity perspective, we're well positioned to play a key role in some of those emerging new industries. We need to understand how to best position ourselves. PDO has many examples where we're well ahead of the curve. For example, PDO's WRFM (well reservoir facilities management) and exception-based surveillance programme is a best practice globally that we're planning to monetize into a new value stream. We're setting up a new company to launch it in the region and beyond.

Sean Evers: You're going to grow the business 20% or somewhere in that direction. Where is that going to come from?

Raoul Restucci: It's not in terms of initial value streams. We're focusing on leveraging our human capital, which is a competitive advantage we have in this region and arguably in many locations globally. It's recognizing that although the solar business is at an early, if not embryonic, stage in Oman, the opportunity is huge. And we're doing a lot about it. We're currently developing, together with Glasspoint, the largest solar steam plant in the world. Phase one is on stream, phase two is on the way. We're removing the pilot plant to install new technology for phase three. We're increasing efficiencies while progressing a more modular approach that will further reduce total costs. We are also in the process of completing the installation of 19,500 PV cells in our car park. Six megawatts to support PDO head office requirements. It's less about the solar itself and more about how we run the operation, how we maintain it, how we understand the supply chain and how well we understand how Oman is positioned to play in that space. By

“ We drive the equivalent to the moon and back every single day. We can reduce this exposure and cost significantly. The key is how you monetize production – that's where the dollar needs to be made.”

the end of the year we'll be tendering out for 100 MW in our installations. We're working together with OPWP and engaging with them to see how we can assist them in their 500 MW project.

Sean Evers: In this new activity that PDO is moving into of renewables, water and so on, would you envisage the need to hire more staff beyond your 9,000 today? And skill sets would they need to have?

Raoul Restucci: I don't believe we need to grow our headcount because of the dramatic efficiency that we're seeing. Exception-based surveillance enables our systems to identify the problems with our wells and now we're focusing on fixing and not finding problems. Within two or three years, we won't even be doing that. Instead, we'll be elevating the deployment of staff to other activities. That's a continuous journey. I don't think you're looking at significant increases in the establishment. What you are working on is establishing a supply chain for the industry, in this case, the renewable industry, where the employment and market opportunity is significant.

Sean Evers: Is Oman behind or ahead of the curve on renewables? We've seen very big developments in Abu Dhabi, Riyadh and so on.

Raoul Restucci: There's a lot going on, but much tends to be in individual silos, so the integration under one authority, one management, will enable and accelerate the whole process significantly. I'm confident that we're starting to see a lot of engagement and alignment. If you look at the key projects around the region, in Abu Dhabi, Dubai, Morocco, Jordan, Saudi Arabia, major plans and ambitions have been announced. But with less emphasis on the in-country value and local supply chains. And that's an area where we've done extremely well in as an industry in oil and gas and we can easily transform that to renewables.

Sean Evers: You have been quoted as saying that you're going to identify sweet spots in the context of PDO's new business opportunity that you will look to build. How do you set the criteria for identifying a sweet spot? Is it a pull approach of seeing what the demand in the market is, such as solar energy, and then trying to meet that? Or are you going to identify what you are good at and then push that out as a service or product?

Raoul Restucci: It's a combination of both. There's no doubt that we'll focus on areas where we believe we understand the business model. And that's a key challenge. If you look at the coal, steel and electrical industries, major providers like RWE, EON, EDF, are really struggling to move into a new business models. Similarly, for oil and gas where the margins tend to be quite high at \$40 or more, a move into the renewables business means margins can be thin, manufacturing often suffers from oversupply and many companies have gone bust. It's critical to understand what it takes to win.

Sean Evers: How do you think PDO and national oil companies in general can manage their dual mandate of making profit and the national commitment to employment? For example, if Saudi Aramco goes public, it will be very difficult to see how it maintains that dual obligation. There are similar developments in ADNOC. How do you see that going forward as a challenge?

Raoul Restucci: I struggle with the understanding of the conflict. They go hand in hand. We don't do in-country-value (ICV), because it's a corporate social responsibility need. We do ICV because it's simply good business. When you look at the direct, indirect and induced values that you create through that new supply chain, it's enormous, and dramatically improves costs. The renewables business in the region is expected to grow more than 200,000 people over the next five years and will see more than \$200 billion dollars being invested in the same period.

“ We have 23 digitization projects and there’s probably another 50 to 100 that are just clambering at the door and we’re trying to control them. There are the Microsofts and Oracles of this world who can’t wait to provide us with their own bespoke solution. But they also want our data and we’re saying no. We want to first make sure that we’ve got our common data systems to enable various plug and play arrangements.”



We want a piece of that. So, it’s not about establishing huge new organizational upgrades. It’s more about ensuring that the supply chain is delivered and that it’s also very sustainable.

Sean Evers: *What should the private sector supply chain in Oman be doing now to get ready to transform themselves?*

Raoul Restucci: It starts with the private sector recognizing that it needs to really step up in terms of creating employment opportunities for Omanis. Secondly, it’s about working with government and seeking legislation that will enable the private sector to grow. Less talking and more doing. We are engaging monthly with The Research Council (TRC) on how we can progress key technologies and we’ve engaged recently with government to look at curriculums and review how we help each other. We’re also challenging the Cloud constraints because that’s a significant disadvantage. We won’t be able to secure a step change in digitalization unless Cloud access is opened up. There are also several technologies that we want to test, several algorithms, sub-surface simulation technologies that we want to avail of but we’re currently unable to do that because of sovereign data transfer constraints.

Sean Evers: *What impact will digital technologies have on the energy industry in the Middle East over the next decade?*

Raoul Restucci: The impact will be transformational. We’ve been on this journey for quite some time. Three years ago, we used to manage 50,000 data points in production. Today, we manage a billion data points a day and unless you’ve got augmented facilities to deal with that, we’re

going to really struggle to manage. I really wonder who is ready and positioned for it. There are a lot of discussions in terms of what we need to be doing and a lot of companies are focusing on transforming the digital expertise into value.

Sean Evers: *Which aspect of Middle Eastern or Omani energy operations will digital technologies impact the most? Health and safety, development, production, maintenance or integrated planning?*

Raoul Restucci: It will have a dramatic impact on all. On safety, we drive the equivalent to the moon and back every single day. We can reduce this exposure and cost significantly. The key is how you monetize production – that’s where the dollar needs to be made. You can have the most efficient maintenance program, but if you don’t deliver more barrels, there’s a bust there somewhere. It’s about determining the key driver that will make the biggest difference to monetization, value-creation and production. We see enormous opportunities on maintenance, exploration, seismic and safety. And this is not only in terms of logistical improvements, but also in asset integrity assessments.

Sean Evers: *Do you think early or accelerated adoption of these tools by PDO and the skills around deploying them could give you an opportunity as you transform to offer that as a professional service in the market? And where could you possibly take some of this expertise and offer it into regional markets?*

Raoul Restucci: In some areas, we’re really at an advanced stage and in others, we’re lagging. At this stage, we have 23 digitization projects. The reality is that there’s probably another 50 to 100 that

are just clambering at the door and we’re trying to control them. There are the Microsofts and Oracles of this world who can’t wait to provide us with their own bespoke solution. But they also want our data and we’re saying no. We want to first make sure that we’ve got our common data systems to enable various plug and play arrangements. Again, it all comes down to understanding where you can create the most value. We’ve got a fantastic portfolio within our concession and we’ve been growing in a challenging period. We’ve got so much human capital, so much know-how. We recently presented to the Board opportunities in PDO Services, PDO International, and transforming PDO into Energy Development Oman (EDO), which covers these additional streams. On the services side, there are also many areas that we can add considerable value; as a contractor, a subcontractor or service delivery. This is because we’ve got the best practice in several areas. That’s what we’re focusing on.

Sean Evers: *How will the new PDO present itself in 2018?*

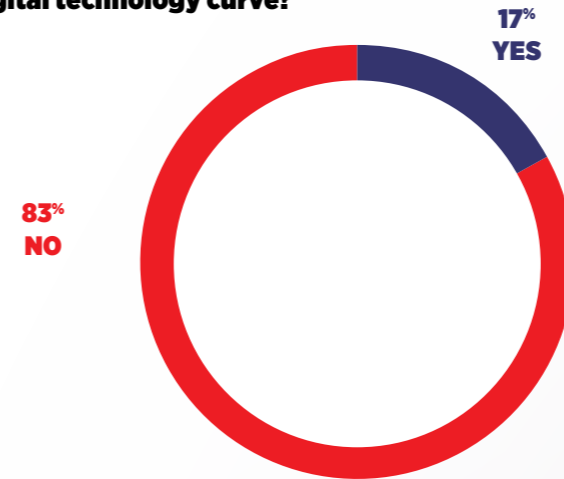
Raoul Restucci: We have three or four areas that go outside our normal mandate, where we will start sharing expertise and know-how with other entities. We will open training programs to the industry and we’ve got some world class facilities for this. We have established a dedicated company that is integrating with national entities to monetize in house systems and create value for Oman Inc. and to demonstrate how we manage sub-surface data and system optimization and acceleration of field development plans. You’re going to also see project management consultancy on several themes. ■

GI OMAN’S DIGITAL TRANSFORMATION The Current Outlook

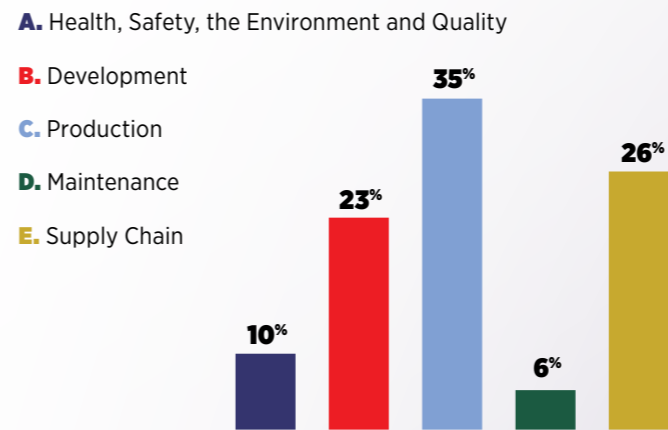
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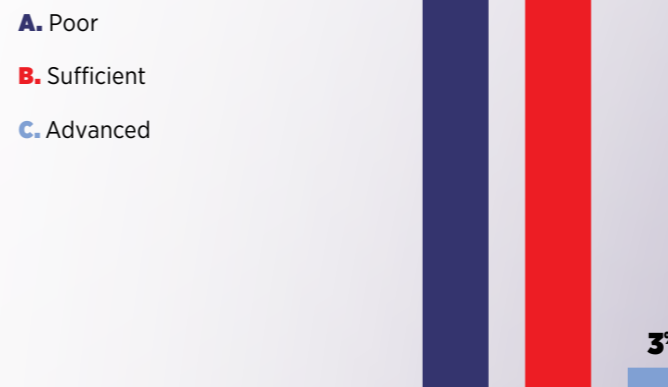
Is the Middle East energy industry doing enough to be ahead of the digital technology curve?



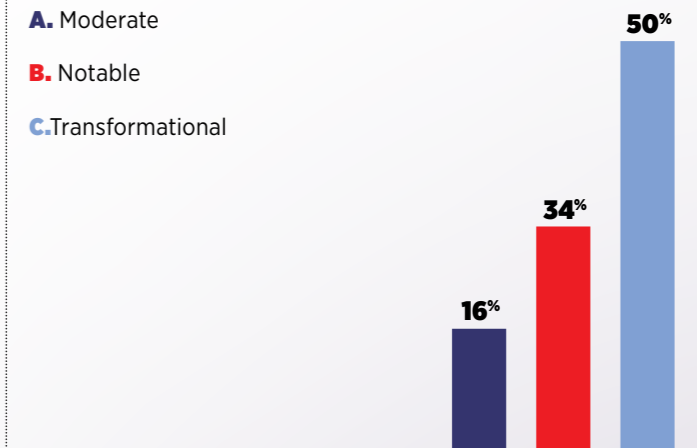
Which aspect of Oman Energy operations will digital technologies impact the most?



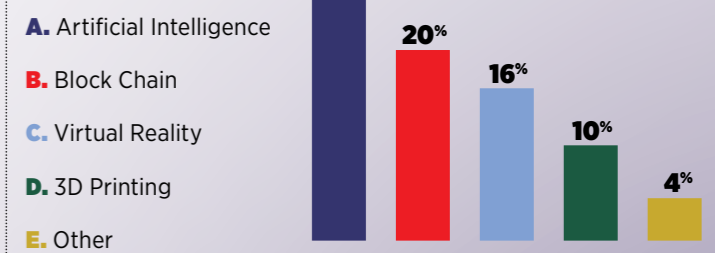
Digital literacy within the Oman energy industry is:



What impact will digital technologies have on the Oman Energy Industry over the next decade?



Which of the following digital technologies will have the biggest impact on the Oman Energy industry over the next 10 years?



Oman: A Digital Energy Future

BY H.E. TALAL BIN SULAIMAN AL RAHBI, DEPUTY SECRETARY GENERAL, SUPREME COUNCIL FOR PLANNING, OMAN



At the beginning of the century, Ray Kurzweil, Futurist and Chief Engineer at Google, predicted that 20,000 years of progress would be crammed into the next 100. But the rate of progress appears to have been even faster – and the impact on the job market more extreme. More than half (53%) of respondents to a survey by global consultants PWC said technological breakthroughs will transform the way people work in just the next decade.

As the pace of change accelerates, Oman must be at the front of the pack of competing energy producers who are learning and applying the new digital tool box of the 4th Industrial Revolution. Predictive data analytics, blockchain, robotics and Artificial Intelligence (AI) are just the tip of a rapidly maturing digital iceberg that Oman must master. The same applies to reshaping the way Oman approach challenges; worldwide, the value of critical and imaginative thinking are quickly replacing rote learning.

Slipping behind risks raising unwelcomed questions surrounding energy security and profitability, at a time when the UN expects Oman's population to rise by a staggering 45% to 6.7 million by 2050 and BP Outlook forecasts a 49% climb in the Middle East's energy consumption by 2035. The good news is that an ability to flex is ingrained in Omanis' psyche – the world's oldest independent state in the Arab world excels at navigating change.

But Oman must leverage new digital opportunities correctly. A global study of nearly 1,000 organizations with revenues over \$500 million by Capgemini, a leader in consulting and technology services, found that 83% of respondents have created new jobs because of AI, for example. Three-quarters of firms have seen a 10% uplift in sales directly tied to AI implementation and 63% said that AI has not destroyed any jobs in their organization.

But that is only half the story. To ensure Oman can maximize such potential, the sultanate must ensure its population is intellectually ready. This means nurturing talent – especially among youth – to think critically and be digitally fluent. These are two cornerstones of harnessing the positive power of the 4th Industrial Revolution and safeguarding affordable and reliable energy supplies for the long-term.

The skills required to fill jobs in today's multi-faceted energy market – where fossil fuels, renewables and digital evolutions merge – need improving. Such demand encompasses talent with a core understanding of traditional oil and gas disciplines – geophysicists, petrophysics, reservoir engineers, for example – to those able to thrive doing what are commonly referred to as 'jobs of the future.' These include data specialists, chief digital officers, water quality technicians, low-carbon car engineers and solar cell technicians.

But as popular estimates suggest that 60% of children entering primary school today will have job titles that do not yet exist, Omanis must be able to juggle and adjust to challenges in what will become a



“Omanis must be able to juggle and adjust to challenges in what will become a less predictable energy ecosystem.”

77th
Oman's ranking on the Global Innovation Index for 2017, out of 127 countries

53%
More than half of respondents to a survey by global consultants PWC said technological breakthroughs will transform the way people work in just the next decade

83%
A global study of nearly 1,000 organizations with revenues over \$500m found that 83% of respondents have created new jobs because of AI

60%
The percentage of children entering primary school today who will have job titles that do not yet exist

22m
The number of people that the SME sector in the GCC region has the potential to employ in the next five years

201m+
Global unemployment reached around 201m people in 2017, with an additional rise of 2.7m expected in 2018

less predictable energy ecosystem. Digital tools will be integral to enabling Oman's energy industry to zoom in on critical information, increase transparency and create accurate forecasts, thus streamlining profit margins and bolstering security.

My recent visit to the opening of the giant Khazzan gas field highlighted the skills and breadth of technology required for such operations, with 70% of the workforce being Omani. The Khazzan tight gas reserves, operated by BP in partnership with Oman Oil Company Exploration and Production, lie at depths of up to five kilometers in narrow bands of extremely hard, dense rock. Such complex and challenging conditions require specialized equipment, the precise drilling of both vertical and horizontal wells, and well stimulation to free the gas. Advanced technologies utilized by quality talent are vital.

Significant progress means the landscape today versus the late-1990s for entrepreneurs and small and medium-sized enterprises (SMEs) is unrecognizable. But the process to spur innovation can still be bettered. Laws for bankruptcy, regulation and funding can be less punitive and more open-minded for those experimenting with ideas – a golden stepping stone to innovation. Creating intellectual playgrounds, havens for experimentation, will also bear fruit.

The SME sector in the GCC region has the potential to employ up to 22 million people in the next five years, research by Mena Research Partners (MRP) shows. This is particularly good news for the Middle East and North Africa (MENA), which has one of the highest youth unemployment rate in the world. Unemployment was 27.2% in the Middle East and more than 29% in North Africa, according to the World Economic Forum (WEF) in 2014. Global unemployment has peaked at around 201 million people in 2017 and Oman alone has thousands of displaced oil and gas workers.

Oman already ranks 77th on the Global Innovation Index for 2017, out of 127 countries – not bad considering our small population. But let's leverage the new digital era and the entrepreneurial spirit that dominates our history books to make our 2018 ranking much higher. ■

LEADERSHIP PANEL

Tomorrow's Workplace in the 4th Industrial Revolution?

FEATURED SPEAKERS:

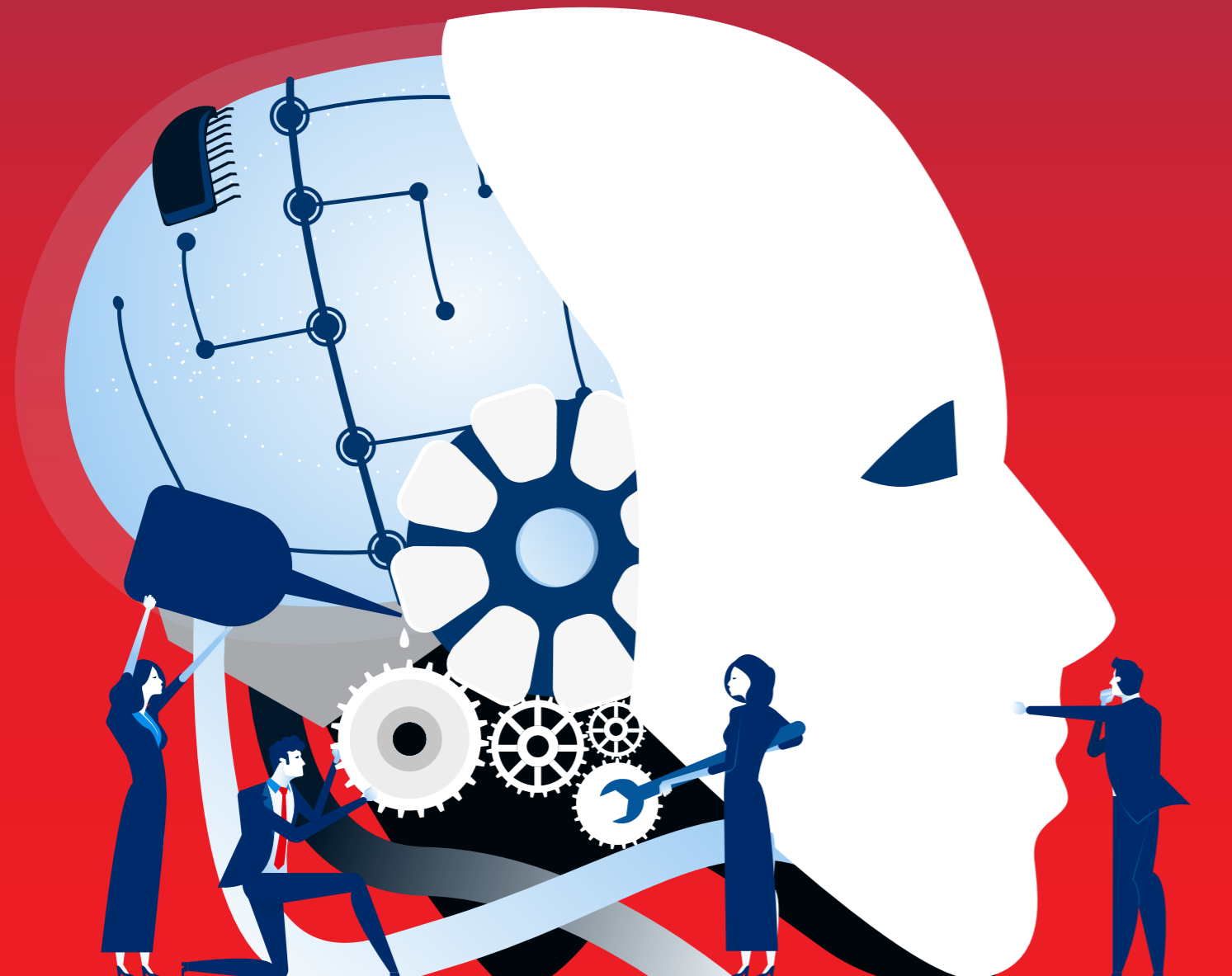
H.E. TALAL BIN SULAIMAN AL RAHBI, DEPUTY SECRETARY GENERAL, SUPREME COUNCIL FOR PLANNING, OMAN

DR. ABDUL HAKIM HILAL AL ISMAILY, DIRECTOR GENERAL, TECHNOLOGICAL EDUCATION, MINISTRY OF MANPOWER, OMAN

STEVE KELLY, PRESIDENT AND GENERAL MANAGER, OCCIDENTAL OF OMAN, INC.

MOHAMMED ARIF, REGIONAL DIRECTOR, MODERN WORKPLACE & SECURITY, MICROSOFT GULF

MODERATOR: SEAN EVERS, MANAGING PARTNER, GULF INTELLIGENCE



Sean Evers: *Your Excellency, I would imagine much of your planning or at least one factor to it would be the answer to this question: how much disruption is digital transformation going to have on energy producing countries? What's your outlook for the impact?*

H.E. Talal Bin Sulaiman Al Rahbi: As a national company, we are pushed most of the time to make profit, and there is also the political role to hire Omanis, develop skills and to provide support for the community. But when it comes to oil and gas companies in Oman, we see big development in that area. The recent oil price crisis has provided us with a good window to reflect. It has not only pushed oil companies themselves, but also the government to come together with other players and academia to think about how we're going to make changes. The major players in our economy, beside the government itself, are government companies. They must provide a bigger role in terms of developing skills and education for nationals. Oil and gas companies are leading their own sectors and other sectors by innovation and education and skill development.

Sean Evers: *Is the sector suitably mature to be in front of the digital curve or are you playing catch up?*

H.E. Talal Bin Sulaiman Al Rahbi: If you look at the Khazzan Field as an example, the advancement in skills and technology is pretty much cutting edge and we need to keep this momentum. Over 70% of the workforce at the Khazzan project are Omanis and I was amazed how such a highly skilled workforce has been developed in three to four years to cater for this huge project. If it can be done for this sector, it can be done in many others.

Sean Evers: *I'd like to invite Dr. Abdul Hakim to weigh in on the same question.*

Dr. Abdul Hakim Hilal Al Ismaily: Technology allows us to increase efficiency by combining a lot of activities in one person. Oman's population is very small, and we must focus on industries that Omanis feel proud to work in. Now, Oman is hiring or importing capability from abroad, around 1.6 million people. By using technology, we will still have Omani jobs, but we need to empower and upskill. Teaching Omanis such skills is a



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responsibility. We need every Omani to have the skills to be able to do 10 or 15 jobs.

Sean Evers: *In terms of the supply chain, the private sector is having to make a greater commitment in stepping up and hiring Omanis. Steve, like your peer group, you have done a lot of consolidation over the last few years given the correction in the oil price and the industry has laid off a lot of people and stopped hiring. From a global perspective, and as the market starts to look at the seeds of recovery and a stronger platform, we're also now getting into the weeds of digital transformation. So, does the recovery trigger the rehiring of all the people that were left in the downturn, or will we see less of that because of digital transformation?*

Steve Kelly: The starting point really must be, to address the question of layoffs and so on, and yes, we have consolidated in some countries. We have also focused on areas where we have great relationships with host governments - in our tremendous position in the Continental US, we haven't had any enforced layoffs during the downturn. We've maintained our size of the company well as it is. We have shareholders who are insistent on delivering returns - that that's what our raison d'être is as a company. And yet for the size that we are in Oman and for the production levels that we're at, the assets that we hold, we employ close to 3,000 people just within Oxy and over thousands of contractors that are attached to the assets that we have. Without the remit of being a national oil company, our

shareholders don't require us to be a big employer; they just require us to deliver returns. Despite all of that, we're able to employ at the level that we are here in Oman. I would say that going forward, as investment opportunities continue to open up, we'll have a pretty similar approach. I don't expect digital transformations to require us to lay people off. Efficiencies will allow us to grow and get people doing different jobs and that's where our focus will be. The real opportunity is in the supply chain and in everything that surrounds us as a company here and that's applicable elsewhere in the world.

Sean Evers: *Our research at GI has shown that there's great optimism that disruptive technology, like most previous generations of technologies, will create more jobs than it destroys. But the question is whether those jobs are transferable to the people whose jobs have been destroyed.*

Mohammed Arif: It's a zero-sum game and this notion that the social contract for a large enterprise in a country is just about the people they employ is a very narrow way of thinking. The education and the skills you build in the employees and preparing them for the next generation of jobs are all part of the social contract. To some extent it will be a disservice if you're not able to focus on the employees that you already have and build them up to those new skill sets. If you broaden that description, a large enterprise which adopts digital and disruptive technology will end



up benefiting the overall jobs economy although it might have a short-term impact on the jobs that they have in house.

Sean Evers: Are industry and academia aligning fast enough to ensure the right skills will exist for the energy sector jobs of the future? There's many jobs currently being filled by expats that Omanis could be doing if the skills were present, so there's inevitably some sense of the skills gap to be looked at.

H.E. Talal Bin Sulaiman Al Rahbi: It's very difficult for academia to match with industry. If you look at the efforts by academia in Oman for example, they do ask the industry. I know for sure that Sultan Qaboos University (SQU) does and maybe other universities as well. They survey the industry in Oman and the government and private sector on what degree majors we should focus on and which areas. Those surveys get collected and reflected, but you still have this gap between the supply of graduates and the intake of the people who get the jobs. Even in the US, for example, the statistics show that close to 80% of graduates work in jobs different than the major they studied in. A priority should be that academia prepares graduates to be critical thinkers. The difficulty is when people focus on the process and not on the thinking behind that process. Technical training is relatively easy, but emotional intelligence and other aspects of what makes a person well rounded enough to give that company or job an advantage is the challenge.



Sean Evers: Does industry need to become more accurate? Dr. Abdul, how are you tackling that? Obviously, it's not good in your line of work to see such a gap between industry and academia. How can we prepare for the fact that more than 50% of current jobs today may not exist in the next two decades?

Dr. Abdul Hakim Hilal Al Ismaili: We must focus on critical thinking, innovation and creativity. We don't really have companies here working and developing technology. They are buying it, implementing it, making it work and finishing their goods. Another problem in Oman is that the workforce is divided in two groups – the expatriates and the Omanis. The largest group of Omanis work in the public sector. People who are involved in really dealing with day to day interactive technology are mostly in the private sector and most are

“Oman is hiring or importing capability from abroad, around 1.6 million people. By using technology, we will still have Omani jobs, but we need to empower and upskill. We need every Omani to have the skills to be able do 10 or 15 jobs.”



expatriates. We need to make more Omanis work in the private sector and help them establish their own businesses. We also need to include in our curriculum how to utilize technology to execute different work and disruptive technology will help Oman progress.

Sean Evers: Steve, how do we get more efficient guidance from industry to academia?

Steve Kelly: Participation in curriculum development and content is very important and we're engaged in discussions around that. But the reality is that we still have a great need for what you might call traditional oil and gas disciplines – geophysicists, geologists, reservoir engineers, facilities engineers. What disruptive technologies will do is elevate the activities people are going to be taking part in. They're still going to need a deep understanding of the core of our business, such as the sub-surface and how to transform that into a product that can be delivered. We may have AI doing the bulk of what was previously done by people for well surveillance, for artificial lift surveillance

“I don't expect digital transformations will require us to lay people off. Efficiencies will allow us to grow and get people doing different jobs. That's where our focus will be.”

and so on, but then it's still somebody who has a deep understanding of these factors that is looking at the flags that come up and the optimizations that need to happen. Technology will get us to a point where optimizations are happening on an automated basis, but you still need human oversight.

Audience Member: For us to be able to match the industry with the skills it needs, students need to see the reality on the ground. They need to see how these technologies are applied. Academia must change. We cannot expect students to study for four years and then be able to apply themselves to industry.

Audience Member: At Muscat University, all our undergraduate programs have a compulsory one-year internship within industry, because we recognize that we can't teach the students everything within the confines of the university. The third year is completely industry based and is credit bearing, but we call out to industry to take our interns as this is a two-way road.

Sean Evers: How important a role will tech companies like Microsoft and Google play over the next decade in the servicing of the global oil and gas industry? Will they become as important as major service providers, such as Schlumberger or Halliburton are today?

Audience Member: I've been involved in the implementation of sub-surface in PDO for the last five years and digital transformation. In a sense, the implementation of lean and digital transformation that we've already



implemented in PDO is a disruption by itself. The way we currently operate our fields and wells is completely different from just three to five years ago. As for how we can better enable the connection with academia, what we have done in PDO is to create an environment in which people can experiment and figure out what skills are required from an organic evolutionary mode. The same thing has happened obviously in Silicon Valley where there was a combination of technical skills, both IT and commercial, and the right venture capital to drive the value perspective. So, you create these environments in which you figure it out as you go along. One question is whether corporate systems are still too rigid to allow that flexibility for people to come in and experiment. And therefore, do we need to enable that?

Mohammed Arif: I don't think the IT business wants to be in the oil business per se, but there are a lot of things that we have discussed around digital transformation – such as big data and analytics machine learning – and it is simply not possible to implement in its full force if you do not have computer power at scale. There are only a handful of companies worldwide, us being one of them, Facebook, Amazon, that have the capability to build computed scale. I'll give an example. We spend \$1 billion just on data centers. We have enough network fabric that it will take you



from the earth to the moon three times over. So, we invest in this on an ongoing basis and I don't think any large company, oil, gas or otherwise would want to invest that kind of infrastructure in IT. We can provide this as a platform, as a service to all oil and gas customers. There are challenges that we face, and data's already been one of them and there will be potential solutions as regulations, data classification and other factors improve. Companies and governments will continue to review the pros and cons and there will be the tipping point where they feel the benefits that cloud computing can provide to modeling reservoirs, to efficiency of equipment and so on. And then they will start to look at the added scale.

Audience Member: One thing that I would put to policy makers is to create a better ecosystem for entrepreneurs to be able to take risk and be part of the equation. It's not just academia and the key players. We currently have multiple gaps. We have bankruptcy laws, which are very punitive to those who experiment and fail. This is very counterproductive to innovation. This is what Silicon Valley has and we don't. And although we talk about supporting small and medium-sized enterprises (SMEs), the core financial system is also very punitive. For example, an entrepreneur working full time in his company is taxed on his salary above thousand rials. Policy makers need to examine this sort of thing if they want to have a vibrant, innovative entrepreneurship segment in Oman.

H.E. Talal Bin Sulaiman Al Rahbi: Many things have been done for the development of SMEs and entrepreneurs in the last four years, but I agree that there is still a way to go on closing the gap and making it easier for SMEs to work in Oman. ■

“We spend \$1 billion just on data centers. We have enough network fabric to take you from the earth to the moon three times over. We invest in this on an ongoing basis and I don't think any large company – oil, gas or otherwise – would want to invest that kind of infrastructure into IT.”

TALENT: TACKLING UNPRECEDENTED 21st CENTURY CHALLENGES

Oil Worker of the Future

How can Technical and Vocational Training Programs evolve to better Re-skill and Up-skill Omani workers?

BY JAMAL AL HABSI, OMANIZATION AND ICV TEAM LEADER, OCCIDENTAL OMAN

Industry & Academia in Oman need to align better to enhance vocational education and meet future labor market requirements. Currently, vocational education is viewed as an alternate educational pathway whereas, in its essence, it should be viewed as complementary and just as a different style of learning, that can work hand in hand with traditional education. Rebranding the image of vocational education and enhancing the current mindset around its reputation in Oman needs improvement. Society needs to move away from

the commonly held view that vocational education is not up to par or not as prestigious as a university degree. Industry, academia, and government need to work together to encourage the younger generation through designed incentives. Improving accreditation and standards for vocational education through new legislation in Oman would be a pathway to further credibility - young professionals need to be assured that their training is transferable and fully accredited, and it is crucial that individuals are recognized both domestically in-country and internationally.



“Improving accreditation and standards for vocational education through new legislation in Oman would be a pathway to further credibility. Young professionals must be assured that their training is transferable and fully accredited and it is crucial that individuals are recognized both in-country and internationally.”



for a diverse skill set of knowledge and provide the required tool kit for future success. The new world of technology is a key pillar in generating entrepreneurs and self-employment and contributes to the growth of the private SME sector – a critical factor in developing economies’ growth trajectories.

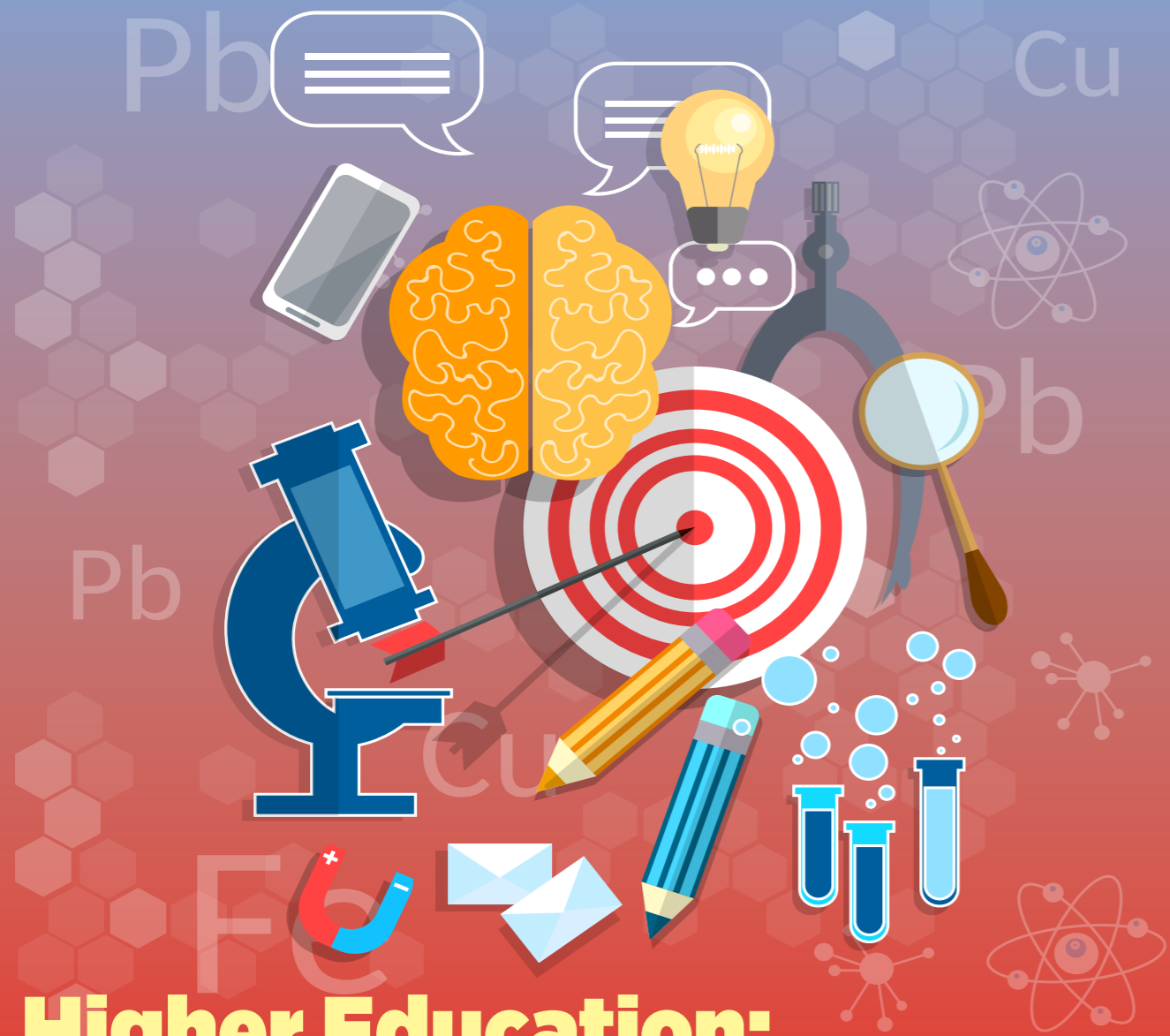
Given the rapidly changing environment brought on by digital disruption, energy stakeholders should strive to work with technology companies to ensure that standards and accreditation for technical education is constantly improving and up to date. By establishing this closer collaboration, they can learn better and faster how technological infrastructure is developing and introduce that into current and future vocational standards and frameworks.

The rapid rate of technological advancement renders what we learn today obsolete in a very short period of time, so learning and re-learning continuously has to become an important skill and needs to be cemented into society. It has been suggested that 65% of children entering school today will, when they graduate, work in jobs that currently do not exist. The education system will only go so far, and energy stakeholders have to understand this. Organizations need to direct their staff actively on transferring knowledge and teaching their employees how to be efficient learners. ■

One of the top recommendations harvested from the 2017 Oman Energy Forum was that Industry should work with academia throughout the entire period of a student’s university career to develop vocational qualifications. Having a structured framework and learning process where students go from university or college into the workplace will resolve at least some of the challenges in meeting future labor market requirements in Oman. Vocational qualifications can be established from entry university level through to PhD; an example of a vocational PhD would be a medical doctor that gains hands on experience while completing a theoretical degree in tandem.

Internships and apprenticeships are the bedrock of skills training. They encompass all three stages of learning - watching, participating and doing. The culture and environment surrounding apprenticeships or internships in Oman needs to be greatly enhanced.

Applied skills in technology and real-world learning will be particularly crucial in the new era of the 4th industrial revolution – and would allow



Higher Education: Are we Missing the Point?

BY BRIAN COZZOLINO, SENIOR ASSOCIATE, GULF INTELLIGENCE

What are the key elements that will define value-added curriculums for the energy sector in the 4th Industrial Revolution? Trends in the world of technology create many new cross-functional rules for which social, analytical and technical skills will be required. However, most educational methods and institutions provide silo training and utilize dated practices that do not foster progress in talent development.

One of Oman's current challenges is how best to diversify its energy mix to ensure energy security for its rapidly growing young population. There is recognition that an effort to foster better collaboration between academia and industry could provide one pathway towards this. But not enough progress has been made. Why are academia and industry still

not engaging in a meaningful enough way to meet their mutual needs? Very few universities around the world have been successful on this front thus far, bar a handful, such as Princeton University in the US and Masdar Institute in the UAE. What needs to be done to finally bridge this gap?

Education in Oman needs to keep up with what is happening in the industry and identify how it can be more relevant and flexible. This requires a structured and defined dialogue. Some are of the view that academia must not work in isolation and need to first get their 'own house in order' before engaging with industry. This would ensure that the courses they offer are complementary; this would give them a stronger case when they approach corporates for investment or collaboration. Perhaps the educational sector is



currently overregulated, which prohibits it from being creative and achieving certain targets.

Academia should work on devising programs, courses and methods of delivery that are relevant to today's generation, be it theoretical or vocational. Sometimes for example, the training requirement is what's needed more than academics and using social media as an educational tool may be more effective than a power point presentation. Another avenue is to choreograph and align educational courses to match more precisely the needs of Omani industries. Otherwise their knowledge could be rendered mostly irrelevant when they start work.

Academia needs to deliver active and independent learning processes. There are different ways to cultivate and nurture students' development. One can often find students at universities who want to be creative and innovative, but certain curriculums or teaching methods force them into a certain way of learning that are no longer in sync with the environment.

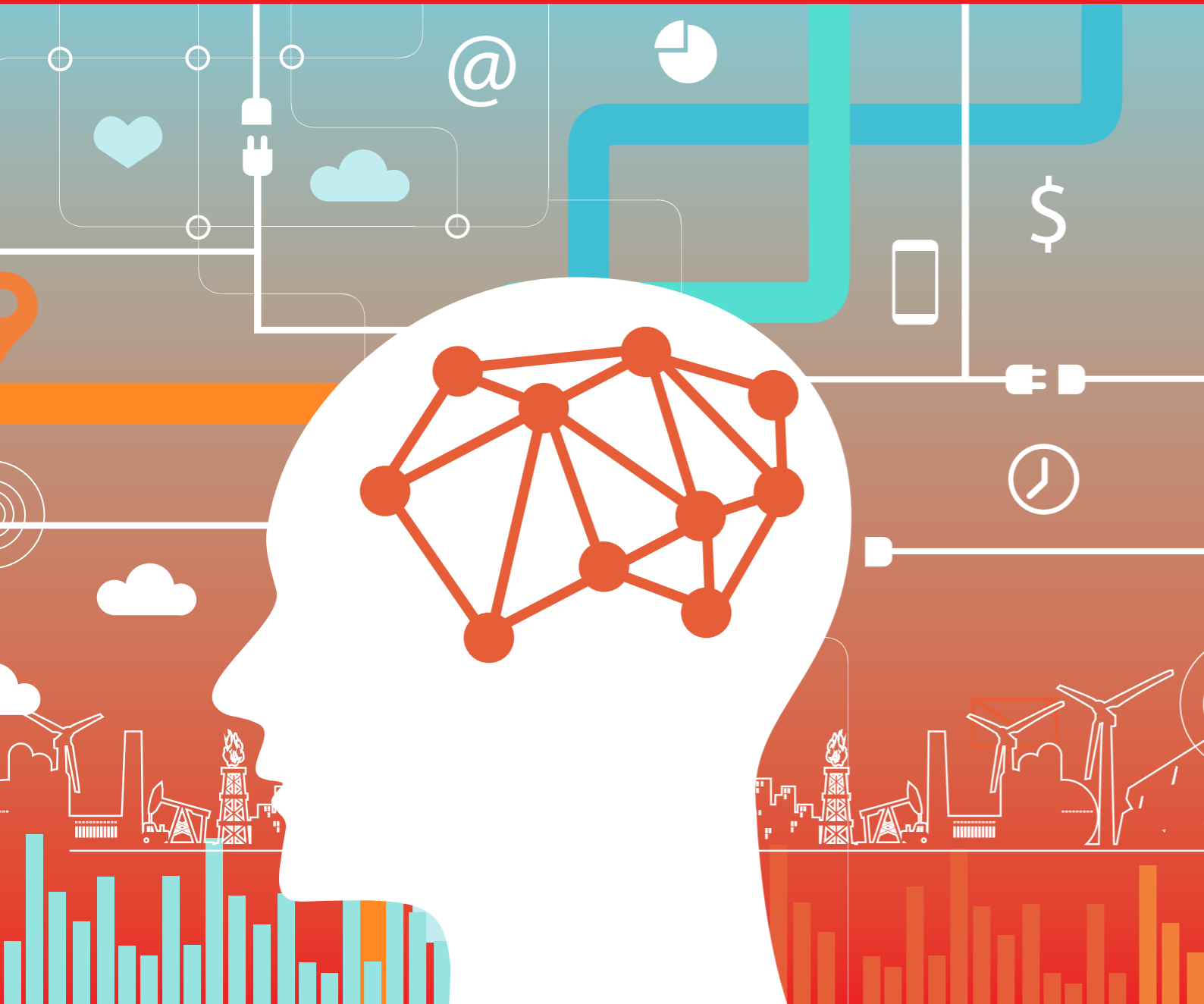
Some progress is being made in the way that academia thinks and functions, such as using benchmarking. The University of Oman Project Office recently established a new campus that will specialize in science, technology, medicine and health sciences. It benchmarks against Nanyang Technology University, which has partnerships with industries like Rolls Royce engines. The model entails measuring performance on how such partnerships are working, research and development and even detailing what each faculty or researcher is doing and who is involved in the process.

The private sector must ensure it is making its own needs clear to academia. There needs to be a full and continuous mechanism of engagement about where that is headed. This includes interactive feedback on whether industry needs oil engineers, chemical engineers, IT engineers, or indeed renewable energy technicians. These elements must be mapped out and adopted as a national strategy that is compatible to all participating companies.

“The energy industry needs people with skills in critical thinking as well as the fundamentals like numeracy, literacy and science. Students also need to be fully represented as the third leg of the academia-business stool.”

The energy industry needs people with skills in critical thinking as well as the fundamentals like numeracy, literacy and science. Students also need to be fully represented as the third leg of the academia-business stool, but this is often not the case. Young and relatively inexperienced talent can sometimes identify opportunities that no one else can. An open mind must always be kept when thinking of ways to involve them. The UK has a model called the Knowledge Transfer Partnership or KTP, whereby the government funds 50% of a project and the academic institution funds another portion, as does business, for example. Graduates doing a Bachelors or Masters degree are then placed in industry. A company like PDO could do this and place a student with preliminary knowledge on a 6 or 12-month project. There would be a workplace mentor, as well as an academic mentor and the company would work with academia via this individual's secondment through regular monthly meetings and measured outcomes.

Lastly, there is no need to reinvent the wheel as there are many models out there that have been proven to work. Studying best practices that have been tried and tested when it comes to integrating academia with industry is a viable route. For example, universities in Australia are quite aggressive at marketing themselves and engaging with industry on what students they may be seeking. They inform industry on what research is being done and what innovation centres they hope to open and so on. That way, they both establish a relationship and capture investment. ■



A New Breed of Talent: Millennials

BY MUSTAFA WARSAME, SENIOR ASSOCIATE, GULF INTELLIGENCE

Millennials are ambitious, career-driven and tech savvy. They thrive on challenge and have a strong focus on the mission and vision of companies. They research their roles thoroughly and are more structured in their approach to work in general. Creative thinking is embedded in their psyche and they enjoy and expect to have a work life balance. They look for collaborative environments, while also being capable of independent thought.

Understanding these attributes, among others, and adapting to accommodate them is crucial in enabling the energy sector to attract millennials. By

2020, they will make up 50% of the global workforce. The industry needs to instill a level of trust in them and create opportunities to do the jobs they want to do – and that requires a change of mindset. Millennials will change jobs more often and organizations unprepared to accommodate this may lose out. A healthy turnover of staff benefits both employees and companies in the long-term as they gain exposure to new skills, new ways of thinking and doing. This brings in fresh intellectual material.

The on-off switch for millennials is undoubtedly passion; that's the bottom line for retention, particularly with the diverse industries that are



“ It’s part of business strategy to compete on our best assets and those are not the drill machines – it’s the people. They are more relevant and important now than ever.”



springing up in technology. If millennials think an energy company is focused on the environment for example, it may be a more attractive prospect. They tend to view their work as serving the larger community and not just the company per se.

Nurturing creativity to help solve problems is important. Millennials should be empowered to act relatively freely and not be suffocated by convention or a top-down approach. Clear company structure and leadership guidance is key. At the same time, giving young leaders direct access to senior company members to pitch innovative ideas and be part of the decision-making process reinforces an ecosystem of full engagement. The alternative ideas that new recruits present may sometimes be naïve, but challenging the status quo can also be a very powerful tool. Of course, it is not just millennials who are introducing changes to the work environment in the energy sector. Technologies

and value chains are evolving, so it's about how the transition in the oil and gas industry in Oman is managed going forward.

Traditional skill sets still matter. If you are an operator running a dangerous operation, you must have experience. Some parts of the business simply need that rigor and diligence and such experts cannot be replaced with technology. Millennials can work and learn from this old school experience. Yes, we need to focus on millennials' potential, but we also need to ensure that we are not leaving the Baby Boomers behind.

The world has become more connected, opportunities are more available and skill sets are more developed. We need to stay relevant by re-training the workforce and transforming the leadership mindset. It's part of business strategy to compete on our best assets, and those are not the drill machines - it's the people. They are more relevant and important now than ever. ■

Change Ahoy

How can the Oil and Gas sector encourage an innovative energy transition culture?

BY STEVEN MOERMAN, PROJECT MANAGER ENERGY TRANSITION, SHELL DEVELOPMENT OMAN

The shift in the world's energy system from its current state that is underpinned by oil, gas and coal, to one that is more efficient and based on a lower-carbon energy mix represents an unprecedented transition. One that is driven by technological innovation, policy shifts and a change in consumption patterns.

According to the International Renewable Energy Agency (IRENA), growth in renewables could deliver 24.4 million jobs worldwide between now and 2030. Both private and public organizations need to implement incentives and demonstrate a clear direction of purpose to foster an innovative energy transition culture to help secure a pipeline

of workers with the right skills who can form the backbone of this technological revolution.

The traditional oil and gas sector is reputed to have a relatively fixed mindset and low risk appetite when it comes to disruptive change, but that is changing. Both international oil companies and national oil companies need to be creating in-house cultures that embrace a low-carbon development model. This may bring with it higher costs in the near-term, such as intensive training or acquisition of newly skilled personnel. But it's crucial to maintain a long-term view of the tangible benefits. Some companies have started to rebrand themselves to attract and acquire this new generation of talent.





In the GCC, energy efficiency among the public could be encouraged by devising financial incentives, such as discounted fees for energy efficient households and for those using electric cars. The level of awareness can be further supported by education – starting small in schools and moving into college education – by teaching youth to become resourceful and embrace clean energy and efficiency. Deploying messages via social media would be a very effective tool to reach generations Y and Z.

Governments need to direct policies and regulations to be more supportive of the private sector. They could set up a dedicated authority to encourage investment, for example. Or designate brand ambassadors and ‘champions’ to work on behalf of the energy ministry together with corporates and awareness programs. Easing bureaucracy and regulations on financing, particularly for SMEs that are promoting clean energy or efficiency, would be beneficial to economic growth.

Regulatory procedures are often cumbersome and an impediment to change, preventing incentives from materializing. Alignment among government institutional bodies on the main goals to achieve energy efficiency is generally lagging in the region. Government departments and businesses need to be more embracing of a ‘change culture’, with procedures and processes made more flexible to allow this energy transition to transpire more easily.

When we talk about energy transition, most people think about the power sector: renewable energy and solar energy. Other sectors, such as transport and heavy industry, are much harder to decarbonize fully. Therefore, full energy transition will need decades and requires continued collaboration among policy makers, business leaders, non-governmental organizations and consumers.

For Oman, energy transition presents a challenge as well as an opportunity. The challenge is to keep meeting the increased energy demand from a growing population and a growing economy while living up to the commitment of the Paris Agreement. The opportunity lies in using the energy transition to create new employment opportunities, reduce the

“Government departments and businesses need to be more embracing of a ‘change culture’, with procedures and processes made more flexible to allow this energy transition to transpire more easily.”

physical impact of the energy system and maximize the contribution to the diversification of the economy.

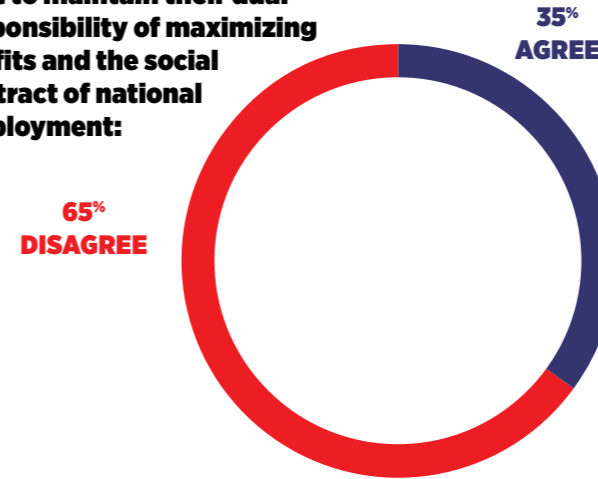
There are two dominant themes for energy transition in Oman. The first one is around the adoption of renewable power in the energy mix, as sunshine and wind are two of the country’s major resources that remain largely untapped. Several initiatives are gaining ground. Shell has initiated a program whereby it has invested in solar PV panels for 22 schools, for example. It educates children on the importance of renewable energy and trains and contracts local SMEs to do the insulation works. OPWP and PDO have announced tenders for large scale solar farms.

Energy efficiency is the other key element in Oman’s energy transition. Proven technology is available to significantly reduce energy demand while maintaining or even improving living standards, yet little progress seems to have been made on a national scale. Using significantly fewer resources to keep the population and the economy energized is within reach and would make gas available for the government to monetize in a different way. On top of that, it would reduce the fiscal impact of subsidies and it represents a significant opportunity for employment of local talent. ■

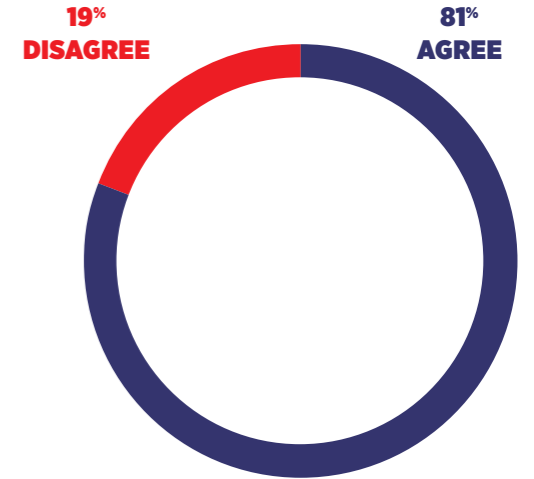
GIO RESHAPING DIGITAL ATTITUDES: What’s Next?

SURVEY
NOVEMBER 2017

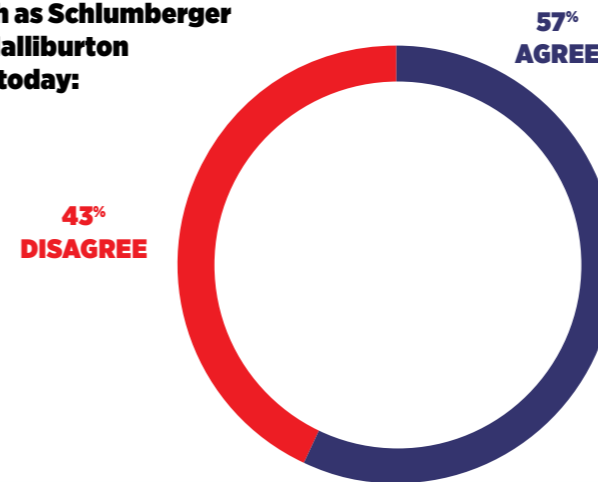
Disruptive technologies will accelerate the transformation of the oil industry and make it difficult for National Oil Companies in the Middle East to maintain their dual responsibility of maximizing profits and the social contract of national employment:



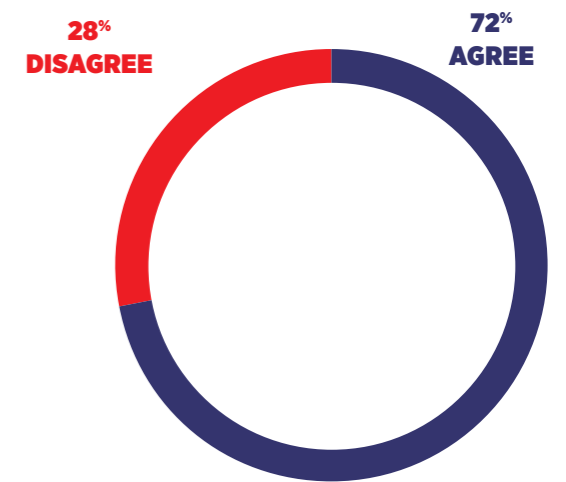
Industry and academia are not aligning fast enough to ensure the right skills will exist for the energy sector’s jobs of the future:



The group of FAAMG – Facebook, Amazon, Apple, Microsoft, and Alphabet’s Google – will emerge over the next decade to play a leading role in servicing the global oil & gas industry i.e. as important as major service providers such as Schlumberger or Halliburton are today:

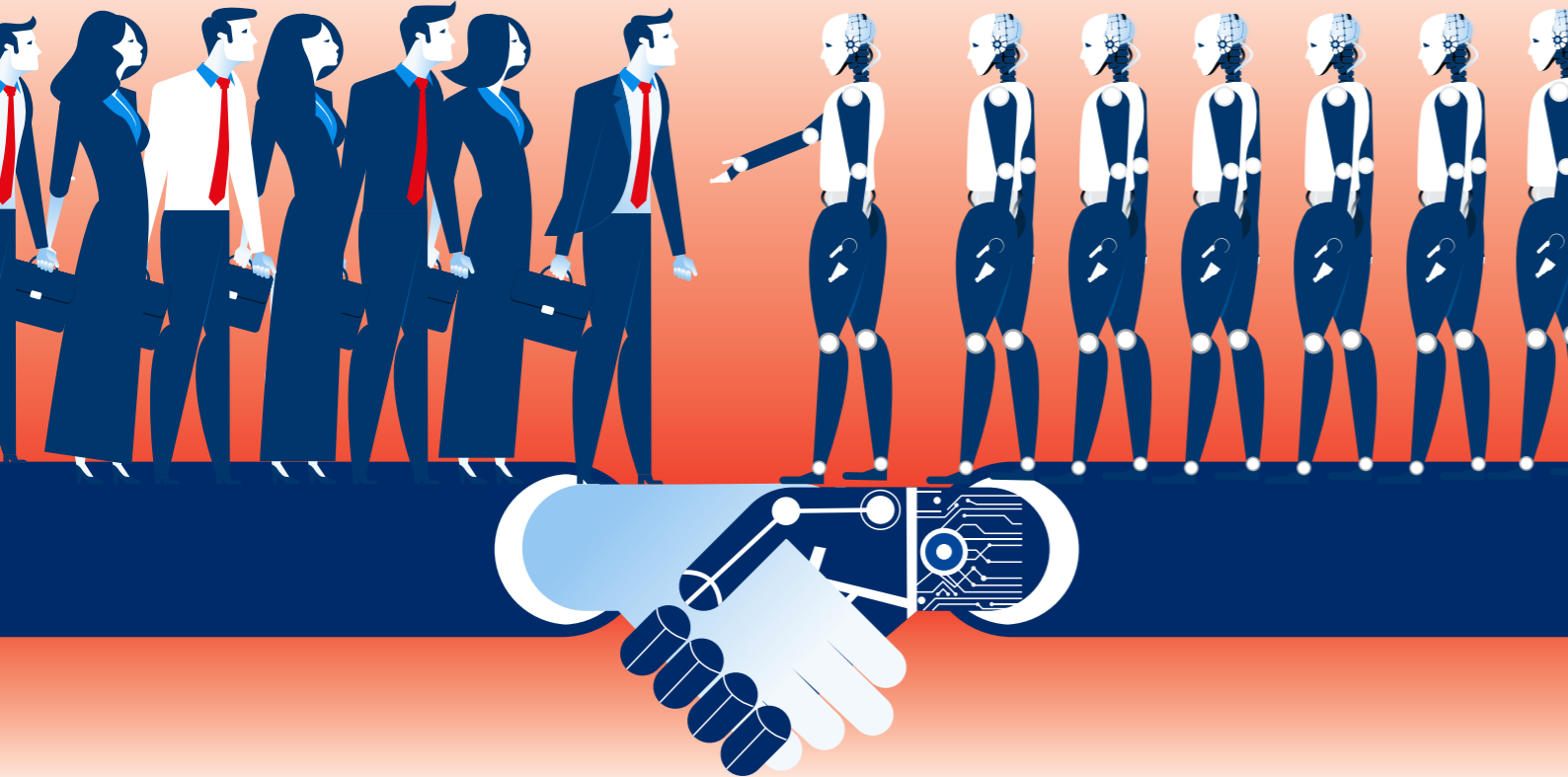


The global average of how much oil can be recovered from a reservoir currently stands at about 35% of oil in place – with the deployment of Future technologies this number can double to 70%:





شركة تنمية نفط عُمان
Petroleum Development Oman



Artificial Intelligence & Robots

- What impact will automation, robotics and artificial intelligence have on the future of work?

BY SALAH AL BAHLANY, BUSINESS SUPPORT MANAGER WELL ENGINEERING DIRECTORATE, PDO

Automation will be a game changer for the energy industry. More digitization, machine learning and robotics, specifically in the drilling industry, will reduce non-productive time, disruption due to human error, injuries and fatalities. Until about five years ago, there was minimal talk about automation, digitization or using artificial intelligence (AI) in the upstream oil and gas business. Now, AI has the potential to automate almost the entire process of drilling wells using robotics and digitized controls of the whole system. A rig generally employs about 120 people, excluding supporting logistics staff; automation can cut that manpower requirement by about 70% and synchronize, drastically improve operational and safety performance and hence reduce operational costs.

While automation will make some jobs redundant, it will also create more targeted jobs which will require people with specialized and focused skills and emotional intelligence. Striking the right balance is important, and strategizing to make sure we automate correctly and employ the right people in the appropriate domain to minimize redundancy and safeguard against machine-made errors. Moreover, we need to ensure our future strategies continue to create the appropriate jobs along the supply chain.

Machines will be important in harvesting, collating and tabulating data but the human element will always be required for knowledge and expertise in deploying emerging AI areas. However, we also need to be mindful of human error and bias and ensure the appropriate talent and expertise is employed in data



Automation will create more targeted jobs, which will require people with specialized skills, a high IQ and emotional intelligence. Striking the right balance is important and strategizing to make sure we automate and employ people correctly to minimize redundancy and machine-made errors will be a top priority."

analysis and data science – these upgraded skill sets are very important. It is also crucial to be committed to not only harvest data but also make sense out of it - analyze it and be transparent about what has been collected. This will ensure alignment across the business cycle and help in deploying AI most efficiently.

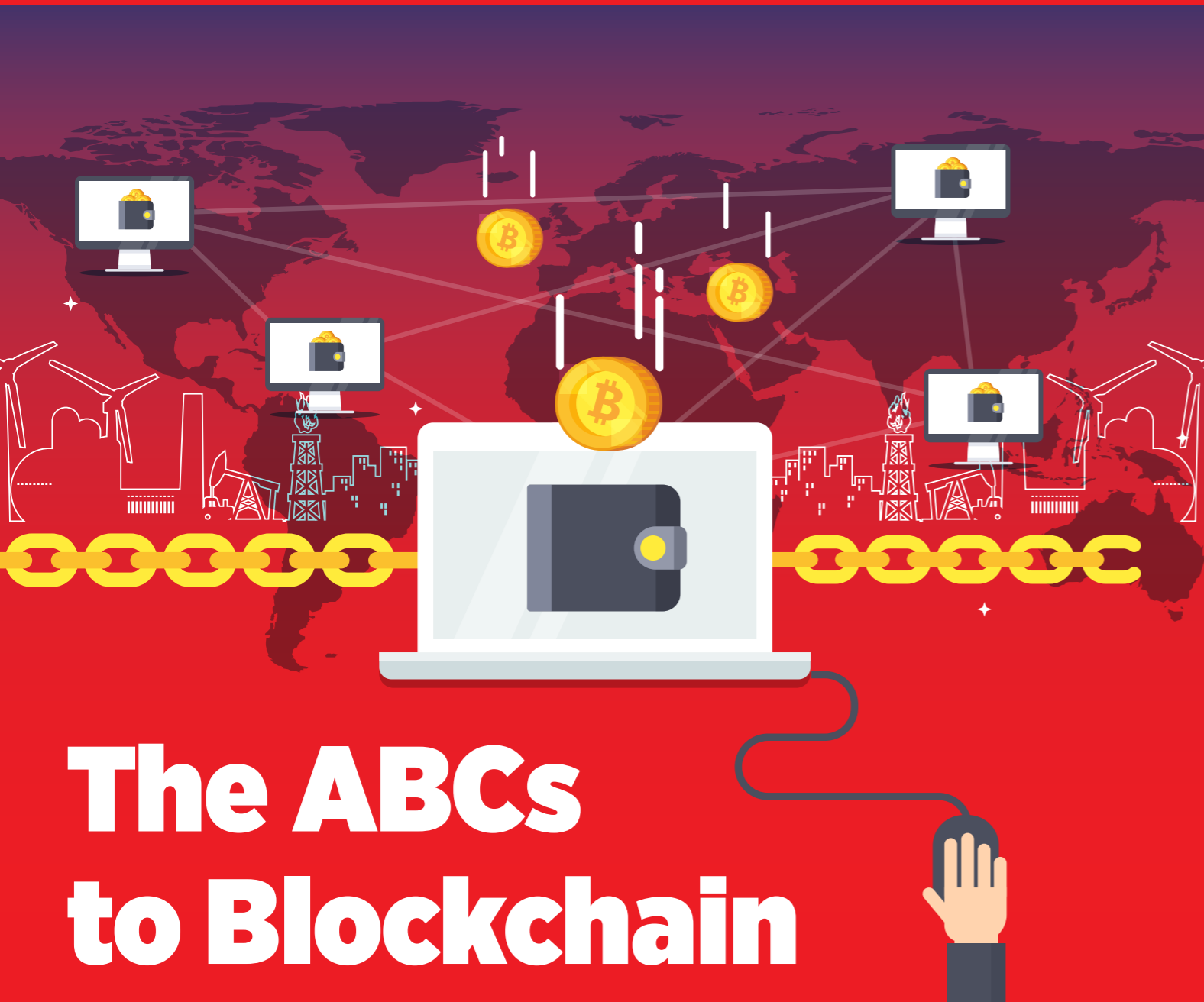
The uptake of automation has tended to vary widely within company strategies. So far, it's the service companies who have invested more than the operators have.

Companies like BP, Shell, Total are starting to move their core systems to the cloud because they realize the benefits of accelerating AI adoption but in this region and some other countries, it's not happening as fast as it could due to data security sensitivities. We need to educate and create an awareness and understanding that AI and its related applications are secure. The lack of technological literacy is still creating a fair amount of fear of cloud technology and its related advantages.

In Oman, we need to work on building digital skill sets, and fast, so that a healthy level of employment can be maintained. Traditional and basic skills will always be needed but we have to be able to complement

these with qualifications that can address particular elements related to AI and digitization – and this takes a very selective approach. New jobs need appropriate training.

The World Economic Forum Jobs Report highlights that by 2020, more than a third of the desired core skillsets of most occupations, do not currently exist in today's job market. In this region alone, digital transformation could create above 20 million jobs over the next three years but only if the right skill sets are developed. There is still much misalignment between those seeking new jobs and the skills needed in the new economy, across both companies and geographies. The soft skills of emotional intelligence are progressing, but we also need to focus on specialized and technical attributes. The adoption of personal computers globally over the past four decades has created around 300 million jobs in programming and related fields and we now witness it transitioning into areas like AI. This is proof that technology disruption can be a very positive development but the labor market and the policies directing it must keep up for this to be fully realized. ■



The ABCs to Blockchain

How can companies take advantage of this new technology?

BY JAMES RILETT, GLOBAL DIRECTOR OF INNOVATION & DIGITAL STRATEGY FOR S&P GLOBAL PLATTS

Blockchain is everything that we know about cryptography, networks and operating systems. It is one of the key elements that enables us to bring forward a permanent digital record. Before blockchain, anything digital could be fiddled with, but that is no longer necessary. There are three key features of distributed ledger technology in blockchain that are important. Cryptography – where the underlying method of exchanging data is encrypted – and in this increasingly insecure digital age, that’s an important advantage. The second is that it is a distributed technology – it doesn’t sit on one server, computer or any one cloud – and it has the capacity to share

information synchronously everywhere. And thirdly, it uses various protocols that allow for data to be immutable, which means in theory it cannot be changed by any one central player.

Disruptive instruments of change like blockchain are increasingly becoming an area of focus for all businesses. Gartner Research has said that two thirds of large companies with more than 20,000 employees expect to implement blockchain technology into their systems during 2018. There has already been \$2 billion invested in corporate venture capital activity in companies targeting this technology and exploiting it to add value to new and existing industries.

The oil industry is a target rich environment for

blockchain as there is a lot of interaction. Interaction between parties associated with government, contractors, subcontractors and many more all encompass factors that are enhanced by the consensus layer element of blockchain. Remove this layer and you are left with a database. Distributed databases today are used among a few groups, but they are not the same as a distributed ledger or blockchain, which critically brings a new level of trust to any interaction. It apportions responsibility and you also get resilience in a manner that is permanent and unchallengeable. Blockchain is very effective where there is a need to decentralise activities – it cuts out the middle man.

The most well-known successful application of this, thus far is Bitcoin, the first generation of cryptocurrency. Another blockchain application is in smart contracts – such as Ethereum – that can be used in the finance or insurance industries, as well as other sectors.

The most advanced generation of blockchain application is in the Internet of Things (IOT), which would be a gateway to the technology’s use in the energy industry. To find out where blockchain would be most useful, we need to figure out who the players might be – they may not necessarily trust each other and have different responsibilities. We also need to establish how that trust may fail and lastly, where this sits exactly within the scope of government and private enterprise. Most critically, we should study where this technology of digital transfer can reduce costs and enhance the speed of projects and services and make quality enhancements. What can it do, for example, for challenges in oil production, for gas distribution businesses, transport logistics, sensors in the oil field? And where can it lead to cost savings in the oil industry?

A blockchain solution would mean everyone has the same Excel sheet and ledger and no one could change it without consensus. All players can add data and applications to this process – as long as all agree on them. Thereafter, the system is automated through a sensor and then judged by a smart contract which rules on performance.

An example of blockchain in the upstream sector side of the business could be in the paperwork on moving water in shale projects. Blockchain could remove the need for manual ticketing and would instead store records digitally and remove the friction around the speed of payments and processing.

Further downstream, in trade finance or in the process of trade documents, advantages could be found in reducing back office operations and costs by 30-50% and in removing fraud and errors in trading. The focus would be on process efficiency and the crystalizing of sharing information back and forth.

On the other hand, bear in mind that blockchain is not necessarily a solution for all problems. We really must understand where the value is and how to move forward in degrees of access to the iCloud.



Automation will create more targeted jobs, which will require people with specialized skills, a high IQ and emotional intelligence. Striking the right balance is important and strategizing to make sure we automate and employ people correctly to minimize redundancy and machine-made errors will be a top priority.”

For example, on a national level, there are currently constraints because of sovereign limits, such as China’s limits on Bitcoin.

The first steps to implementing blockchain in the energy industry would be to educate people on its mechanics and develop skill sets for it. For example, Oman has established an Oman Blockchains Solution Company and an Oman Blockchain Club to spread awareness and educate people on what databases do and what are basic scripting languages like JAVA.

The Oman Research Council is testing blockchain by running proof of concept and pilot case studies with partners in government, academia and industry. One example would be an application in renewable energy, whereby residents would sell energy to neighbors and get micropayment using cryptocurrency. Oman wants to trial that via PPPs and other projects in the supply chain of the energy industry.

Blockchain has different scopes. Bitcoin, which has had millions of transactions and never been hacked is an example of a public blockchain that is anonymous and decentralised. An example of a private permission blockchain is the one recently designed for Dubai’s government, where 50 entities will share documents and 120 million documents will be removed through the use of blockchain by 2030. Then there is the consortium model, such as in companies like IBM and the finance sector. This is where multiple people work along the value chain on something that is controlled by that chain.

An element of control needs to be applied to private permission blockchains, be it a governance or procedure. Blockchain has turned security upside down, so we need to figure out which parts of our data will remain encrypted and private for a long time and which won’t. ■

THE FUTURE OF WORK – ACTION PLAN

The Leadership Summit brought together an exclusive group of senior stakeholders in Oman to be briefed on The Future of Work Action Plan. The senior leadership then voted on and scored in order of priority the Top 10 Recommendations from the action plan to be implemented immediately.

Recommendation	Total Score	Adopting Institution
1. Energy industry to lead an emotional advertising campaign that places vocational education in line with being a patriot building the future of Oman.	310	
2. Create and execute an action plan to enhance digital literacy throughout Oman's energy sector.	279	
3. Create a digital platform that directly matches job seekers with industry opportunities based on their identified skill sets – an Oman LinkedIn. A job seeker can upload their CV to the platform and receive insights on the best jobs that they have skills and experience for.	275	
4. Create an Innovation Index that Measures a Company's Performance on Advancing the Employability of Omanis?	204	
5. Create a digital platform that facilitates real time engagement between industry and academia on labor market requirements. This will provide a foundation where academia can proactively evolve its curriculum.	178	
6. Align Industry & Academia to enhance vocational education and meet future labor market requirements. (ex. Leverage a protocol framework that closes the gap between industry & academia on vocational training).	173	
7. Run proof of concepts and identify the pain points within the energy sector that can be greatly improved by implementing blockchain technology.	172	
8. Establish internship or apprenticeship programs that last for a minimum of 1 Year where students can engage in a longer period of applied learning.	169	
9. Establish a structured framework, aligned with industry and academia, to develop vocational qualifications throughout the entire period of a student's university career.	161	
10. Blended Degrees: Make it a compulsory part (elective courses) of university education that every student must have at least two semesters in a vocational training skill (plumbing) and/or 4th industrial revolution skill (AI).	80	

Participants

GOVERNMENT

Ministry of Oil & Gas, Oman
 Supreme Council for Planning, Oman
 Ministry of Manpower, Oman
 Ministry of Higher Education, Oman
 Ministry of Education, Oman
 Ministry of Finance, Oman
 Ministry of Environment and Climate Affairs, Oman
 Ministry of Foreign Affairs, Oman
 The Research Council
 Public Authority for Electricity and Water, Oman
 Authority for Electricity Regulation, Oman
 Oman Power and Water Procurement Company
 Innovation Development Oman
 Oman Technology Fund
 The National CEO Program
 Al Raffd Fund
 ITHRAA
 Riyada

ACADEMIA

Sultan Qaboos University
 German University of Technology in Oman
 Muscat University
 Higher College of Technology
 A' Sharqiyah University
 University of Nizwa
 Nizwa College of Technology
 Sohar University

Dhofar University

University of Oman Project
 Waljat College of Applied Sciences
 International Maritime College Oman
 International College of Engineering and Management
 Al Musanna College of Technology
 Mazoon College
 Ibra College of Technology
 Global College of Engineering and Technology

INDUSTRY & ORGANIZATIONS

Petroleum Development Oman
 Occidental of Oman
 S&P Global Platts
 Shell Development Oman
 Oman Trading International
 Glasspoint Solar
 Oman LNG Development Foundation
 Oman Oil Company
 ORPIC
 Oman Oil Duqm Development Company
 Oman Gas Company
 Oman Environmental Services Holding Company
 BP Oman
 Daleel Petroleum
 Petrogas
 Gulf Energy International
 MEDCO Energi
 ABB
 Microsoft

LinkedIn

IBM
 Bahwan Cybertek
 TNO
 Wood Plc
 Oman Fiber Optic
 Port of Duqm
 Port of Sohar
 Oman Society for Petroleum Services
 Omani Society for Human Resource Management
 General Federation of Oman Trade Union
 Oman Center for Skills Development
 Competence HR

Injaz Oman
 Young Arab Leaders
 Occupational Training Institute
 Oman Tank Terminal Company
 Takatuf Petrofac Oman
 Bank Dhofar
 National Bank of Oman
 Investcorp Bank
 Oman Wanfang
 Al Baraka Oilfield Services
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 Duqm Refinery
 SNC Lavalin
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 Next Arabia
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