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A Gulf Intelligence

Special Report

2016

R&D

Lower Gulf States - UAE, Oman, Qatar - Reach for the Silicon Valley Stars

CONTENTS

"Man cannot discover new oceans unless he has the courage to lose sight of the shore."

Andre Gide, the winner of the Nobel Prize in Literature in 1947

Will an Innovation Ecosystem Sit at the Heart of the Lower Gulf States' Future?

Investment in research and development (R&D) can be seen as buying down the risk that a country, or organization faces.

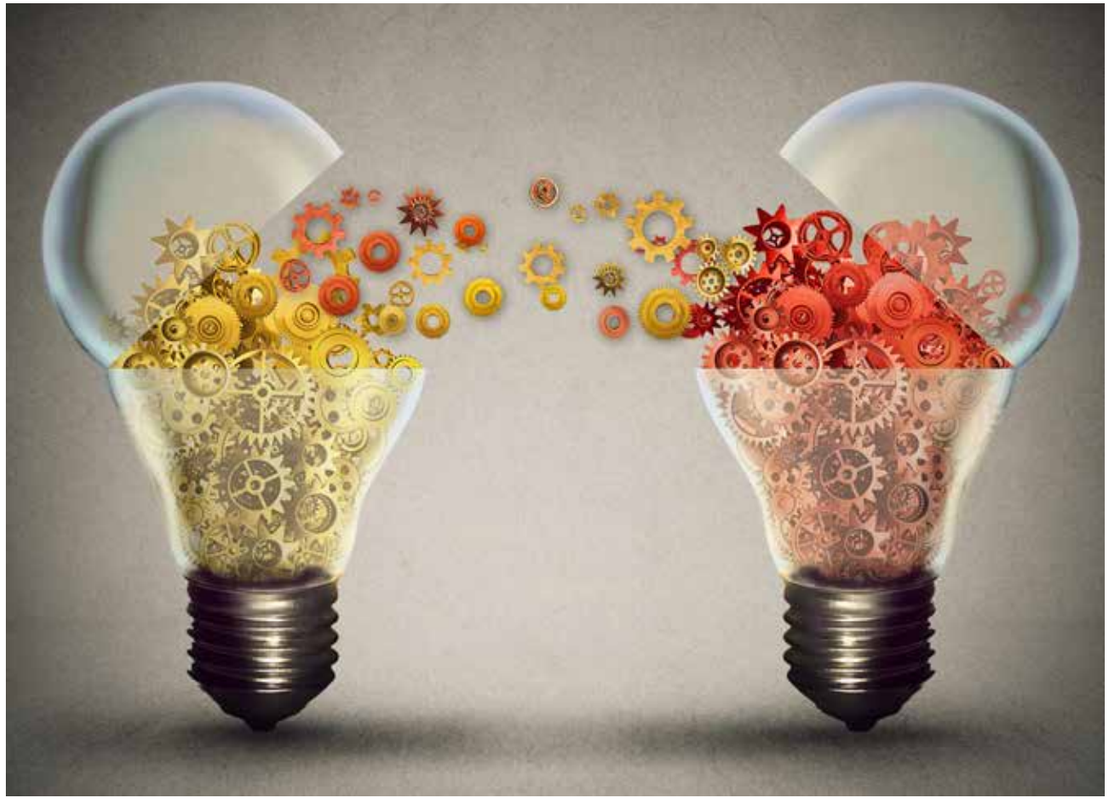
BY SEAN EVERS
Managing Partner, Gulf Intelligence

The driver behind the Lower Gulf States' investments in R&D is to achieve, or help achieve, the National Vision of their respective states – creating a diversified and knowledge-led economy. There are a number of ways to get there and R&D is one contributing factor. Education and research are often viewed as two separate activities, but they are very much a holistic activity. A research-intensive university helps train students not only for today's jobs, but also for careers of the future. Developing a cadre of people who are invested in the future to tackle important challenges is one way that nations are looking to buy down their risk.

This is easier said than done. How do you build a world-leading research and innovation ecosystem? Scientists do not commit thirty years of their lives to a challenge if they do not believe that the problems they are studying are worth solving. There needs to be a fresh focus on how to motivate youngsters to tackle the Lower Gulf States' most important challenges – they are the ones creating career pathways that can lead to solutions.

Collaboration sits at the core of any innovation ecosystem. Creating an environment that incentivizes collaboration is particularly critical for relative newcomers, such as the Lower Gulf States. Each is looking to build their R&D capabilities as part of a broader goal to step away from a long-held reliance on hydrocarbon revenues and emerge as knowledge economies over the coming decades.

An innovation ecosystem is ideally facilitated by a space where science meets commercial vision and entrepreneurial efforts; where large investments are channeled into human capital; and where governments establish useful policies, regulations and incentives. None of this will be possible without the key stakeholders from academia, industry and government coming together. ■



R&D: The Glue That Will Unite Industry-Academia

The UAE's energy industry has made strides over the last decade to build the foundations for a world-class energy research and development (R&D) ecosystem in Abu Dhabi, which holds close to 10% of the world's proven oil reserves. Now, research is emerging as the engine that will unite the country's sometimes disjointed worlds of industry and academia. Abu Dhabi's new goal to hit a 70% recovery rate from its oil reservoirs – double the world average – and become a hub of innovation by 2023 sits at the heart of the country's recent ramp up in R&D. The Year 2015 was declared the 'Year of Innovation', illustrating the UAE's appetite for novel thinkers.

Abu Dhabi has gotten off to a strong start. The Petroleum Institute was established with foreign partners in 2001, followed by the launch of Masdar as an alternative energy research hub in 2006 and the Takreer Research Center in 2009. Next on Abu Dhabi's R&D agenda is the opening of the Petroleum Institute Research Center, which will use its annual budget of over $30 million to primarily develop Enhanced Oil Recovery (EOR) in carbonate reservoirs.

But the UAE still has a long way to go. The gap in collaboration between industry and academia is too wide and the country came 47th on the Global Innovation Index 2015, in between Saudi Arabia (43rd) and Qatar (50th).

THERE ARE ALSO strong doubts within the oil industry that the 70% target will succeed unless Abu Dhabi immediately boosts its domestic R&D ecosystem and recruits more foreign help. Carving out clearer communication channels means academia could tweak the curriculum throughout the education cycle to create students that are more aligned to the energy industry's needs. In turn, oil and gas leaders could provide mentors, organize internships and help students define their career paths through a sector that is oft considered archaic.

Greater collaboration requires bright minds; a lack of which has emerged as one of the top hurdles that industry and academia need to tackle together. There is an ever-growing shortage of graduates with skills in science, technology, engineering and mathematics (STEM) and almost half of the world's petroleum engineers are scheduled to retire over the next decade. Investing in human resources is vital. Expecting a researcher who has come up with a novel idea to also market that concept commercially does not work. Each profession along the value chain plays a unique role in global R&D and in bringing fresh ideas to boost cost and production efficiency in the energy market.

ACADEMIA, INDUSTRY AND GOVERNMENT need to pin down their common goals and Abu Dhabi's highly publicized 70% target is at the very least a positive and accountable step in that direction. The road to achieving the 70% target could stretch over the next five decades, but the value in even a 1% increase holds significant monetary value for Abu Dhabi.

Many lessons can be learned from abroad, including the astronomical and unexpected success of the fracking industry in the US, where companies deliver R&D and solutions for production issues along the spectrum.

Norway's 'Goodwill Agreement' sees preferential access offered to new concession blocks for oil companies that invest more heavily in Norwegian researchers in local institutions. In Brazil, a monetary amount equal to 1% of a field's gross production income is channeled into R&D projects if production hits a specified level.

In the Gulf, the 20-year old semi-private chartered, non-profit organization Qatar Foundation started the Qatar Science and Technology Park; international and national oil companies working together under the same umbrella in a tax free environment. Oman's particularly challenging oil and gas fields forced Muscat to pioneer EOR technologies over a decade ago. Other industries are also taking action; the world's largest chemical producer BASF funnels up to 10% of its sales revenue into the company's R&D, for example.

"The UAE still has a long way to go. The gap in collaboration between industry and academia is too wide. The country came 47th on the Global Innovation Index 2015, in between Saudi Arabia (43rd) and Qatar (50th)."

THE ABU DHABI Education Council (ADEC) recently held a competition for a grants programme that generated almost 250 proposals, despite the tight submission window of four weeks – the cycle typically takes six months. Many of the applications came from major research institutions, like the Petroleum Institute and Masdar. The significant appetite highlighted the pent up interest for funding research in the UAE and the untapped potential. Many of the projects can either be plugged into existing industry operations to improve efficiency, or they propose a fresh approach.

Relative newcomers to R&D, such as Abu Dhabi, benefit from a combination of top-down and bottom-up approaches. A framework where the government provides infrastructure, a regulatory framework and national goals that can be complemented by the energy industry's know-how and academia. The UAE's 70% target will also encourage companies to brainstorm internally for solutions along the value chain, thus boosting bottom-up thinking.

The need for applied research – research that answers specific queries with a practical solution – tops the agenda for the UAE and the wider Gulf, especially in Saudi Arabia, Oman and Qatar. Applied research adopts the thinking that study cannot wholly be done for the sake of study. ADEC, for example, doesn't plan to shy away from risky projects, acknowledging that also funding offbeat ideas is how disruptive technologies are born. But the industry in the Gulf and beyond need to prioritize field experiments and pilot projects in the exploratory process and start realizing the academic theory out in the field as soon as possible.

This raises the question of whether the UAE and wider Gulf should be registering their patents locally. The UAE has three patents versus 47,000 in the US, with up to two of those three patents also registered in the US. There is also a growing push in the UAE to send students to train abroad to learn about how to work in a corporate environment, with the hope that they will have the tools and confidence to build their own small and medium-sized enterprise (SME) back home.

There is huge hunger for more innovation in the UAE, which can only be realized by tighter partnerships between industry and academia. Now, it's a case of squeezing that potential to put the country higher on the global podium of innovation by 2023. ■

In Numbers

70%
Abu Dhabi's new recovery target from its oil reservoirs.

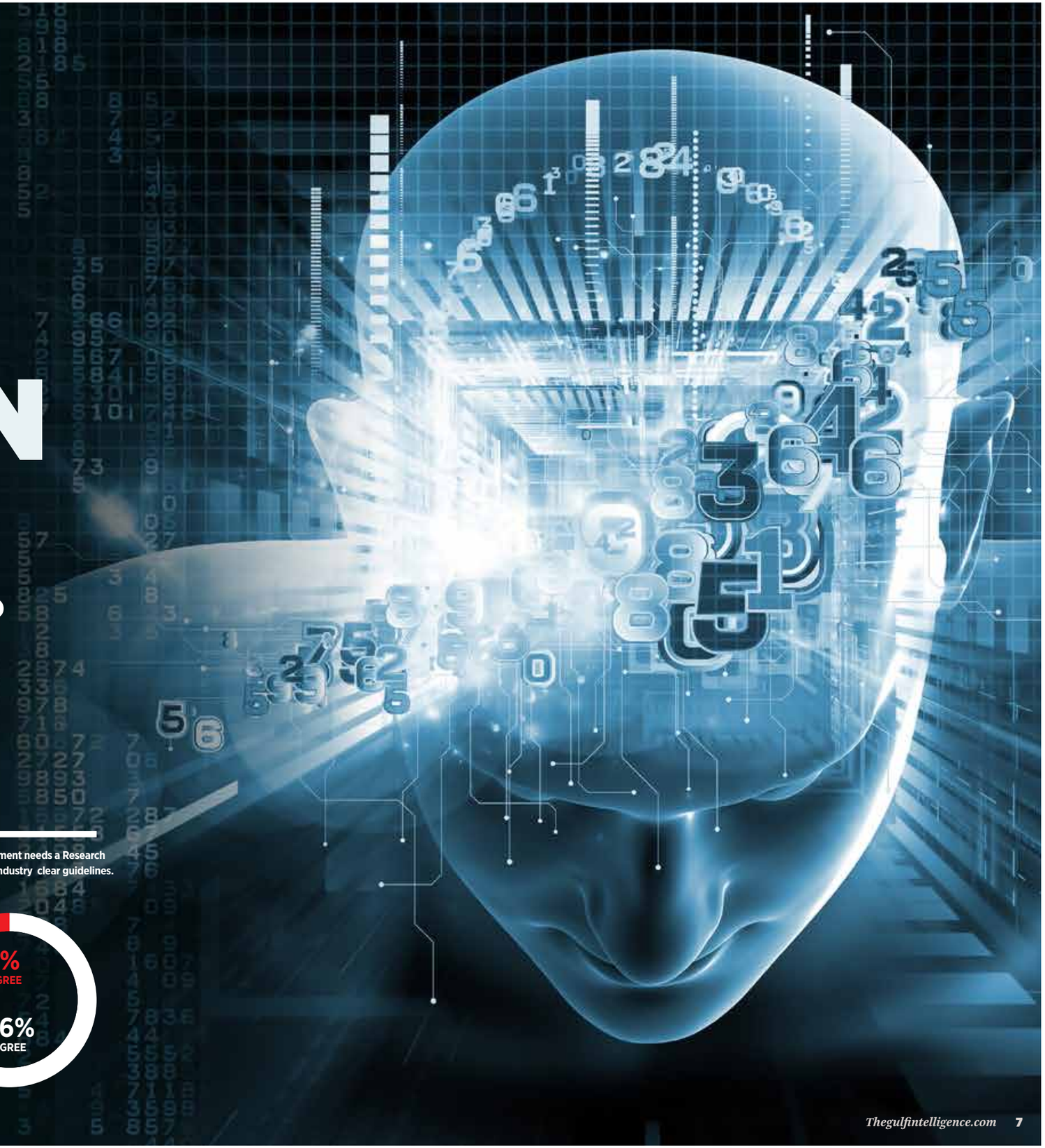
250
The Abu Dhabi Education Council (ADEC) recently held a competition for a grants programme that generated almost 250 proposals.

3
The number of patents in the UAE.

Source: Maersk Oil Industry Roundtable, Adipec 2015

Creating an INNOVATION CULTURE

Top Down vs Bottom Up?



1 The majority of industry stakeholders recommended that the UAE establish a Research Council to act as an overarching regulatory body that both communicates the government's top research and development (R&D) areas and facilitates partnerships between national and international stakeholders.

In developing countries especially, governments are often the main drivers in building the growth of soft and hard R&D infrastructure. Governments need to work collectively and strategically if they want to create a knowledge-based economy.

The establishment of a Research Council in the UAE would give clearer guidance and provide a roadmap for future R&D development. This guidance would ensure that the building blocks of an R&D ecosystem are brought together to encourage partnerships between national and international stakeholders throughout industry, academia and government. Plus, this guidance will help determine specific challenges in the oil and gas sector and mean R&D can be targeted to achieve specific solutions.

Only 14% of the survey respondents to

The UAE government needs a Research Council to give industry clear guidelines.

“Greater private-sector involvement will be required to turn robust R&D infrastructure into a hotbed for innovation.”

the Gulf Intelligence Industry Survey disagreed with this thinking; one executive warned against establishing yet “another committee”. A second executive from an international oil company (IOC) suggested creating a ministerial post with the appropriate authority and according to a specific budget.

Similar research councils and funds have been set up over the past decade as policy making institutions and funding agencies in other oil-producing countries in the Gulf region, such as the Qatar National Research Fund and the Research Council of Oman. Each has gone a long way in providing guidance on the direction that local R&D activities should take, supporting education, promoting scientific inquiry, fostering researchers and building capabilities, as well as rewarding collaboration.

One IOC executive working in Abu Dhabi said that such institutions are invaluable to IOCs, because they act as a focal point for research and innovation, liaise with various research institutions, formulate a strategy with a nationally integrated plan for research, monitor its development, identify local research priorities and supervise the implementation of the programmes.

“One role for research centers is to be the facilitator of an innovative ecosystem with a cross-institutional collaborative environment, which includes setting up collaborative programmes and projects between oil companies and technology companies, service companies, academia and authorities. IOCs could easily play into that and participate with projects, activities and ideas for developing new ways of doing things,” said Bo Cerup-Simonsen, Managing Director of the Danish Hydrocarbon Research and Technology Centre. The Centre was founded in 2014 by Maersk Oil with a budget of around $150 million to support its North Sea assets.

2 An R&D ecosystem that follows a combined top down and bottom up strategy will produce the most impact in meeting the UAE’s future energy production targets over the long term, according to almost half of the survey respondents.

The R&D strategies adopted in the Gulf region are mostly ‘top down’ approaches, but supporting a more ‘bottom up’ approach to energy R&D is seen as a key contributor to creating an innovation culture. It is this innovation culture that then attracts international partners and engages youngsters to study the sciences and pursue careers that support the R&D ecosystem.

Isolated government-led efforts to develop R&D clusters have generally proven insufficient to create genuine centers of innovation. Greater private-sector involvement will be required to turn robust R&D infrastructure into a hotbed for innovation. For relative newcomers to R&D, such as Abu Dhabi, a combination of ‘top down’ and ‘bottom up’ approaches are considered by 43% of survey respondents to be the best option, followed with the government providing infrastructure, regulatory framework and national goals. Meanwhile, industries in partnership with academia will help bolster innovation from the ‘bottom up’.

The frequently adopted ‘top down’ approach was seen by 23% of survey participants as the best model for Abu Dhabi to follow, as it compels stakeholders to better manage the R&D process by pooling risks and skills, sharing costs and eliminating the duplication of efforts. However, 34% advocated for the adoption of a more competitive R&D culture from the ‘bottom up’ to spur on rivalry and innovation.

Although much progress has been made, instilling an interest in science amongst Emirati youth from as early as kindergarten and primary school remains an ongoing imperative. Successful promotion of science, technology, engineering and mathematics (STEM) education requires an understanding of what motivates today’s youth, while creating an innovative learning environment that is on par with the advent of new technologies. As technologies evolve at an ever-faster pace, teachers and traditional education systems will have to adapt in order to spark youngsters’ interest in STEM and equip today’s young generation with the skills needed to fuel the knowledge economies of the 21st century.

The Organization for Economic Cooperation and Development (OECD) released a report in 2015 ranking countries’ school systems based on students’ math and science test scores. Singapore ranked as the smartest country in the world, followed by Hong Kong, South Korea, Taiwan, Japan, Finland, Estonia, Switzerland, Netherlands and Canada rounding out the top ten. The UAE ranked highest in the Gulf at 45, with neighbors Qatar 68 and Saudi Arabia at 66.

Singapore received special commendation for an initiative from the public sector research authority, which could be adopted in the UAE. Science Center Singapore set up its new STEM Inc unit, which enables secondary school students – between 13 and 15 years old – to apply what they have learned in STEM lessons to create solutions for real-world problems. STEM Inc aims to give students a strong sense of ownership in their own learning.

3 The most important policy that the UAE could adopt to boost international energy companies’ appetite to establish Abu Dhabi as a global R&D hub would be to create a culture of innovation, according to 26% of survey respondents.

The oil and gas industry will continue to need pioneering graduates and entrepreneurs who possess the technological and commercial skills needed to deepen R&D efforts and help achieve commercialization of the subsequent research. But while the R&D capacity has been expanded on a large scale in Abu Dhabi, some argue that entrepreneurship capacity building in the energy sector has lagged. Questions are mounting over where the entrepreneurs will come from and what can be done to help them play a bigger role in the UAE’s R&D ambitions.

Like the ‘incubator’ programmes for IT start-ups in the US’ Silicon Valley, the energy sector also needs its own breed of entrepreneurs. The UAE will need to create the right conditions and clusters for such entrepreneurs, such as funding, laboratory access and specialist nurturing from government and industry. All these tools are required in the early years before research can be taken up commercially.

A business-friendly environment, transparent regulations, financing mechanisms and venture capital are also required to create jobs for nationals and to encourage entrepreneurs and innovators to commercialize proven research output and innovative ideas.

Developing a knowledge economy requires an approach that brings together researchers, entrepreneurs, industry and policymakers. Connecting research and industry with entrepreneurs is also an essential ingredient for an innovative ecosystem. The development of this ecosystem should be a dynamic and interdependent process where stakeholders collaborate and interact to promote the commercial experimentation of new ideas and technologies.

“IOCs can help accelerate the maturity of technologies in the UAE and therefore benefit earlier from leading edge technologies in our fields. They can also help us build our local skills for research and technology. The IOCs have technology labs internationally, so they can help us by training some of our employees,” said Wafik Beydoun, who is tasked with the responsibility of leading ADNOC’s R&D team.

Industry could do more to invest and mentor youngsters with an innovative spirit, with 24% of survey respondents saying this support would generate the greatest results in elevating the UAE into the top 20 on the Global Innovation Index.

Over 11,000 entrepreneurs were assisted through the Government of Dubai’s Development Advisory Services in 2002-2010. Around 300 start-ups were incubated and more than 1,100 small and medium-sized enterprises (SMEs) registered and licensed during the same period. Part of the Marketing and Outreach programmes for Dubai’s SMEs are the Mohammed Bin Rashid Awards for Young Business Leaders, which are designed to award exceptional entrepreneurs.

Plus, Afkar.me, which means ‘ideas’ in Arabic, was started by digital agency Intigral to support start-ups with digital products and content-oriented ideas for the Arab world. Afkar.me offers a three-month incubation period with seed loans, office space and access to expert mentors. ■

This is an excerpt from a *Gulf Intelligence Industry Survey* that was produced with the support of Maersk Oil.

FOR THE FULL REPORT CLICK HERE

Water-Food-Energy Nexus: KEY LESSONS FOR THE UAE?

2016 WFES KNOWLEDGE SESSION: EMBASSY OF THE NETHERLANDS

The level of awareness for improving the UAE's increasingly strained water-food-energy nexus has rapidly climbed the country's agenda over the last five years, with significant chunks of capital allocated to boosting energy efficiency and renewable projects. The UAE, just 44 years old, has made vast inroads into research and development (R&D) of innovative green technologies that could provide a blueprint for the wider Middle East. Gulf leaders' attendance at the Cop 21 global climate change talks in Paris last December marked an unprecedented appetite for change.

Business opportunities for collaboration with foreign entities are also gaining traction as the UAE demonstrates a willingness to learn from those that hold unique expertise, like the Netherlands. The impetus for economic diversification by shedding a long-held reliance on hydrocarbon revenues is well illustrated by the 12-year low in oil prices in January 2016.

But, the outlook for both the Gulf and world's water-food-energy nexus remains sobering and the UAE has little choice but to adopt a holistic strategy to find cost-efficient solutions – and quickly. Over the next two decades, the world will need up to 40% more water to meet rising demand and agricultural production will increase by 70% by 2050. Such increases drastically reshape the land and water resources that we know today.

Excess consumption is a serious issue in the UAE and beyond. The GCC is rated as the world's most water-stressed region, with the least available water per capita. On a per capita basis, Saudi Arabia and the UAE consume 91% and 83% more water than the global average and about six times more water than the UK, according to research by Booz & Company.

"The UAE, just 44 years old, has made vast inroads into R&D of innovative green technologies that could provide a blueprint for the wider Middle East."

Equally, it is worth remembering that Gulf countries have literally built their towns and cities from scratch in very recent history – this inevitably takes a heavy toll on natural energy resources and the environment. The UAE's food and water security are particularly concerning, as the country imports more than 90% of its food. Imports are set to double by 2030.

In response to the worrying outlook, the UAE aims to have 24% of its total energy mix be attributable to low-carbon sources by 2021 – up from 0.2% in 2014. The economic benefits for renewable energy are already clear. The UAE could save $1.9 billion (bn) a year by 2030 if it hits its target to have just a 10% share of renewable energy in the total energy mix. Accounting for the health and environmental benefits, the additional net savings could reach $1bn-$3.7bn within the same period. Again, savings are particularly attractive as low oil prices remind regional governments of their economic Achilles' heel.

The UAE can offer a regional beacon of green insight, but it must equally learn from other countries that have fought and won the battles against water and resource management that it now faces. The Netherlands, which lacks enough hinterland to accommodate its needs, has become an expert in water management since the 1953 North Sea Flood, in which 1,800 people died. Meanwhile, Singapore has achieved what the UAE needs; Singapore has closed the loop between resources and usage, recycling 100% of its water.

SHIFTING PERSPECTIVES

The UAE has imported a lifestyle that does not correspond to its natural resources. Residents own multiple cars per household, which are often petrol-guzzling 4X4s, and live in air-conditioned villas with gardens that require constant irrigation. Historically, homes were designed without gardens and indigenous trees supplied residents with fruits. Arabs used to live on less than 20 liters a day of water per capita – today, it is 500 liters. The UAE, like most countries, still suffers from a gap in awareness.

Reams of statistics about how to better the UAE's water-food-energy nexus do little to shift mindsets, especially as people often rely on technology to resolve issues arising from limited natural resources. But technology will be useless when the natural resources inevitably run dry.

The UAE, which anticipates a 30% growth in water demand by 2030, requires ten times more energy for seawater desalination than fresh surface water production. Related costs could soar by 300%, according to Masdar Institute, Abu Dhabi's renewable energy company with

a strong focus on research. Accordingly, Masdar is carrying out a two-stage desalination programme, with the first stage from 2013-2016 including four pilot desalination plants in Ghantoot in Abu Dhabi to gauge performance. The second stage runs from 2016 with a focus on implementation, targeting a commercial scale desalination facility by 2020.

Plus, steps have been taken in the UAE to boost residents' energy awareness, notably the first round of petrol and diesel subsidy cuts in August 2015 – saving up to Dhs9.1bn ($2.5bn) a year. The cuts marked a significant social shift in a region where subsidized energy is ingrained in the population's psyche as a national right. Plus, Abu Dhabi's Water and Electricity Company (ADWEC), which forecasts water supplies and demand, introduced a tariff in 2015. The UAE is the first country in the region to build a complete water budget.

CIRCULAR ENERGY ECONOMY

A circular energy economy, which focuses on the reuse of resources and materials, is emerging – a shift that is good for the economy and the environment. The amount of water that is within the UAE's food is not incorporated into the country's wider data set about water supply and wastage, for example.

Greater efforts to develop a circular energy economy would see the entities and data sets for these two parts of the UAE's essential resource portfolio merging to complement each other. A better understanding today leads to a smarter strategy tomorrow.

Often, the bridge connecting business and government disconnect and there is a communication gap – efforts to tackle the water-food-energy nexus are not immune. Who should take the first step? Businesses tend to wait for governments to take action and provide regulatory guidelines on the emerging renewables sector, while governments expect businesses to take the initiative and suggest green capital strategies. A stalemate ensues and costs soar.

The appetite for a holistic green economy within the UAE is rising, which will support the national growth of renewables, energy efficiency and social change. But the government and businesses must be made accountable to ensure that the management strategy outlined on paper is realized – isolated efforts are costly and time-consuming.

Ideas that the government and private sector could immediately work on include expanding storage for power from renewable energy; solar and wind, predominately. There are unique applications for solar power in the UAE via clever planning and greater efforts to pin down demand forecasts. For example, solar power could supply daytime exhibition events – held daily in Abu Dhabi and Dubai – as events are planned far in advance and the power demand can be estimated using data from the previous event.

The next ambitious step – one that may require years to evolve – is to carve out a GCC-wide circular energy economy, which collectively invests into renewable technologies, water and energy management and green policy. Such a goal would heavily rely on developing a region-wide manufacturing capability, which could in turn create innovative technologies for export.

BUILDING BLOCKS: TECHNOLOGY & DATA

Abu Dhabi's Masdar is a living lab, acting as a hub where technologies and ideas can be tested with the view of being implemented out in the field on a larger scale. The logjam in the UAE and the wider Middle East occurs when completed technologies do not receive the proper marketing and distribution support from governments and the private sector. It can take up to two years for a technology to hit the market, which is far too long considering the UAE's 2021 target of having 24% of its total energy from low-carbon sources.

Smart data will also help the UAE both improve its energy efficiency and map out business opportunities that arise from streamlining its water-food-energy nexus. The UAE's predominant view is that the wrong data is just as worthless as no data. Efficient use of big and simple data can be applied to water management, as clarifying the key components of day-to-day use help build a critical database of insight that can be referred back to for decades. How much rain does the UAE get and how much of this evaporates, or percolates? How much desalination does the UAE need and what percentage of desalinated water is going back into the system?

Abu Dhabi's smart meter, which provides residents with real-time feedback on their water and electricity usage, has the potential to gather reams of data. What is being done with this data; is it being examined and analyzed in the right way and being used to inform future decisions?

STEP-BY-STEP

The exhaustive list of steps that the UAE must take to improve its water-food-energy nexus must not dilute how much the country has achieved in less than half a century. The Mohammed bin Rashid Al Maktoum Solar Park will have 1 GW of operational capacity by 2019 and 3 GW by 2030, with plans to source 7% of Dubai's total power output from renewable energy sources by 2020 and 15% by 2030.

On a smaller level, the UAE is reusing water, such as polluted water coming from shrimp farms, to irrigate local algae. This in turn generates biofuel, which means water can be cleaned and energy produced simultaneously. Plus, algae can be fed with carbon dioxide. The process reflects a small and successful local example of an efficient water-food-energy nexus.

The outlook on managing agriculture in the UAE has also evolved now that the social component of having to stabilize a population within a certain area is not as prominent. The focus is now on the analytical component of improving the energy and economic efficiency of the sector. Which crop should the UAE produce versus imported foods, for example? It is a gradual process, but the integration of the economic, social and technological aspects are underway.

The excitement that galvanized world leaders to flock to Paris for Cop 21 has settled and all eyes are on the most crucial stage – carving out actionable steps to boost energy security in 2016 and beyond. The UAE will be front and centre of the Gulf's push for sustainability as public and private leaders' awareness of the stressed water-food-energy nexus evolves. ■

"The logjam in the UAE and the wider Middle East occurs when completed technologies do not receive the proper marketing and distribution support from governments and the private sector. It can take up to two years for a technology to hit the market."

Gulf Intelligence Knowledge Session:

Background: The 2016 World Future Energy Summit (WFES) Gulf Intelligence Knowledge Session for the Embassy of the Netherlands took place on January 19 in Abu Dhabi. The one-hour session focused on pinning down key lessons for the UAE – both local and global – as it works to improve its strained water-food-energy nexus.

Panel Speakers:

Henk Ovink, Special Envoy on International Water Affairs, Kingdom of the Netherlands

Dr. Taha Ouarda, Head of the Institute Center for Water and Environment, Masdar Institute

Mohammad Al-Hajjiri, Head of Water Section, Planning and Studies Directorate, ADWEC

Gus Schellekens, Partner, EY Clean Energy and Sustainability Services

OMAN

Tackling the Skills Mismatch Before the Challenge Becomes Insurmountable

BY H.E. SALIM AL AUFI, UNDERSECRETARY, MINISTRY OF OIL & GAS, OMAN

As the major contributor to Oman's national GDP, the oil and gas industry and the energy sector in general are uniquely placed to drive innovation in the Sultanate's economy. To achieve this, there will have to be a much greater focus on producing an indigenous skilled and expert work force that can drive and sustain an expanding private sector.

As the world makes advancements in areas like technology and science, new jobs are continually materializing. Yet, they are proving difficult to fill as they require particular skills that academic institutions and potential employees have not yet developed. It can be difficult for academia to focus their programmes on developing all the skills one could need in the future if they do not even know what all of those skills will be. But, even for today's jobs university graduates are not necessarily equipped with the skills and degrees that employers in Oman's energy sector need.

ONE OF THE BIGGEST challenges is to ensure a steady flow of students into science-related subjects, so that they are well-placed to choose careers as petroleum engineers and researchers, for example. The challenge is becoming even more pressing in today's interconnected and technology-driven world, where companies want graduates to have both the right knowledge base as well as 21st century accomplishments – critical thinking, communication, collaboration and creativity.

Firstly, we need to identify the caliber of skills we need and how to recruit the right people. Secondly, we need to retain good quality individuals and keep them incentivized by continuously developing and expanding their skills, knowledge and expertise inside an organization. Thirdly, in the event that employees are let go, how do we redirect them into areas that they are not necessarily qualified for in an immediate sense?

All of these questions and many others require a significant interface between industry and academia to ensure that we actually match supply with demand. But, there is very little discussion, if any, taking place between what the industry really needs today and over the next two decades and what academic institutes are capable of producing. We seem to be working in completely different universes and government and industry end up wasting a lot of resources.

> **“There is very little discussion, if any, taking place between what the industry really needs today and over the next two decades and what academic institutes are capable of producing. We seem to be working in completely different universes and government and industry end up wasting a lot of resources.”**

INDIVIDUAL COMPANIES have specific requirements and sometimes they develop their own training programmes to ensure that their staff are qualified to do the job well, but these courses tend to be ad hoc and on a small scale. I think there is still an element of mistrust between the industry and the training bodies that exist and that could be because they are not very well governed. Companies may not be sure if the programmes that the institutes are running are accredited, or whether its instructors are actually qualified. So instead, they find a solution in house – that is what has been happening. PDO set up its welding programme to create skills instead of going to an educational institute and asking it to train its employees to the standards it needed. Similarly, BP is setting up its own training institute for its 2018 operational programme, as opposed to going to an existing training institute.

In order for this existing dynamic to change, Oman's industry needs to work on communicating and defining very specifically what it needs from academia. We need to get much better at researching and identifying the skill sets that our staff need to develop. Only then can we go to academia with a case for them to invest and develop new programmes. From academia's standpoint, it also does not always make economic sense for schools and universities to invest in developing and teaching a particular course if it only applies to a select few.

From a government policy point of view, I believe the priority through to 2040 should be to improve the quality of education in general. If this is not addressed properly, the energy sector and other key sectors for Oman's economy, like manufacturing and tourism, will not witness an improvement in the labor pool. As part of this initiative, the government should continue to be the regulator of education and ensure that no school, university, or vocational institute is set up unless it meets certain criteria and standards. Equally, government should not act as the service provider; this should be left to the institutions themselves, to develop curricula and courses – in conjunction with industry when appropriate – that will equip people with the required knowledge and skills for the 21st century. ■

Aligning Oman's Industry-Academia to Deliver an Enhanced R&D Ecosystem

A MIX OF THREE FACTORS will determine the success of the relationship between Oman's industry and academia as they push independently to establish the country as a world renowned R&D hub: transparency and communication, research clusters and keeping Omani PhD students in Oman.

WITH THIS IN MIND, Oman could establish a 'Ministry of Science, Research and Technology' that oversees indigenous technology development, promotes and markets innovations and supports the immediate implementation and transfer of the best ideas. The ministry could also investigate ways to decentralize research, reduce bureaucracy and give researchers more freedom to manage and fund their projects.

There are also multiple benefits to developing regulations for effective intellectual property (IP) and technology transfer management; notably the speed of transforming theoretical knowledge into practical value. Clearer processes could also improve how Oman's innovative research and spinoff investments are funded and commercialized, both domestically and globally.

Much more should be done to raise the global awareness of Oman's leading research and enhanced oil recovery (EOR) technological developments, for example. Oman is amongst the world's top innovators in EOR, with many home-grown technologies designed and tested by Omani engineers and researchers. Yet, none of these technologies is currently owned by an Omani institution, or company. This highlights a big waste of effort and resources.

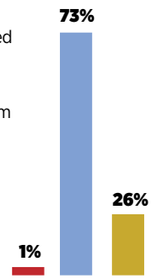
ESTABLISHING MORE knowledge-based companies within Oman could help. Innovation Park Muscat is making headway in its aim to provide an enabling environment for researchers, scientists, start-ups, small and medium-sized enterprises (SMEs) and multinationals. Its work could provide a blueprint for other companies and official bodies in Oman.

Another way of realigning the disjointed worlds of industry and academia is by setting up a 'Chair in Enhanced Oil Recovery', which would require a holistic view of Oman's energy innovation. Single research projects may not yield specific answers to long lasting problems within the field of EOR and heavy-oil recovery, which means researchers have to seek industry insight to tackle the problem from multiple angles. A 'Chair in EOR' could promote a collaborative learning and practical environment, creating cohesion between

the country's research bodies and strengthening the existing collaboration with national and international institutions.

Oman's R&D ecosystem would also benefit from clarifying and loosening import regulations for research tools. Waiting for approval for the import of R&D infrastructure causes big delays to research projects.

What are the top recommendations needed to align academia and industry to develop an enhanced R&D ecosystem in Oman?



A More Omani PhD students to get their PhD's in Oman.
B Bring industry and academia together to establish public-private partnerships for R&D.
C Establishment of research clusters & incubators with universities across the country linked with promotion entities.

1 Narrow the gap between industry and academia to establish efficient R&D partnerships.

The alignment between Oman's industry and academia must be urgently improved in order for Oman to deliver an enhanced R&D ecosystem that fosters efficient private-partner partnerships. Academia cannot do research for research sake; efforts have to be focused in order to deliver results that are useful to the industry and to Oman as a whole. Academia needs to fully understand the challenges that the industry faces – legislative and economic hurdles, for example – and work with private and public companies to find solutions.

Equally, the industry needs to appreciate the capacity and limits of local universities and research institutions. Industry must also be ready to come to the aid of institutions to help propel their learning and research capabilities to ensure that Oman's academia has the tools it needs to facilitate world class R&D. The benefits of such academic growth will feed back into the industry and Oman's economic growth.

Regular workshops held by an overarching body, such as the Research Council, could nurture the relationship and help create a joint roadmap that sets clear and measurable targets.

2 Establish research clusters and incubators with universities across Oman that are linked with promotional entities.

The establishment of research clusters and incubators across the country will aim to promote R&D in all parts of Oman, bringing together the various stakeholders and facilities across the country. Their goal will be to foster collaboration and to leverage knowledge of the local, regional and global market.

The establishment of research clusters will also help facilitate more private sector funding, which in turn will produce a highly qualified and skilled local workforce of engineers, technicians, scientists and researchers that Oman desperately needs.

"Academia cannot do research for research sake; efforts have to be focused in order to deliver results that are useful to the industry and to Oman as a whole."

3 More Omani students need to get their PhDs in Oman.

Encouraging a higher number of PhD students to study and work in Oman is vital - they represent the intellectual value and home-grown driving force behind top-level research. However, two main challenges mean that much of Oman's research does not currently get the attention it deserves.

Firstly, the majority of Omani graduates move abroad to complete their PhDs, with many studying topics that have no relevance to Oman's research needs, or key industries. Secondly, foreigners studying for their PhDs in Oman usually move abroad following graduation.

If more Omani PhD students can be persuaded to stay, then more may focus their research on issues that fall within Oman's energy sector. Oman could also develop learning platforms for students to practically apply their newfound knowledge and innovative thinking. Students' inventions, if any, would be the property of Oman and not a foreign university, while more academic publications will boost the country's university ranking on regional and global listings.

Oman's PhD students could carry out short-term internships abroad to gain international exposure, but they must return to Oman to defend their thesis. Plus, employees of Oman's energy companies should be allowed access to part-time PhD studies. ■

An excerpt from *The 25-Year Oman Energy Master Plan.*

FOR THE FULL REPORT CLICK HERE

Time For a New Era of COLLABORATION ACROSS THE GULF:

Delivering R&D Breakthroughs in Carbonate Oil & Gas Reservoirs

By Dr. Philippe Julien, Vice President Upstream External Communication, Total

Reducing complexities and building knowledge is the name of the game when it comes to the exploration and development of carbonate reservoirs. Carbonates are truly challenging because they are heterogeneous at all scales, from the microscopic level all the way up to the macro engagement of the entire field. They feature layers of high and low permeability, as well as fractures. This poses a significant problem when it comes to reservoir characterization, modeling and simulation technologies aimed at optimal production.

Carbonate reservoirs can be found in limestone and dolomite formations that were mostly formed from the shells of plants and animals in ancient shallow seas. Of the world's proven conventional hydrocarbon reserves, more than 60% of oil and 40% of natural gas are found in carbonate reservoirs – typically, only up to a third of the available oil resources are recovered. Over the past decade, two-thirds of all giant discoveries holding more than 500,000 barrels of oil (bls) were located in carbonate reservoirs.

In the Middle East, approximately 70% of all proven conventional oil and as much as 90% of gas reserves are located in carbonate reservoirs. Across the Gulf region, Qatar's Al Khalij and Abu Dhabi's north east Bab fields are among the carbonate reservoirs being developed by international and national oil companies.

But even though carbonate reservoirs are very common and there is research into their characteristics, they are still poorly understood. The challenges associated with their development remain substantial. Almost all technical domains show specificities when dealing with carbonates, whether in geology, geophysics, geochemistry, reservoir modeling, enhanced oil recovery (EOR) and CO_2 storage and production.

This is a problem. With global energy demand estimated to roughly double by 2050, more of these resources will have to be tapped to meet the world's rising thirst for oil and gas.

IN ORDER TO ACHIEVE optimum reservoir performance, detailed understanding of their petro physical, geological, geomechanical and dynamic properties is seminal. Given the technical difficulties and complexities involved in developing carbonate reservoirs and a need to develop a better understanding of these reservoirs, there is a significant need to step up research and development (R&D) activities aimed at developing innovative technologies. The industry needs technologies that will help discover more carbonate reserves, improve understanding of their complex nature and enhance production and recovery rates.

Several R&D projects have been set up already. One example is the Total Research Center – Qatar, which was inaugurated in 2009. The Center teamed up with the Qatar Petroleum Research & Technology Center on a joint acid stimulation research project in an attempt to boost production from the country's carbonate oil and gas fields.

But researchers tend to have different opinions on what R&D activities should be prioritized in order to advance the understanding and production of carbonate reservoirs. This is by no means unusual and all areas involved in research on carbonate reservoirs are important and relevant in their own right. It does underline that – especially given the complexities involved – there is an opportunity to foster coordination, communication and collaboration among the various research domains and across the industry.

"As water issues do not sit at the core of an oil company's business, it may be a good starting point for greater information sharing and collaboration."

This should also entail sharing information and experiences, which would lead to greater alignment, better focus and improved efficiencies in R&D activities. Information sharing in Qatar could be facilitated, for example, through a platform such as the Qatar Science & Technology Park (QSTP).

Another complexity in tackling hydrocarbon production from carbonate reservoirs is that they generate substantial volumes of water, with the water-to-crude production rate often as high as 9:1. Finding different ways of managing this water will be an important aspect going forward. As water issues do not sit at the core of an oil company's business, it may be a good starting point for greater information sharing and collaboration. It may be worthwhile for the Qatar National Research Fund (QNRF) to consider promoting research in this domain, either through pilot projects or applied research.

SOME OF THE solutions to these technological challenges may also come from other industries in the form of crossover technologies. From aerospace to automation, robotics and medicine, there are numerous innovative technologies that have the potential to revolutionize the oil and gas industry further in coming years. And to identify potential solutions for carbonate reservoirs, the establishment of platforms to share R&D knowledge and experience is an important starting point. ■

Getting Ready to Join the Oil & Gas Industry

An Academic Perspective

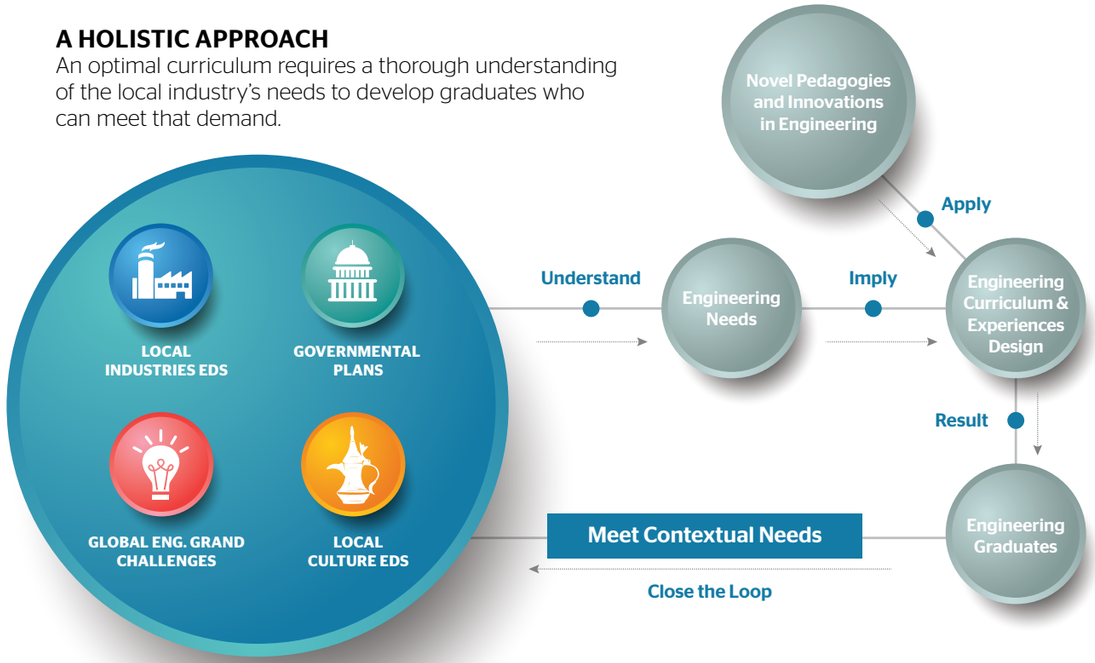
BY DR. MAHMOUD ABDULWAHED AND DR. RASHID ALAMMARI, COLLEGE OF ENGINEERING, QATAR UNIVERSITY

The oil and gas sector will play a major role in transforming Qatar into a knowledge-based economy as per the country's National Vision 2030, with STEM (science, technology, engineering & mathematics) highlighted as the most critical fields. The energy industry can contribute via multiple routes, such as increasing and implementing effective internal research and development (R&D) divisions that tackle applied research – research that aims to answer a specific question. Industry leaders could also build stronger collaborations with existing academic institutions in Qatar that focus on technology and engineering to facilitate knowledge sharing and technology transfers. Thirdly, industry can help kick start and groom new ideas to add high-value technology and engineering small and medium enterprises (SMEs).

QATAR UNIVERSITY: LEADING THE WAY

The College of Engineering (CENG) at Qatar University (QU) is the largest provider of engineering and computing education in Qatar. CENG provides eight undergraduate programmes, seven Master programmes and the first established PhD programme in Qatar. The College is currently one of the largest attractors of research funds from both the government and local industries, with the value of the funded projects at more than $150 million. The CENG contributes to about 20% of the indexed publications Qatar.

The CENG is progressively embracing the elements of the closed-loop model; designed to match up curriculum and experiences for a contextual fit within the energy sector. In this context, feedback collected from industrial advisory boards – be it college-wide or departmentally focused – is matched with robust research projects that are then fed into the curriculum. This is key to pinpointing current, short and long-term targets that culminate in meeting Qatar's 2030 goals.



"The CENG is progressively embracing the elements of the closed-loop model; designed to match up curriculum and experiences for a contextual fit within the energy sector."

Qatar University's dealings with the oil and gas sector have revealed several useful contributions to the university's curricular designs. The industry is content with the level of technical and engineering theory of our graduates, but there is a growing emphasis on the need for practical skills and soft competencies. Soft skills require students and employees to have strong leadership and communication skills, as well as be good team players.

The CENG is continuously responding with a number interventions that are aimed at enhancing the skill sets of engineering graduates, including establishing a competition for plant design. The annual competition is run as part of the CENG's curriculum and evaluated by industrial experts. The CENG also hosts the Gasna competition, which aims to attract K-12 students to study engineering disciplines that are related to the energy industry.

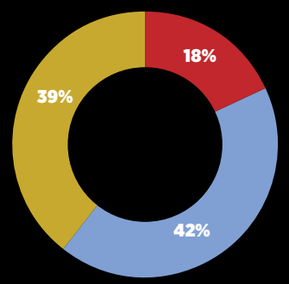
The CENG's Gas Processing Center was established to provide an institutional platform to link R&D with the gas industry sector, while the Office of the Associate Dean for Industrial Relations and Development focuses on enhancing linkages with industry. The CENG also facilitates mandatory internships for engineering programmes and Project Based Learning (PBL), which uses engineering courses as a platform to develop students' soft competencies.

Qatar's ambitious academic development plans also open up opportunities for existing academic and industrial entities, as the benefits of having higher quality graduates loops back into the energy sector. Accordingly, Qatar University envisages a unique opportunity for mutual collaborations between academia and the oil and gas sector in matters of technology and knowledge transfer. Start-ups that promote high-value technologies present another opportunity, especially as small and medium enterprises (SMEs) have already significantly contributed to Qatar's goal to become a knowledge economy by 2030. ■

Results: A Gulf Intelligence QATAR ENERGY R&D Forum

Q1 How would you rate the progress that Qatar has made over the last year in tackling its three Grand Challenges of energy security, water security and cyber security?

A Faster than expected
B Slower than expected
C As expected



Q2 In your view, is maintaining expenditure on innovation and R&D in a down cycle...

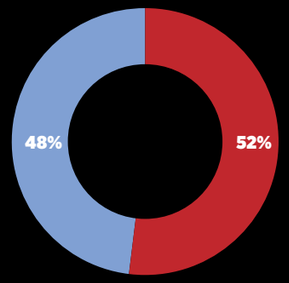
A ...a nice to have
B ...a must have

Q3 The roles and mandates of the various government institutions leading Qatar's research Grand Challenges have been communicated to all stakeholders in a clear and consistent manner – Agree?

A Yes, it's very clear
B No, I have no idea who's in charge of what

Q4 Cyber attacks present the greatest threat to the world's energy infrastructure today, because not enough resources are being deployed fast enough to bolster defenses?

A Agree
B Don't agree

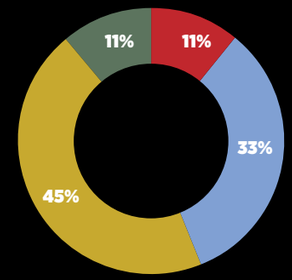


Q5 Services and consultants are the most frequent cause of supply-chain compromise. Should Qatari energy companies reduce their outsourcing requirements to third parties and build up their internal capabilities to analyze the data that sit at the core of their operations, and thus reduce the potential of cyber threats?

A Yes
B No

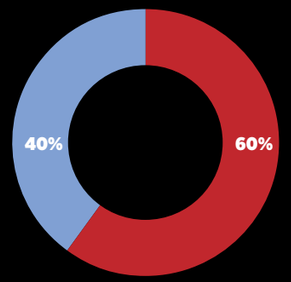
Q6 Which of the following should Qatar prioritize to improve security for the domestic energy sector?

A Data gathering & information sharing
B Develop domestic security expertise
C Educate workers and the general public about cyber security threats
D Define responsibilities of stakeholders



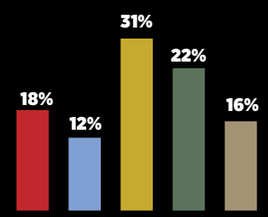
Q7 Do you agree that it is time for major IOCs and NOCs to shift part of their operations to Silicon Valley and other creative hubs to tap into the best engineering talent pools?

A Yes
B No



Q8 Over the next 20 years, which of the following innovations are likely to have the greatest impact on the oil and gas industry?

A Big data & analytics
B Automation & robotics
C Nanotechnology
D Advancements of existing technologies
E Crossover technologies



Q9 Should the oil and gas industry focus on adopting innovations in crossover technologies that are aimed at improving safety and security above others, especially considering the growing focus on cyber security?

A Yes
B No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