HOW CAN THE ENERGY INDUSTRY HELP BUILD THE NATIONAL CAPACITY NEEDED TO ESTABLISH AN R&D HUB IN QATAR?

QATAR SHELL DIALOGUES,
MAY 30 WORKSHOP – WHITE PAPER

KNOWLEDGE PARTNER:
GULF INTELLIGENCE

INTRODUCTION

Qatar Shell Research and Technology Centre hosted the inaugural session of a series of workshops known as the 'Qatar Shell Dialogues' launched by the company to provide a platform to exchange ideas and knowledge across business, government and academia in support of various areas under the Qatar National Research Strategy.

The inaugural event engaged thought leaders in a focused dialogue to generate recommendations on how the energy industry can help bolster Qatar's national research and development (R&D) capacity.

The discussion drew more than sixty participants, including Faisal Al Suwaidi, President of Research & Development at the Qatar Foundation; senior Shell officials as well as representatives of major industry and academic institutions, such as Qatar Petroleum, Qatar University and Texas A&M University at Qatar.

USE OF HYPOTHETICALS

The foundation pillar for this strategy is the exploration of hypotheticals, situations, statements or questions about something imaginary rather than something real. Hypotheticals deal with the concept of "What if?" Hypotheticals are very important because they provide a means for understanding what we would do if the world was different. Although this may assist in our understanding of risk, and help us plan and create a new and better future, hypotheticals also help us understand the past, and why things happened or how things work.

FINAL TOP 12 RECOMMENDATIONS

Two breakout sessions took place where attendees were asked to provide responses to different hypothetical questions. Each hypothetical helped to probe the delegates to provide their views on R&D in Qatar and the initiatives that could help the State of Qatar achieve their ambitions to be a leading Knowledge Economy, in line with the QNV 2030.

The final recommendations are listed below:

for Government:

1. Provide permanent residency for scientists
2. Take away the 'lock-in' clause; allow mobility for further education and institute prestigious R&D scholarships
3. Import research talent
4. Hold an annual 'National Research Day'

for Companies & Academia

5. Define and promote clear career paths for R&D students
6. Define R&D focus themes
7. Set up sponsored 'science focused' Summer Camps
8. Engage children through technology – ie. ipads/ipods/internet
9. Deliver partnerships with academia

Additional guidance to successful researchers of Qatar in the Future

10. Do not be afraid to take a position against conventional wisdom
11. Find solutions to the challenges of water as a finite resource
12. Demonstrate an Interdisciplinary aptitude across all scientific fields

FINAL TOP 12 RECOMMENDATIONS – IN DETAIL

RECOMMENDATIONS FOR GOVERNMENT:

1. PROVIDE PERMANENT RESIDENCY FOR SCIENTISTS

For the government to encourage talented scientists to commit to Qatar by providing permanent residency incentives for 'scientists'. In tackling the topic of non-Qatari locals and their potential contribution to the R&D landscape in Qatar, a discussion emerged that they are not being offered adequate incentives to remain in the country long-term. The group agreed that this is a model that would allow Qatar to attract and retain top talent in the world by providing more stability and security to the individual who meets Qatar's critical national needs.

Put forward by:
Mark Weichold, Dean & CEO, Texas A&M Qatar

and

Nabeel Al Salem, Deputy Executive Director, Qatar National Research Fund

2. PREVENT 'LOCK-IN' CLAUSE; ALLOW MOBILITY FOR FURTHER EDUCATION AND INSTITUTE PRESTIGIOUS R&D SCHOLARSHIPS

The majority voted that by preventing the 'lock-in' clause that new graduates are currently facing with their sponsors, mobility for further education is thereby allowed and with it, more prestigious R&D sponsorships would follow. The 'lock-in' clause was nearly unanimously seen by participants as an inhibiting factor for students to pursue advanced degrees. Raising the level of 'prestige' for R&D sponsorship was seen as a necessary 'non-monetary' incentive to attracting talent.

Put forward by:

Clare Harris, GM Development, Qatar Shell

and

Abdelmajid Hamouda, Associate Dean for Research and Graduate Studies, College of Engineering – Qatar University

3. IMPORT RESEARCH TALENT

There was general agreement among workshop participants that importing research talent would be a necessary step to find a solution to the immediate challenge outlined by the hypothetical. Importing talent would have to be seen within the context of a longer-term strategy of transferring know how. It was acknowledged as part of the debate that facilitating the process of importing that talent by the relevant authorities in terms of providing residency and incentives for family members such as schooling etc would be important. Depending on the nature of the R&D challenge the imported talent would be assigned to, i.e. if it was a long-term project, there would be a need to provide clear career perspectives. For short-term commitments, talent may be attracted by lucrative financial compensation. On a more general note, it became clear throughout the debate that the challenge presented in the overall hypothetical wasn't easy to address because it asked for a short-term response to a long-term issue such as R&D.

Put forward by:

Wael Sawan, MD & Chairman, Qatar Shell

4. NATIONAL RESEARCH DAY

Similar to the concept of National Sports Day (a national holiday in Qatar held annually on the second Tuesday in February, with the main objective of promoting a healthy lifestyle among its population). National Research Day activities could include shows, exhibitions, science fairs, presentations of competition prizes, neighborhood challenges (i.e. 'car washing with least amount of water challenge'). Another idea put forward was the opportunity for presenting inventions to a get support with lower thresholds in place.

Put forward by:

Dr. Hisham M. Sabir, Program Manager, Qatar National Research Fund

RECOMMENDATIONS FOR COMPANIES AND ACADEMIA:

5. DEFINE AND PROMOTE A CLEAR CAREER PATH FOR R&D STUDENTS

The group was trying to capture two ideas: 1) put in place a clear career path where it may not already be, or enhance the path where there is, and 2) raise awareness of this R&D career path. The team seemed to agree with the general consensus that there is an unfortunate relatively very small need for PhDs in the industry today, and thus highlighting the few careers that are available is crucial.

Put forward by:

Jamal Al-Marri, Head of Qatarization, Qatar Shell

6. DEFINE R&D FOCUS THEMES

The rationale behind choosing this recommendation was that – with the hypothetical in mind – the logical first step in solving the provided task would have to be identifying and defining the R&D focus themes, i.e. R&D themes that are of relevance and importance to the QP JV at this point in time. There was broadly consensus that defining the R&D themes would have to precede other recommendations as it determines which path to follow. There was an argument that assessing the strength of the R&D staff's existing capabilities (talent gap analysis) should be top priority, before defining the focus themes, but this was rejected after detailed discussion on the basis that the themes will determine what R&D talent would be required.

Put forward by:

Guillermo Pastor, Upstream Technology & Innovation Manager, Qatar Shell

7. SPONSORED 'SCIENCE FOCUSSED' SUMMER CAMPS

This recommendation was as a merger of two summer camp recommendations. This resulted in the division of the Summer Camp into two phases - phase I for Children & Youths; Phase II for Teenagers & Students. Phase I for Children & Youths: This recommendation was put forward by Josee Gagne, Qatar Shell Learning Events Coordinator and was the concept of a summer camp for youths aimed at developing self awareness to encourage/teach children to make the right decisions based on their awareness of their own attitudes, interests and skills. The children would be grouped with targets aimed at their developmental stage and would involve activities around 'Learning to Think' & 'Learning to Learn'. The camps would last two to three weeks at a fun/funky venue and would involve a partnership between parents, academia and industry. Phase II for Teenagers & Students: This recommendation was put forward by Shannon McNulty, Director Career Services, Texas A & M University at Qatar and was the concept of a summer camp aimed at teenagers and students. This camp would focus on learning about different sectors of engineering (chemical, electrical & computer, mechanical & petroleum) and what they involve. It would also focus on learning about the commitment needed to pursue a career in engineering.

The camp could involve current engineering students as camp volunteers and industry representatives may be involved to speak to the teenagers and students about sponsorship and internship processes and programs. The camps would involve the collaboration of all disciplines and should aim at promoting the drama and excitement of engineering and the industry.

Put forward by:

Josee Gagne, Learning Events Coordinator, Qatar Shell

and

Shannon McNulty, Director Career Services, Texas A & M University at Qatar

8. ENGAGE CHILDREN THROUGH THEIR OWN TECHNOLOGY

This recommendation was put forward by Texas A & M University at Qatar graduating student Laila Qaedi. The recommendation is based around the concept of 'Edu-tainment' – entertain and educate at the same time using technology that children enjoy and are familiar with – Apps/Cartoons/Games/Children's TV shows; 'fun' that comes with educational benefits. Industry and academia would be involved in the partnership and development of the products and franchise. Partnerships could also be made with media production companies, TV channels etc. This recommendation was merged with Qatar Shell Technology Planning Analyst Manzoor Roome's recommendation that revolved around the celebration of Arab scientists from the medieval era and the teaching of history of science. This could be folded in by creating an App/Game that promotes the discoveries and history of science.

Put forward by:

Laila Qaedi, Student, Texas A & M University at Qatar

and

Manzoor Roome, Technology Planning Analyst, Qatar Shell

9. DELIVER PARTNERSHIP WITH ACADEMIA

It was broadly acknowledged that, as part of addressing the task provided under the hypothetical, it would be important to enter into partnerships and deepen collaboration with academia. While there was agreement that this was not going to provide an immediate solution to the outlined challenge, entering into such collaboration would ensure a positive long-term impact on R&D and thus should happen in parallel to recommendations 1 and 2. The general importance of industry-academia collaboration within the context of building up R&D capacity was a recurring theme in the debate.

Put forward by:

Bader Al Jaidah, Tafawoq Development Manager, Qatar Shell

ADDITIONAL GUIDANCE FOR FUTURE SUCCESSFUL RESEARCHERS IN QATAR:

10. DO NOT BE AFRAID TO TAKE A POSITION AGAINST CONVENTIONAL WISDOM

Demonstrate an entrepreneurial attitude, be ready to go against convention in research and not be afraid to fail. There was consensus in the room behind Dr Ken Hall's recommendation - that the educational infrastructure in Qatar and also in some other countries should encourage more unconventional or creative thinking. There is pressure to conform to what everyone else is doing, and therefore no room for scientists to be unconventional. There is a need to create an environment which allows risk-taking ideas (as in the U.S.) and where someone can feel that they can take a giant leap of faith, as this is what leads to truly big advances.

Put forward by:

Dr. Ken Hall, Associate Dean for Research & Graduate Studies, Texas A & M University at Qatar

11. FIND SOLUTIONS TO THE CHALLENGES OF WATER AS A FINITE RESOURCE

The challenge of finding a commercially viable method on how to capture water in humid environments such as the Gulf, for re-use should be a research priority. It was highlighted that the challenge of water as a finite resource is greater than that of hydrocarbons and that in 30 years time; we will be facing a global crisis if no solutions are found today. It was agreed that Qatar is well placed to create solutions to water scarcity.

Put forward by:

Dr. Ali Ghalambor, Program Manager, Petroleum & Chemical Engineering, Qatar National Research Fund

12. A CANDIDATE WHO CAN DEMONSTRATE AN INTERDISCIPLINARY APTITUDE ACROSS ALL SCIENTIFIC FIELDS

The candidate needs to have an ability to connect the dots between different scientific fields. This proposal was taken a step further with a suggestion that the interdisciplinary aptitude should extend across sectors – e.g. identify synergies between researches being conducted in chemistry with research in education. As a parallel ingredient to making this possible, there need to be decisions made and actions taken on societal needs early on - for example, instilling an interest in science as children advance through their education, introducing new curricula and promoting an environment for research – all of these factors and others feed into making an interdisciplinary aptitude possible.

Put forward by:

Sheikh Thani Al Thani, Deputy General Manager, Qatar Shell

QATAR SHELL DIALOGUES –
HOW CAN THE ENERGY INDUSTRY HELP BUILD THE NATIONAL CAPACITY NEEDED TO ESTABLISH AN R & D HUB IN QATAR

How can the Energy Industry Help Build the National Capacity Needed to Establish an R&D Hub in Qatar?

Qatar's quest to become a global research and development (R&D) hub for the energy industry is on the right track but will need to be supported by a string of initiatives aimed at building national capacity such as fostering industry-academia relations, providing incentives for researchers to commit to the country for the long term, and instilling interest in science among the young as part of wider reforms to the local education system.

A majority[1] of industry executives and senior academics surveyed at the Qatar Shell Dialogues workshop in Doha in late May said Qatar had laid solid foundations for its pursuit of building a local energy R&D hub in the country, acknowledging that the government had taken a number of important steps so far that have put the nation on the right track towards achieving its ambitious goal.

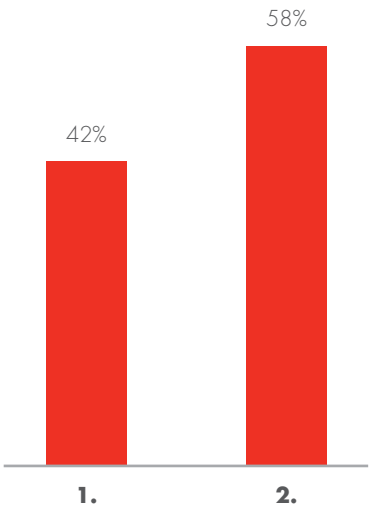
Commitment

Qatar's commitment to R&D goes back at least to 2006 when the government announced that it would allocate 2.8% of its gross domestic product (GDP) annually to promote research, technology and innovation via the Qatar National Research Fund (QNRF). The percentage is above the 1.9% allocated by the U.K. government to R&D relative to GDP in 2010 and equal to Germany's 2.8%, according to World Bank data[2].

The plans gained further momentum in 2008 when the government outlined a number of initiatives aimed at tackling the country's main economic, environmental, human and social challenges as part of its National Vision 2030, which aims to transform the country into a knowledge economy and reduce its dependence on hydrocarbon revenues.

Q. Qatar has stated ambition to build a leading knowledge economy, creating an R&D hub in Doha. Opportunity and resources are significant. How would you assess the current status of this journey?

1. A long way to go, and much to do to put the foundations in place
2. A good foundation is laid, we are on the right track



[1] See graph – 58% of respondents comprising top industry executives and academics surveyed on May 30, 2013

[2] See http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS

The move has been followed up since by the launch of other government initiatives, including the Qatar Science and Technology Park (QSTP) – which opened its doors in 2009 and has attracted a number of big names to set up shop, including Shell and other large energy companies, to conduct R&D activities.

Qatar's decision in 2012 to consolidate its R&D activities under the Qatar National Research Strategy (QNRS), focusing on five key pillars – enterprise; energy and environment; computer sciences and information technology; health; and social sciences, arts and humanities – is widely seen as another credible step in implementing the government's vision by aligning and linking all projects and research visions in Qatar.

Moreover, Qatar has been successful in attracting reputable universities such as Georgetown, Carnegie Melon and Texas A&M among others to open branches in Doha, thereby adding another element integral to establishing a domestic research base of global proportions.

While industry executives and academics acknowledge that these initiatives are important cornerstones in Qatar's overall R&D strategy, there is largely consensus that the country's ultimate goal won't be achieved without putting in place additional, partially interlinked, initiatives.

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Moreover, Qatar has been successful in attracting reputable international universities such as Georgetown, Carnegie Melon and Texas A&M among others to open branches in Doha complimenting the country's own Qatar University and thereby adding another element integral to establishing a domestic research base of global proportions.

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According to the Qatar Shell Dialogues workshop held at Qatar Shell's Research and Technology Centre in Doha on May 30, key issues identified by participants to be addressed by the various stakeholders involved in R&D – academia, government and industry – are as follows:

KEY ISSUE 1

INDUSTRY-ACADEMIA RELATIONS

The need to deepen and intensify collaboration between industry and academia is a recurring theme among R&D stakeholders in Qatar. Faisal Al Suwaidi, Research & Development President at Qatar Foundation, at the Qatar Shell Dialogues workshop said there was an urgent need "to build bridges between academia and industry" to ensure that the country's vision of becoming a knowledge economy would be implemented.

One such gap lies in the different goals and objectives between academic and industrial research: while academic research aims to enhance global knowledge by publishing its findings, industry R&D is not concerned with publication but set to be applied in 'real life', i.e. commercialised.

This hasn't prevented international oil firms and universities in Qatar from collaborating on R&D projects in the local energy sector, with several oil companies involved in ongoing programs with academic institutions such as Texas A&M and Qatar University. Partnerships between industry and universities may offer tangible benefits for both sides: for industry players, they potentially provide a way to accelerate time-to-market for new products and services; for universities they may introduce an additional or alternative source of funding for their R&D activities.

Representatives from industry and academia based in Qatar have often stressed the point that both sides would further benefit from the introduction of PhD programs because the knowledge that benefits industries is created at advanced studies level. Energy companies in turn would then be in a position to support PhD students with meaningful projects that address fundamental questions of relevance to the industry and to Qatar. In general, the introduction of PhD programs would provide an opportunity to prepare both local Qatari and non-Qatari talent to play a greater role in R&D in the Gulf state, thereby supporting the country's ambition to build national capacity.

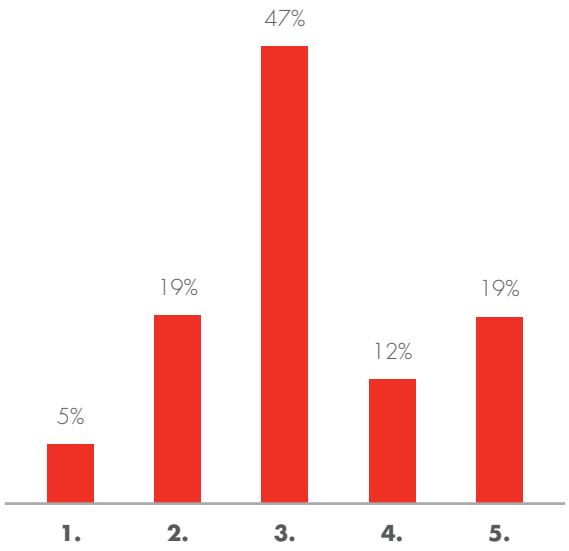
According to the Qatar Shell Dialogues survey conducted at the workshop, 43% of respondents said introducing PhD programs at Qatari universities would be the most important development to enable a Nobel Prize winner to emerge from the ranks of Qatar's R&D community in the coming decade.

Deeper collaboration between industry and universities is also seen as providing academia with a better understanding of what energy companies' needs are while at the same time offering them an opportunity to provide input on university curricula.

The need to intensify collaboration between academia and industry has been recognized on both sides, certainly in the oil and gas sector. As a result of the initiatives launched in recent years, the foundations to facilitate and deepen such collaborations exist but will need to be built on going forward to allow for capacity building on a scale required to meet Qatar's ambitions.

Q. What is the best way to align energy R&D in country with local industry needs?

1. Industry to publish all in-country R&D requirements
2. Academia to embed professors in industry research training centers for sabbaticals
3. Industry to embed research staff in academic institutions for sabbaticals
4. JVs to build internal capacity for R&D
5. Build partnerships across the gulf to establish R&D projects for common challenges



According to industry executives and academics surveyed at the Qatar Shell Dialogues workshop, the best way of aligning in-country energy R&D with local industry needs would be to embed company research staff in academic institutions for longer periods by facilitating sabbaticals[3].

Connecting industry and academia may also be pursued on other levels within the education sphere. Among the key recommendations participants in the Qatar Shell Dialogues workshop came up with was the suggestion to introduce **engineering summer camps** targeting children and youths on the one hand, and teenagers and students on the other.

The concept aims at developing self awareness among children and youths, and encourages them to make the right career decisions based on awareness of their own attitudes, interests and skills. Activities at the camps would revolve around 'Learning to Think' and 'Learning to Learn' themes, and involve partnerships between parents, academia and industry.

Taking the camp concept to the next age group, its goal would be to provide teenagers and students with an induction to the various engineering disciplines such as chemical, electrical, computer, mechanical and petroleum engineering. It would also provide an opportunity to present this age group with a clear idea on what would be required and expected to pursue a career in engineering. The camp would enable young talent to come in direct contact with existing engineering students, who may act as camp volunteers, and industry representatives, who could participate to talk about sponsorship and internship programs and processes.

[3] See graph – 47% of respondents comprising top industry executives and academics surveyed on May 30, 2013

KEY ISSUE 2

INCENTIVES

Providing incentives for foreign individuals such as scientists and teachers to commit to Qatar for the long term is as critical to the country's future R&D ambitions as it is sensitive on a national level. At the same time, it will be important to incentivise new generations of students to take up science-related studies and choose careers in this field.

One such incentive, frequently stated among academics and executives as seminal to attracting and retaining the right caliber and volumes of scientists to Qatar, would be to grant some form of **permanent residency**. The rationale for offering permanent residency, as well as incentives for family members would be to provide select individuals such as scientists, teachers and talented students, who meet Qatar's critical national needs, the ability to commit to the country for the long term as it would ensure stability, security and the ability to plan. At present, these individuals aren't being offered adequate incentives to remain in the country for the long term.

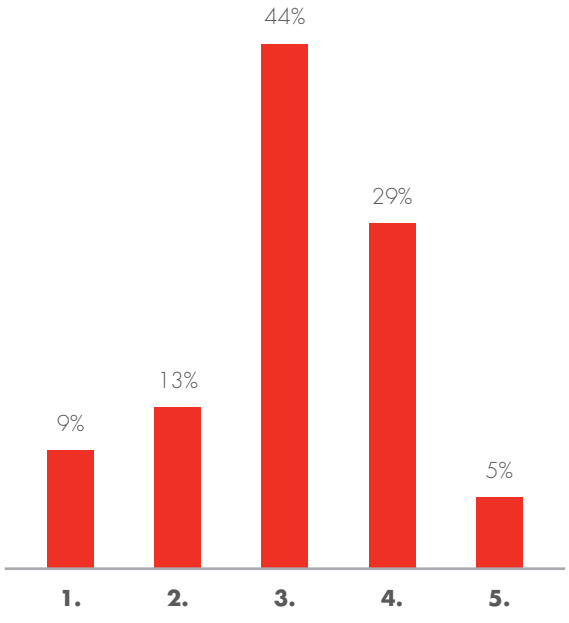
Qatar Foundation Research & Development President Faisal Al Suwaidi at the workshop stressed that long-term residency should be an option to be considered by Qatar. The Gulf state in 2011 announced that – in line with its Qatar National Development Strategy (QNDS) 2011-2016[4] – it would consider a program of permanent residency for expatriates who meet predetermined criteria. However, no such program has been introduced thus far.

The issue remains sensitive, with the government being aware of concerns among the local population, which accounted for only 6.1% of the total population in Qatar in 2011[5].

Industry and academia representatives frequently point to the U.S. as being able to attract the best people from around the world because it offers a visa system and a path to citizenship for people who are highly productive and valuable to society. A similar initiative would make a difference and provide a strong incentive for individuals in the R&D or education

Q. In a recent survey, 52% of the respondents identified that building a clear career path to senior management for technical competence was the most important commitment for industry to adopt in order to attract the right talent – which would be the best initiative to adopt to achieve that?

1. Every member of NOC/IOC executive leadership team should have a corresponding R&D colleague buddy with equal rank & compensation
2. Executive Leadership Team and their R&D buddy spend one month a year swapping roles
3. Add new positions to the C-Suite that directly connects the boardroom to the Lab – Chief Research officer (CRO)/Chief Technology Officer (CTO)
4. In an era of post easy oil technology will differentiate the winners from the losers more than ever – Energy industry should take a leaf out of the Silicon Valley playbook and celebrate the R&D talent as the high flyers in the firm
5. It is not viable to fold business management and R&D activities together



[4] See http://www.gsdp.gov.qa/gsdp_vision/docs/NDS_EN.pdf

[5] See http://www.gsdp.gov.qa/portal/page/portal/ppc/PPC_home/ppc_news/ppc_files_upload/populations_status_2012_en.pdf

sphere who are considering a move to Qatar. This holds particularly true for mid-career scientists who may hesitate to give up tenure in a university, research institute or company elsewhere to come for an uncertain future.

While there is an argument that financial rewards may provide sufficient incentive in favor of a decision for Qatar, this may not always be the case, some academics argue, as many creative scientists are not driven by financial motivators. "It's nice to be well paid, but you want to know that you're going to have stability in your research career development and that your children are going to be educated and live somewhere that's going to become home," according to a senior academic based in Doha.

Incentives away from residency issues also play a role at student level, in particular in a society such as Qatar, where prestige and reputation are key factors in career decision-making processes. To date, these factors are broadly linked with careers in business and sectors such as banking and finance rather than science. Working towards increasing the prestige of R&D sponsorships and offering optional sponsorship for PhD students with financial incentives for top talent were also recommended as important incentives at the Qatar Shell Dialogues workshop.

Educating students in Qatar about their career options in science and R&D, including financial rewards and perspectives to develop their skills either on the managerial or technical sides would provide clear incentives to choose this path. Not surprisingly, **defining and promoting a clear career path for R&D students** emerged a top-three recommendation in the workshop.

According to the Qatar Shell Dialogues workshop survey, 44% of respondents[6] believe one key initiative to attract and retain the right talent in energy R&D could be in the form of adding new senior executive positions at company level, which would essentially connect boardroom with research labs. The same survey question showed that 29% of respondents thought that celebrating R&D high flyers in the energy industry, following the example of Silicon Valley, may be a feasible option to attract talent.

KEY ISSUE 3

- INSTILL INTEREST IN SCIENCE AMONG THE YOUNG; REFORM THE EDUCATION SYSTEM

Building a research culture in Qatar is another key issue that needs addressing by the three key R&D stakeholders – academia, government and industry.

To instill interest in science among the young from as early as kindergarten and primary school level, reforms to the education system and promoting a change in culture supporting creative and critical thinking will be essential. Academics and industry representatives often point to the U.S. education system and society as fostering the kind of thinking that gives rise to the creation of scientists, researchers and entrepreneurs.

According to Dr. Hassan Al-Derham, Vice President for Research at Qatar University:

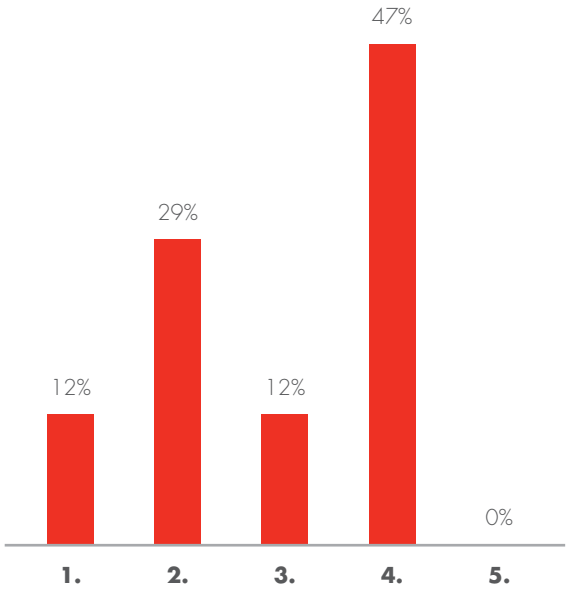
> *"This is the difference between students in the U.S., who have an independent, critical mind and an entrepreneurial way of thinking, and our education system and how we raise our kids. It's a holistic approach. Building a research culture is not only about having infrastructure for laboratories or having research programs or having PhD programs – it has to do with the way we think."*

Nearly half of all industry executives and academics participating in the Qatar Shell Dialogues workshop found that the most significant step Qatar's R&D stakeholders could take to instill interest in science would be to reform the primary school education system, thus encouraging critical thinking[7].

The response to the survey question also shows that nearly a third of the respondents thought science and maths field-related teachers and university professors would need to be equipped with compensation packages commensurate with industry executives as an important means to provide perspective and attract talented youth into areas of science on the one hand, and ensure a high standard of teaching by attracting high-caliber individuals on the other.

Q. What is the most significant step Qatar's R&D stakeholders could take to secure the imagination of talented young people so they develop a curiosity for invention?

1. Celebrate and reward existing role models with high profiled positions
2. Reward science and math teachers and university professors (Mentors) with compensation packages commensurate with industry executives
3. Reward talented high school students with scholarship/ stipends
4. Reform the primary school education system to encourage critical thinking
5. Award Messi, Beckham and Ronaldo with honorary PHDs



Among the Qatar Shell Dialogues workshop recommendations on how to stimulate interest in science was the introduction of a **National Research Day**, mirroring the concept of National Sports Day, which is an annual national holiday in the Gulf state that aims to promote a healthy lifestyle among the local population. A National Research Day similarly could revolve around science fairs and exhibitions as well as related competitions and challenges.

[7] See graph on page 14 – 47% of respondents comprising top industry executives and academics surveyed on May 30, 2013

Another recommendation formulated in the workshop is based on the concept of **'edu-tainment'** – a combination of entertainment and education, utilizing technologies that children grow up with and have become accustomed to use, i.e. computer apps and games, and children's TV shows.

The approach would bring a 'fun' element to the table that could ensure sustained interest in science-related topics among the young, if executed properly. While essentially an education initiative, the 'edu-tainment' concept would require all stakeholders to collaborate in order to ensure that the benefits of such scheme would indeed lead to youths pursuing science studies and careers in R&D.

Conclusion

Among the key conclusions to be drawn from the Qatar Shell Dialogues workshop is that industry executives and academics largely take the view that the Gulf state has been able to put in place the key foundations and infrastructure needed to establish a global energy R&D hub in the country as part of its commitment to building a knowledge economy.

At the same time, international oil companies have become engaged in R&D locally, thus making first contributions to the government's vision. Moreover, recent years have seen the creation of a network of local and international universities as well as research centers that are integral to building national capacity. With that in mind, academia, industry and government agencies now have to take concrete steps to build on these foundations.

It will require society as a whole to embrace a new level of openness and a culture that supports critical and independent thinking from an early age, thus paving the way for the younger generations to develop an interest in science that will be needed to take on the opportunities that R&D has to offer and consider it as a career choice. Bringing about these shifts in thinking won't be easy.

But a journey of a thousand miles starts with a single step, and it is the combined resources and influence of the Qatar R & D community leaders assembled for the Qatar Shell dialogues surely has the ability, collectively, to enable some of these recommendations and take that first step.