

*Report on current developments in
the oil & gas industry in Africa*

August 2016

The choice to change

*Africa oil &
gas review*





Contents

Foreword	3	Impact of renewables/alternative resources	27
Executive summary	5	Change in competitive environment	28
Reserves and production	6	Prioritising environmental and development imperatives	29
Growth and development	6	The Africa diagnostic	30
The challenges	6	Policymakers' understanding of the industry	30
Dealing with decline	8	Regulating local content and skills development in a complex world	32
Where there are threats, there are opportunities	10	The impact of local content on investment decisions	32
Next steps	13	Compliance with local content requirements	33
Take away	14	Reaching for quality higher education	33
New energy futures	15	The digital oilfield	35
Mergers & Acquisitions (M&A)	15	What is digital?	35
Discoveries	18	Digital technology in oil & gas	36
Foreign Direct Investment (FDI)	19	Are you ready	39
Capital spending	21	Leading enterprise advisory playbook (Leap)	41
Dependencies	22	Conclusion	42
Oil price impact on oil rich African nations	22	Contacts	43
Sustainability	24	Acronyms	44
New discoveries are not the only basis for sustainability	24	References	45
The bottom of the barrel	25		
Infrastructure	26		
LNG as an option	26		
Acreage and licence costs	26		

Methodology

The project team, based in Cape Town, South Africa, developed a questionnaire that was distributed across PwC's Africa network via email. Respondents included upstream, midstream, downstream and oilfield service companies, among other industry stakeholders.

The project team used this information together with their knowledge of the industry gained from working with clients throughout the oil & gas value chain, industry events and interactions as well as additional research conducted by the team. The result is a piece of PwC thought leadership that represents the PwC point-of-view for the oil & gas industry in Africa.

Acknowledgements

PwC Africa would like to thank all of the participants who contributed to this publication by responding to our survey questionnaire. We would also like to say a special thank you to our PwC colleagues in the knowledge management teams in Europe and the Americas for assisting us with research and statistics.

Foreword

This review of developments in the African oil and gas industry is our sixth in a series of reviews of the sector.

As in previous years, this review takes into account the experience and views of oil & gas industry players from across the African continent, including international oil companies operating in Africa, national oil companies, oilfield service companies, independent oil companies and industry commentators, to provide insight into the latest enablers and challenges impacting the business.

In this year's edition, we have taken a look at events that have taken place in the last 12 months within the major and emerging African oil & gas countries. With a sustained downturn in the oil price, the industry continues to respond by reducing costs, postponing or cancelling projects and exploring ways to reinvent itself.

Navigating the future is increasingly challenging in a more complex global market, and the longer-term backdrop has changed. Given the lower price of oil, hydrocarbons are no longer as profitable to produce as they were in the recent past. While global demand for affordable, reliable energy will continue to grow for the foreseeable future, the world is transitioning to a low-carbon energy system.

It is clear that the momentum to replace fossil fuels with cleaner energy sources, sooner rather than later, is gathering pace. Consequently, oil & gas companies would be well-served to review their long-term strategies, recognising the possibility that oil could suffer a similar fate to coal in the coming decades.

Africa represents the new frontier for energy in many ways. For example, 70% of households in sub-Saharan Africa do not have access to electricity! Now is the opportunity for oil & gas companies in Africa to reinvent themselves to deliver this much-needed commodity in a lower-carbon form. At PwC, we consider the move to green to be one potential scenario for the 'new energy future'.

The low oil price has led to a reduced level of activity among industry players, and it is having a crippling effect on countries that historically depended heavily on oil & gas revenues. Nigeria, for example, relied on crude sales to make up 70 percent of its government revenue. The sharp decline in price has, therefore, led to a prolonged economic crisis.

Angola has also been hard hit, as it is highly dependent on oil revenue. The state collected US\$468 billion in oil revenue from 2002 to 2014 and as is the case in Nigeria, the government has taken measures to restructure the national oil company in an effort to turn things around.

At PwC, we keep on top of key developments in the industry with a lens focused on analysing and scrutinising their potential impact on our clients, while also generating market-leading solutions to assist companies manage through the downturn and plan for the eventual upturn.

Our industry experts have a thorough understanding of the challenges facing our clients, and they have the experience and knowledge needed to deliver innovative, technology-driven solutions to address the issues keeping energy CEOs up at night.

Pedro Omontuemhen
Africa Oil & Gas Industry Leader

Chris Bredenhann
Africa Oil & Gas Advisory Leader

Ayesha Bedwei
Oil & gas in Africa

Oil reserves

129.1 billion barrels
7.6% of the world's proven reserves

Gas reserves

496.7Tcf, **85.7 billion** BoE
7.5% of the world's proven reserves

Shale oil potential
Libya 5th globally

26 billion barrels

Shale gas potential
Algeria 3rd globally

707Tcf, **121.9 billion** BoE

Shale gas potential
South Africa 8th globally

390 Tcf, 76.2 billion BoE

Numerous bidding rounds in 2016 including Angola, Egypt, Equatorial Guinea, Republic of Congo

Energy consumption to increase by **88%** over the next 20 years
Global consumption by **34%**

Refinery capacity as % of global: **3.7%**
Actual throughput 2015 **2.6%** or **2.1 million** bbl/day

LNG exports from Nigeria, Algeria, Angola, Egypt and Equatorial Guinea was 48.7Bcm, **14.4%** of world exports in 2015

LNG nominal capacity 102.9Bcm
24.2% of world capacity

LNG operating capacity in 2015 **72%**
Rest of world **97.1%**

Natural gas pipeline exports were 36.1Bcm
5.1% of the world's exports in 2015

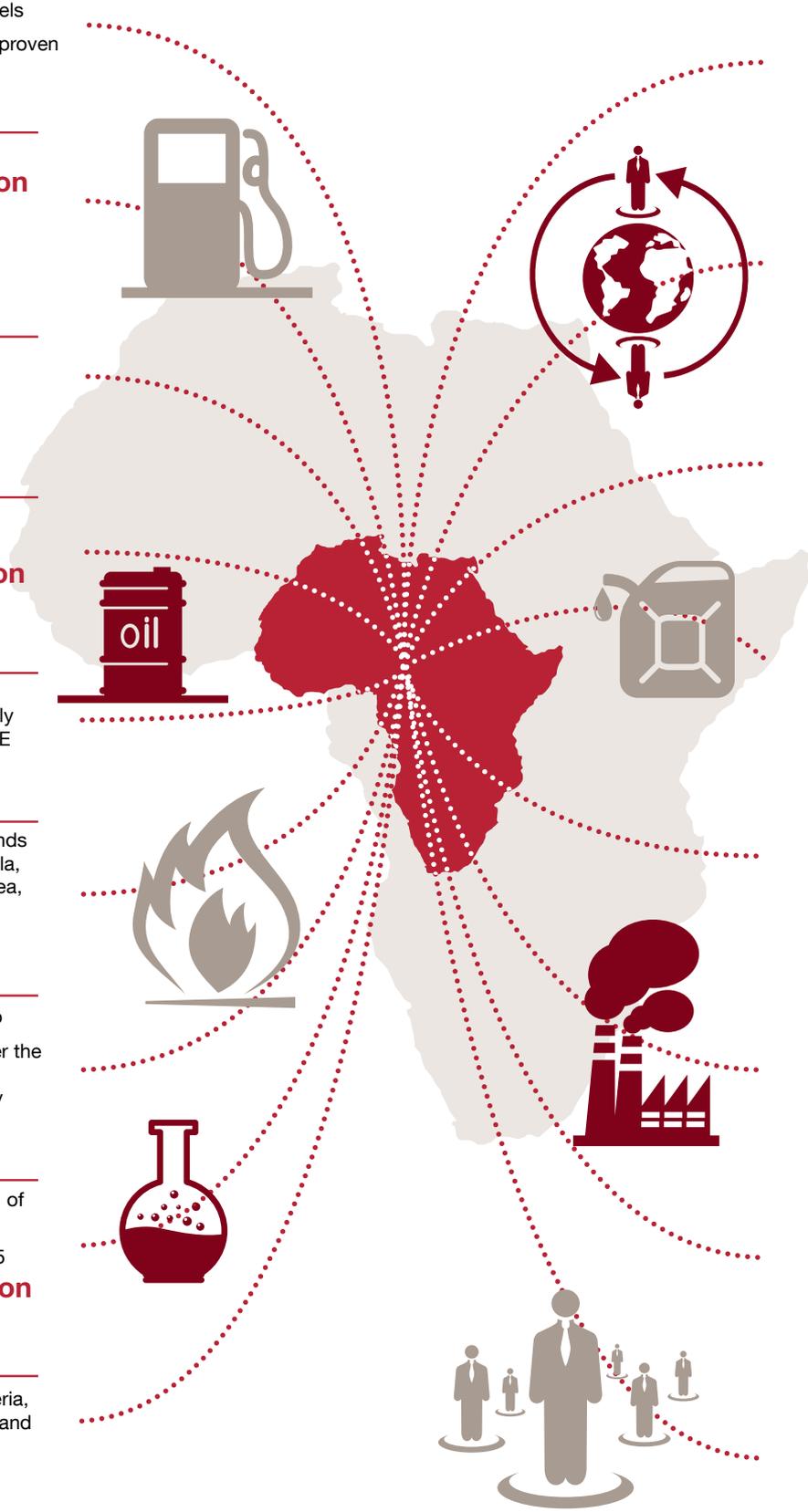
Potential industry investment in Nigeria, Egypt, Libya, Angola and Mozambique estimated at **US\$40 billion** per annum over the next 5 years

11 of the top 20 discoveries in 2015 were in Africa

33 national oil companies

Oil production as % of global: **9.1%**, down 0.3% from prior year.
Oil consumption as % of global: **4.2%**, same as prior year.

PwC has offices in **26** African countries
157 countries worldwide
and more than **8 000** staff in Africa



Sources: BP Statistical Review of World Energy 2016, Energy Information Administration (USA) (EIA), Websearch, The LNG Industry GIIGNL Report 2016 Edition, Rystad Energy

Executive summary

First and foremost, the biggest challenge is for oil-dependent countries to diversify their economies.

Reserves and production

Africa's share of global oil production dropped again slightly since last year, moving it from 9.3% to 9.1% of global output. Proven oil reserves on the continent are still estimated to be 7.6% of the global total, which is the same as the previous year. This comes as no surprise as much of the exploration and appraisal activity has been put on hold with the global oil price downturn. Despite this, Africa boasts eleven out of the top-20 discoveries in 2015 and already six out of the top-20 discoveries at the time of writing in 2016. That said, average discovery sizes are on the decline worldwide.

From a proven oil reserve totalling 129.1 billion barrels, Africa produced 8.4 million barrels of crude oil per day (bbl/d) in 2015 with over 77% of this oil production coming from Nigeria, Algeria, Egypt and Angola.

Despite what may seem like a time to shut-in producing assets to wait out the oil prices storm, many oil & gas companies see production to be their only route to a continuous stream of income. In many cases, production has actually increased!

The emergence of ISIS as well as the civil war in Libya has meant that production levels in North Africa continue to be low, though they have increased slightly due to increased production in Egypt.

Libya saw another decline of 13.4%, though there is speculation that production levels there will soon be on the rise. After the newly formed national oil company of the east failed to export crude (thus temporarily further slashing countrywide production), there has been an accord between the rival Tobruk-led Government and the Government of National Accord to combine the two national oil companies (NOCs) under the National Oil Company of Libya and relocate the headquarters to Benghazi in the east. This seems like a sign of positive things to come for Libya though it may flood the market with additional crude, which is the last thing needed for an oil price rebound.

As of the end of 2015, Africa has a proven natural gas reserve base of 496.7 trillion cubic feet (Tcf), down marginally from 2014. More than 90% of the continent's natural gas production is being driven by Nigeria, Libya, Algeria and Egypt. This is a slight uptick in production (4.5%) compared to 2014.

Africa has dropped from nearly 70 years of natural gas production available down to 66.4 years, given higher current production rates and a slow rate of reserves replacement. With five of the six largest discoveries being largely gas in 2016, we are likely to see growth in the continent's overall proven natural gas reserves. Since gas is positioned to be a bridging fuel in the eventual transition to a lower-carbon economy, this could prove a lucrative natural resource to fuel the emerging economies on the continent.

Growth and development

Industry activity throughout Africa and the world has slowed greatly due to cost cutbacks across the board. Exploration and production (E&P) activities have suffered the most, though we have noted a few discoveries in countries like Angola and Mozambique, as well as some sizeable gas discoveries in Egypt.

There no longer seems to be as much focus on East Africa as there has been in recent years, and companies seem to be scrambling to spend their limited capital budgets in countries with proven resources and decent (if not favourable) fiscal terms. Despite the trend to avoid frontier areas, Kosmos Energy made a considerable gas discovery in Mauritania during the course of 2015.

Despite a slack in upstream activity, there are many investors with an eye on Africa when it comes to delivering power solutions. Many donor funds have projects under way to bring electricity to those in need throughout the continent.

Power Africa is an initiative being driven by USAid in an effort to increase access to electricity to Africans by adding over 60 million new electricity connections with 30 000 megawatts of new and cleaner power generation.

Natural gas-fired power stations are one option for providing cleaner energy in Africa. Africa currently flares 1.2 trillion cubic feet (Tcf) of gas per year. That equals nearly half the continent's gas consumption, so there is no shortage of resources. Gas-to-power solutions would be an excellent way to monetise the numerous gas discoveries made on the continent recently.

Given the high capital costs in this sector and the long-term investment cycle, oil & gas producers have little alternative but to relentlessly focus on cost. Layoffs, reduced capital expenditure budgets and aggressive discounting across the supply chain reflect a sector trying to adjust to a new reality. While the much-heralded wave of consolidation across the sector is yet to be realised, it is clear that more transactions may well follow a period of financial distress.

There are of course other trends shaping the oil & gas sector. With the ongoing emphasis on cost reduction, demand for innovation in technology will grow. Whether it is the more widespread application of the digital oilfield or the use of drones to undertake offshore inspections of pipelines, technology is key to reducing cost and improving operational efficiency.

While several oil & gas companies are focusing on resetting for the future, others have realised that the future will certainly look very different to the status quo to which they're accustomed. The strategies likely to come will be adaptable to a number of possible future scenarios, meaning that the cyclical commodity prices will not impact them as drastically as in the past.

The African continent still offers significant opportunities in the oil & gas sector, albeit delayed by the low oil price environment. The current opportunity for host governments that want to attract oil & gas investors lies in offering an attractive environment by reforming their regulatory, fiscal and licensing systems. There seems to be an increased level of realisation on the part of some governments and policymakers that they have to play their part in enabling projects to go ahead as soon as possible.

This can also be the time to introduce training programmes to up skills levels and company standards in order to give local players a chance to enter the industry when activity picks up again.

The challenges

First and foremost, the biggest challenge is for oil-dependent countries to diversify their economies. Oil & gas will remain a commodity game driven by peaks and troughs. If nations are to survive the ups and downs, they must expand into other industries.

Exploration and production has and always will be a high-stakes, high-rewards game, and oil & gas players will always be looking to minimise the risk and maximise value. For many, that means exploring proven hydrocarbon provinces with lower government take as a preference, but the fact of the matter is that those types of plays are few and far between. Many companies are simply taking their chances to see what they can find. Various approaches are being taken to minimise risk, but the safest bet is to have a balanced portfolio. Just as governments should diversify their economies, oil & gas players must maintain diversified portfolios.

One new challenge on the horizon for oil & gas players will be competition in the form of renewable energy. In July 2016, the Rockefeller Brothers Fund announced that it will be backing a US\$177.5 million wind and solar power programme in Africa. This will be its biggest move to a greener energy space since announcing its plans to withdraw from fossil fuels back in 2014.

Though 3.3% of the fund is still invested in oil & gas companies, this is down from 7% two years ago. Considering that John D. Rockefeller established his wealth through Standard Oil, this is certainly a sign of the times, and oil & gas companies will need to reinvent themselves to survive in the 'new energy future'.

Persistent challenges experienced by industry players include poor physical infrastructure, local content requirements, skills shortages and regulatory uncertainty. There is a sense and evidence that some countries have taken steps to make the environment more attractive, but a question remains whether they can react fast enough for funds not to flow into safer havens that grant more predictable returns.

Oilfield service companies were the hardest hit by the downturn and drastically reduced their headcounts. The total number of jobs lost in the industry since the downturn now exceeds 250 000 and it is estimated that about 80% of this figure represents the services sector.

Oilfield service companies also had to make huge concessions with regards to their fee structures. It is estimated that they have had to compensate for 30% of their revenue elsewhere, and cost cutting is still right at the top of the agenda. The rig count has continued to decline, globally by almost 500 (26%) and in Africa by seven (7%) since the beginning of the year. The trend sees more rigs looking for a safe place for cold stacking until operations pick up again.

The reduced oil price has had a particularly heavy impact on the industry in fledgling countries like Mozambique, Tanzania, Uganda and Kenya. Already vulnerable with a need to attain a number of fundamental prerequisites, these East African nations now face further project delays, meaning that their governments and populations will have to wait even longer to reap the benefits of their natural resources.



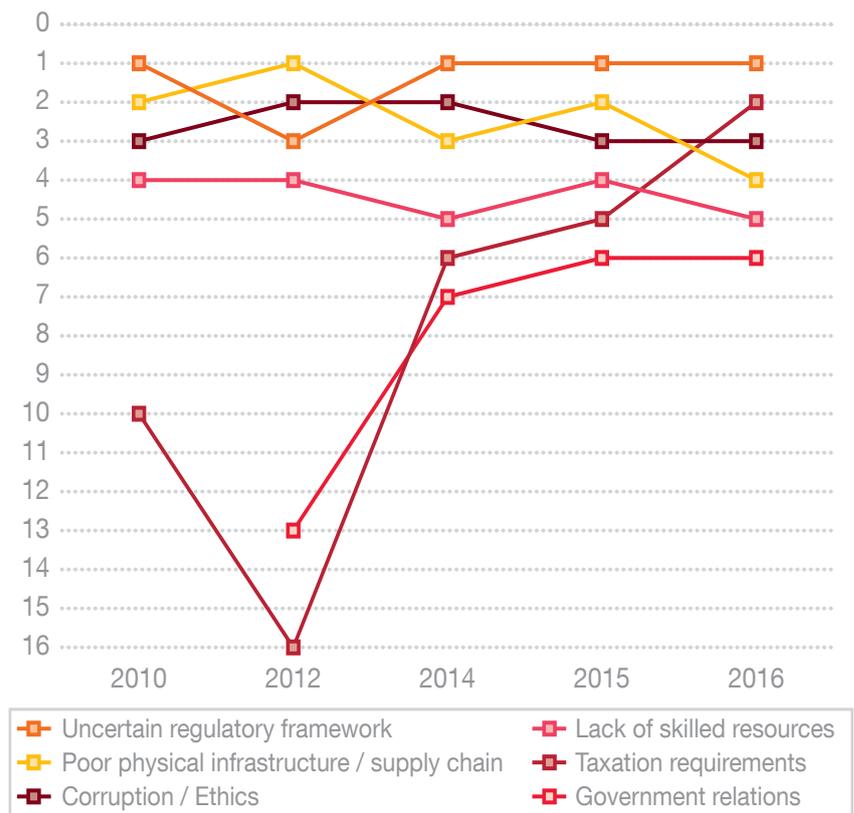
Dealing with decline

The oil & gas industry is facing a difficult time at the moment. In PwC's 19th Annual Global CEO Survey, 72% of oil & gas CEOs report that there are more threats facing their businesses today than there were three years ago.

Among African CEOs surveyed, the top challenges identified by respondents in the oil & gas industry have remained similar to those in previous years – uncertainty in regulatory frameworks, corruption/ethics, poor

physical infrastructure and lack of skill resources. This year, there was also a significant rise in the challenge of meeting taxation requirements, as well as government relations.

Figure 1: Top-six challenges in developing an African oil & gas business



Rank: 1 High, 16 Low
Source: PwC analysis

Regulatory uncertainty has remained the top challenge facing the oil & gas businesses in Africa for the third year in a row. The degree of concern expressed by respondents in our survey correlates with the organisation's primary role in the value chain and operating location.

We found that 85% of companies that operate upstream in our survey rated regulatory uncertainty as one of their top-three challenges. Meanwhile, Tanzania, Angola, South Africa and Mozambique were the most common jurisdictions for organisations that rated it a top-two challenge.

The challenge of meeting taxation requirements has increased dramatically and ties in to regulatory uncertainty. To determine why this challenge has been rated so highly, we looked at the data in more detail. There are three likely contributing factors: the number of respondents operating in Tanzania, pressure to cut costs and a general uncertainty regarding tax regulation.

Of those who rated taxation requirements in their top-three challenges:

- 100% were involved upstream, with 82% upstream-only companies and the remainder integrated companies; and
- 50% of respondents who rated this challenge in their top-two challenges are based in Tanzania.

It is likely that the Petroleum Bill passed by the Tanzanian Government in July 2015 may have increased levels of uncertainty. This regulation mandates a 12.5% royalty for oil & gas production in onshore or shelf and a 7.5% royalty payment for offshore fields. Further, the state share of natural gas profit ranges from 60-85%, pegged on specific daily output.

According to BMI's *Oil & Gas Tanzania Report 2016 Q3*:

Based on the new model production sharing agreement, companies may expect higher taxation, an expanded role for the state and more stringent local content mandates.

An alternative, and likely contributing reason, could be that as many players are looking to cut costs in a low oil price environment, taxation might be a lever. This is consistent with other research. In PwC's *19th Annual Global CEO Survey*, 46% of oil & gas CEOs are extremely concerned that an increasing tax burden could threaten growth. Furthermore, these CEOs are also more likely to agree strongly (46% vs 36% overall) that tax is a business cost that needs to be managed efficiently (as per other business costs). Indeed, 66% of oil & gas CEOs indicate that they are planning to make some or significant changes to their tax affairs.

However, managing tax is tricky. Seventy-six percent agree that their business' approach to tax affects their reputation – which can have effects on public sentiment, attracting talent and even revenue.

Just this year, the 'Panama Papers' leak (consisting of over 11 million documents) uncovered how companies and individuals were using offshore shell companies to avoid tax. While such structures are legal, the leak resulted in some nations creating new measures to tackle tax evasion. Customer response was also significant.

Lastly, the challenge may not be high tax rates so much as uncertainty in the tax landscape. Oil & gas CEOs told us that a clearly understood, stable and effective tax system is a key priority, with 80% agreeing or strongly agreeing that a stable tax system is more important than low rates of tax (compared to 67% of CEOs overall).

For the first time since this series of annual reviews began in 2010, 'Government relations' has hit the top-six challenges. This category correlates with uncertain regulation and taxation requirements.

Around the continent, many organisations have experienced difficulty obtaining government sanction for new projects. This is proving particularly challenging in new hydrocarbon provinces, such as Mozambique, because governments do not fully understand the intricacies and scale of oil & gas projects. They also don't have a full understanding of the risks being taken on by the players. Oil & gas companies are beginning to ally themselves with governments in order to ensure that they are a strategic and supportive partner, with many companies employing people to specifically work on government relations.

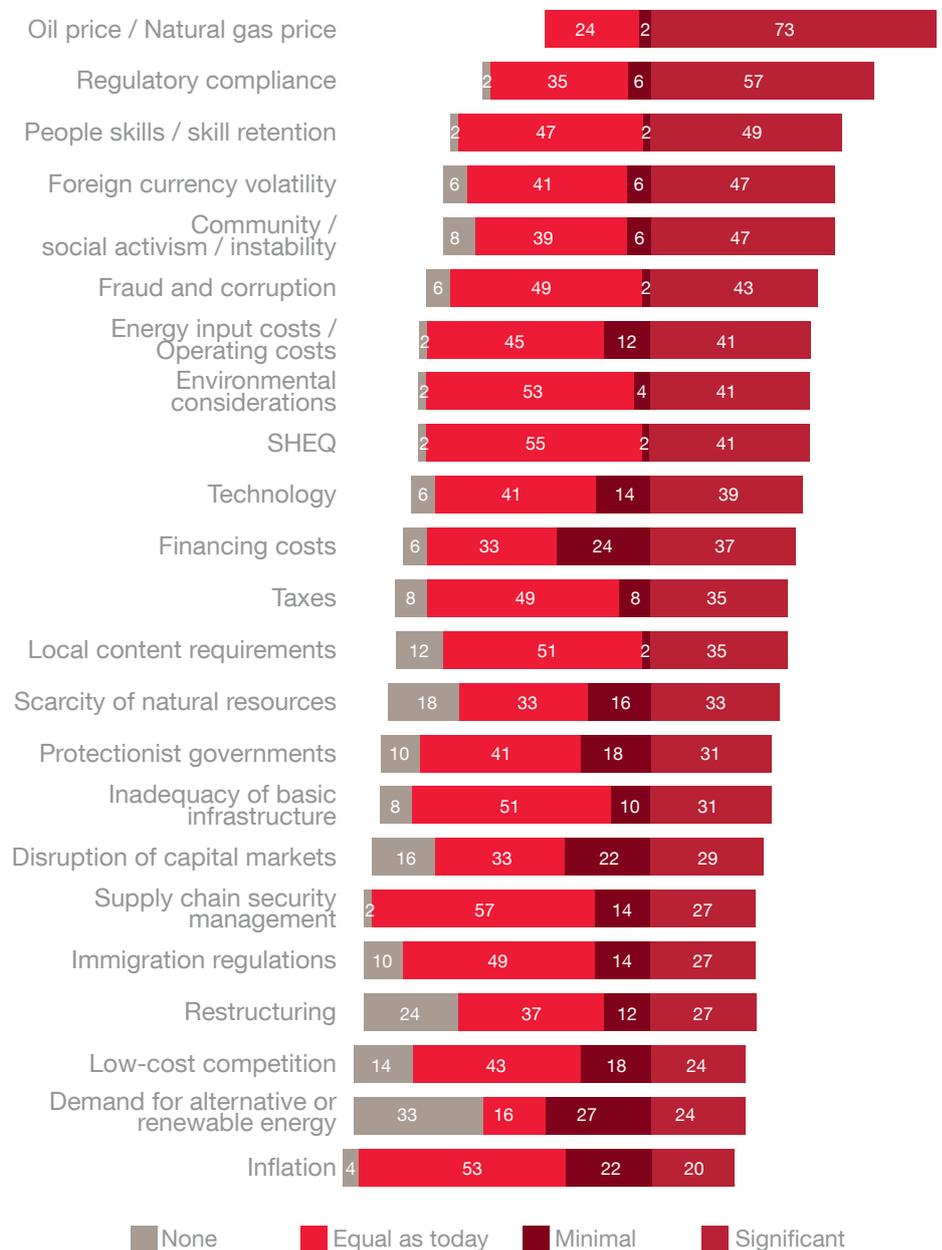
Where there are threats, there are opportunities

Despite a bleak landscape and a view that threats are increasing, companies are still securing their long-term future and making sure that they're ready for what lies ahead.

We asked respondents what they believed would influence their business over the next three years. The results are shown in the adjacent graph:

Figure 2: Factors most likely to impact business in the next three years

Q: Rate the projected impact of the following on your business over the next three years



Source: PwC analysis

Factors most likely to impact business in the next three years

	2016	2015	2014
Oil price / natural gas price (commodity price)	1	1	4
Regulatory compliance / uncertain regulatory framework	2	2	5
Foreign currency volatility	3	4	18
Protectionist governments	4	15	2
People skills and skills retention	5	3	7
Local content requirements	6	13	8
Financing costs / difficulty in securing finance	7	11	22
Energy input costs / operating costs	8	7	10
Community / social activism / instability	9	5	11
Disruption of capital markets	10	17	17
Low-cost competition	11	21	20
Demand for alternative or renewable energy	12	22	19
Taxes / royalty payments	13	12	6
Fraud and corruption	14	6	13
Immigration regulations	15	19	23
Restructuring	16	20	9
Technology	17	10	14
Inadequacy of basic infrastructure	18	16	3
Environmental considerations	19	8	12
Inflation	20	23	21
Supply chain security management	21	18	15
Scarcity of natural resources	22	14	16
Safety, health, environment and quality (SHEQ)	23	9	1

Source: PwC analysis

Unsurprisingly, respondents believe that the price of oil and natural gas will remain or have a greater impact on their business over the next three years. With little control over the price, businesses have focused on improving efficiency and driving down costs.

Respondents are generally confident that the oil price will increase in future, with the average expected price to be \$52 in 2016, \$60 in 2017 and \$69 in 2018.

The oil price is having profound effects on oil-dependent economies, and the UN Conference on Trade and Development (UNCTAD) has urged oil-producing countries to diversify their economies to avoid the economic consequence of declining oil prices in the future.

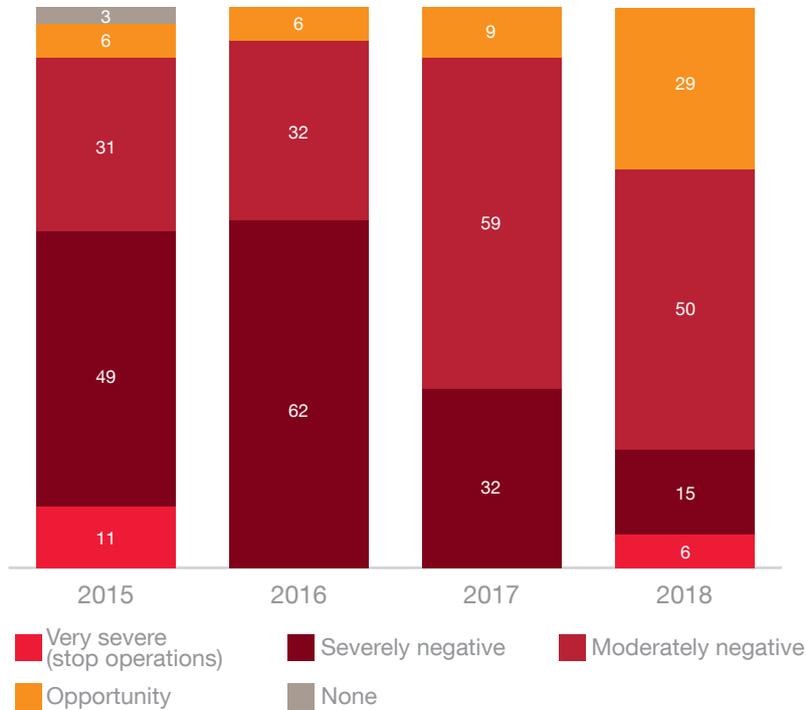
Not only is the price a concern, but so too is price volatility. While no respondent expected to stop operations as a result of volatility this year, there has been an increase in the percentage finding price volatility severely negative to their operations.

By 2018, a small portion of respondents expect volatility to be very severe, but 29% see opportunity – perhaps a sign that business is becoming accustomed to a new reality.



Figure 3: Impact of commodity price volatility

Q: What effect do you think the volatility of the commodity price will have on your business?



Regulatory compliance/uncertain regulatory framework, at number two, remained a significant challenge for respondents this year. This challenge ties together with protectionist governments, which is in 4th place this year – up from 15th last year.

Foreign currency volatility is of course a key issue. As (almost) all respondents operate multinationally, foreign exchange rates are an important consideration. This year alone, we have seen large currency fluctuations – with the fallout from the Brexit vote precipitating some of the largest so far.

Source: PwC analysis

I don't have a crystal ball on oil prices. I try to control what we can control. That's why we've been focused on our cost structure at three various levels – our capital cost to drill new wells, our lease operating expenses, and then our G&A. The bottom line is, we've had to push the reset button and really attack the cost structure to gear for a lower-price environment.

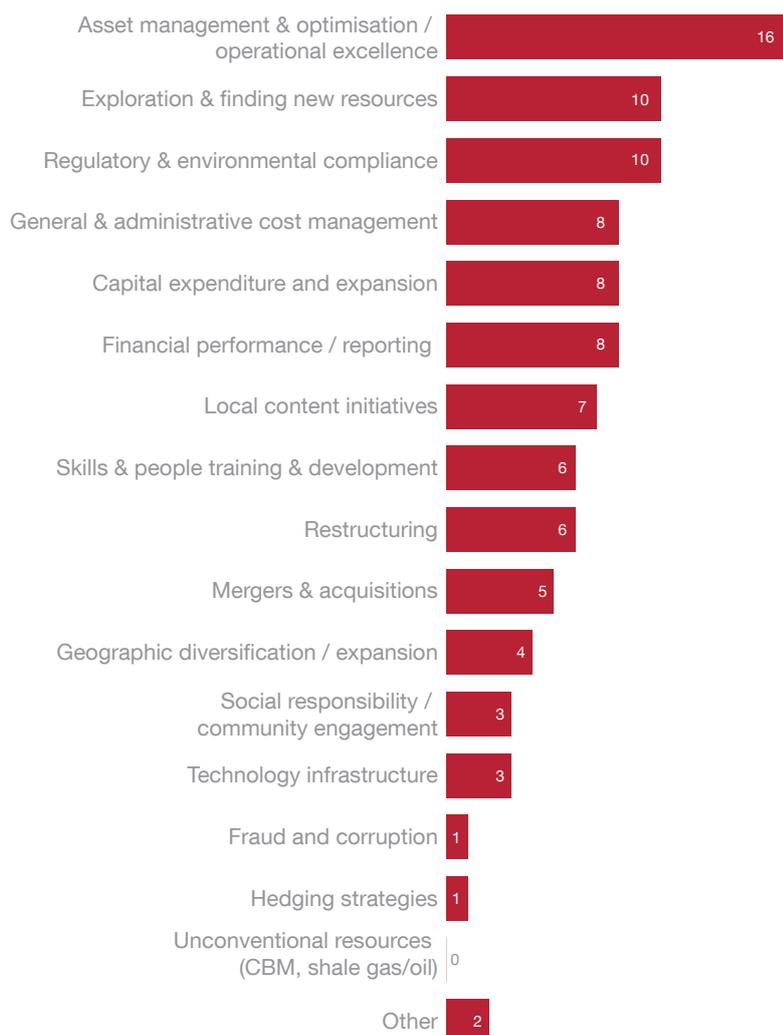
– John J. Christmann IV, Chief Executive Officer and President, Apache Corporation
PwC's Global Annual CEO Survey 2016

Next steps

Given the range and severity of challenges and factors impacting their organisations, oil & gas businesses need to look at creating a robust strategy for the future.

Figure 4: Top strategic focus areas over the next three years

Q: What are the top-five strategic focus areas for your company over the next three years?



Source: PwC analysis

As in previous years, asset management and optimisation / operational excellence remains a key strategic focus area. This is a clear response to the declining price of oil & gas. It was also the likely reason why ‘general & administrative cost management’ was recognised as the 4th most important focus area this year.

Fortunately, the oil industry remains optimistic, and many upstream players are focusing on exploration and finding new resources over the next three years, most likely in anticipation for an upturn in the oil price.

The 3rd most significant focus area is regulatory & environmental compliance. With concerns over taxation and increasingly strict environmental regulations, this is not surprising. Recent news about environmental compliance emphasises the value of this capability.

In July 2016, BP drew a line under the Deepwater Horizon disaster – announcing that the amount spent on expenses and compensation for the disaster totalled US\$61.2bn – over half of the company’s market capitalisation at the time of writing.¹

¹ Dan Cancian, “BP draws line under Deepwater Horizon disaster but quarterly profits plunge”. *International Business Times*. 26 July 2016. www.ibtimes.co.uk/bp-draws-line-under-deepwater-horizon-disaster-quarterly-profits-plunge-1572527

Take away

- Oil & gas companies need to make sure that they have the right people, processes and strategy for managing regulatory risk and meeting taxation requirements. According to respondents, tax and regulation remains a key challenge in the industry and a factor that will impact the industry for years to come. Respondents are moving from talk to action, having decided that this is one of the most important key strategic focus areas this year.
- In a low oil price environment, companies are continuing to look at asset management and operational excellence, as well as general and administrative cost management. In such an environment, companies need to make sure that they don't cut costs across the board and understand their core capabilities. Companies should also look at using digital technology to better enable their businesses, as discussed in the Digital Technology section of this report.



Tough questions on strategy and capabilities

- Do you have a regulatory strategy, with intentions to build good government relations and play a proactive role in any uncertain regulatory frameworks?
- Do you have the right tax capabilities? Have you considered the reputational risk associated with your tax structures?
- Are you measuring and taking action to mitigate the right risks around new political dynamics, including geopolitical uncertainty and cybersecurity?
- In what ways are you using information to assist making strategic and risk decisions? How is your organisation making sure that it's measuring the right things in the right way in order to use data about non-financial impacts in decision-making?

New energy futures

Future economic development depends on solving Africa's energy challenges.

Times continue to be challenging for the industry as the oil price remains low. While we have seen some recovery in the pricing environment, investor confidence remains low as a significant recovery does not seem to be on the horizon and oil market fundamentals are still down. Break-even prices for frontier oil exploration are typically high. Many projects in Africa are therefore less profitable, resulting in delays and even cancellations in some cases.

Investment in the oil & gas sector is likely to become a more critical issue in coming years. The low oil price has led operators to defer FIDs (final investment decisions) on over US\$300bn of projects. With a persistently low oil price predicted for the immediate future, this raises the question of when producers will begin investing again in sources of new production to meet forecast demand.

Foreign investment continues to wane, and oil company stock prices continue to experience declines. There has been a heavy effort by Majors to maintain dividends, but investors know that this pace cannot continue given market conditions. The service companies have been the hardest hit with some having cut distributions by a whopping 82% lower than the peak rate!

That said, there are still some investors looking to take advantage at the 'bottom of the barrel'. Some analysts believe that now is the time to pick up bargain energy stocks. Stocks performing the worst in the oil price downturn include seismic acquisition firms, offshore drilling companies and transport.

Mergers & acquisitions

Globally, mergers & acquisitions (M&A) activity dipped last year, and it is expected that this trend will continue.

In Africa, far fewer transactions have taken place over the past 12 months than we've seen in recent years.

Value of M&A activity, 2011–2016

	2010	2011	2012	2013	2014	2015	2016
Announced total value (US\$ millions)	290 095	293 620	307 645	213 014	390 317	302 812	81 314
Completed	290 052	293 200	307 567	211 812	377 753	280 062	36 637
Pending	43	420	78	1 202	12 564	22 750	44 677
Number of deals	502	551	553	492	540	383	217
Completed	501	550	550	484	481	297	116
Pending	1	1	3	8	59	86	101

Source: Bloomberg

Selected oil & gas farm-in/out investment in Africa (2015 – 2016)

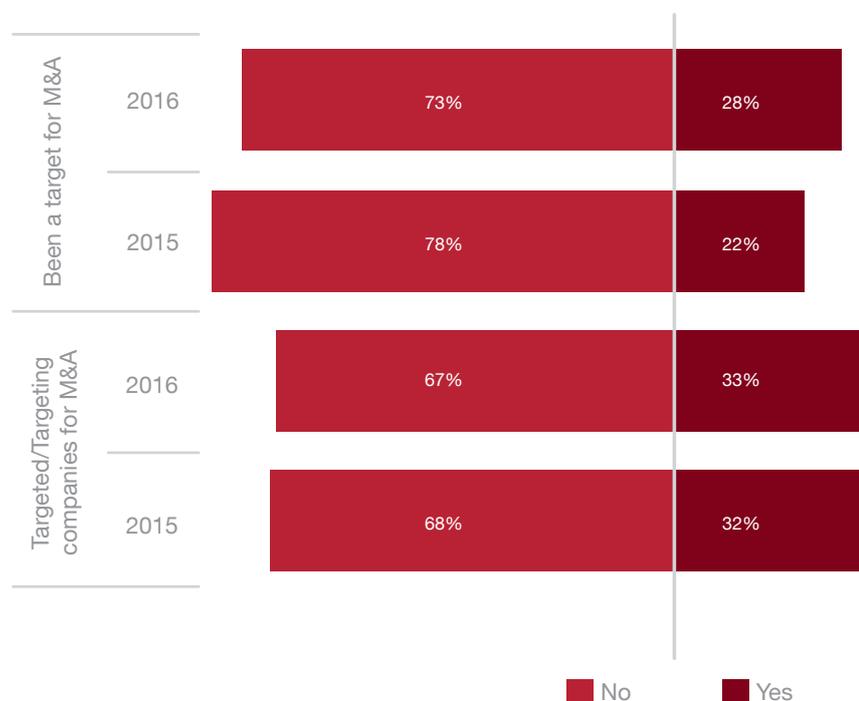
Country	Original owner	Investor
Morocco	Chariot Oil & Gas Ltd	Eni
Morocco	Chevron	Qatar Petroleum
Côte d'Ivoire	African Petroleum	Ophir Energy
Senegal/Guinea-Bissau JDA	Impact Oil & Gas	Woodside Energy
Senegal	Trace Atlantic Oil and CAP Energy	FAR Limited
Ethiopia	Africa Oil	Maersk Oil
São Tomé & Príncipe	Oando Energy	Kosmos Energy
Gabon	Ophir Energy	OMV
Tanzania	Otto Energy	MV Upstream Tanzania
Tanzania	Solo Oil	Aminex
Tunisia	PA Resources AB	ETAP
Kenya	Africa Oil	Maersk Oil
Kenya	Tullow Oil	Delonex
South Africa	ExxonMobil	Statoil
Democratic Republic of Congo	Semliki Energy	Sacoil

Source: PwC analysis

Despite the decrease in M&A activity, survey participants had a similar level of interest in making a transaction as they did last year – with a third of respondents having targeted or planning to target a company for a merger or acquisition.

Figure 5: M&A activities

Q: Have you been a target for M&A activity? / Have you targeted or are you intending to target companies for M&A?



While the behaviour is virtually the same as last year, the drivers of activity have changed drastically. Last year, the main reasons for M&A activity were opportunistic investments into distressed assets or in order to achieve inorganic growth.

This year, respondents are more interested in improving efficiencies through a merged group and some even positioning for the upturn in the oil price (a reason that very few provided last year).

The proportion of respondents looking for improved efficiencies through a merged group has increased by 10% since our previous survey. This aligns with companies looking to cut costs further. In many instances, operators are looking to either strategically partner with oilfield services companies or to develop these skills internally to take advantage of synergies.

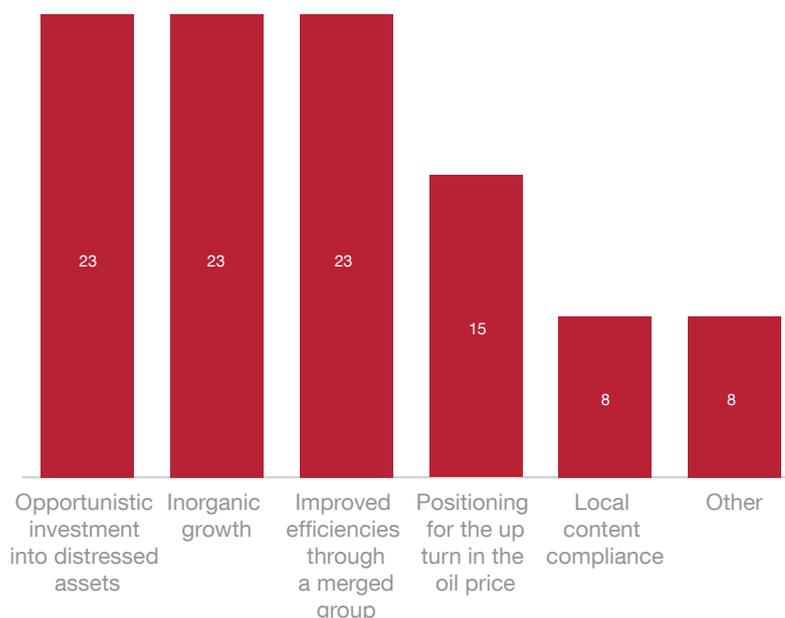
Source: PwC analysis

Levels of opportunistic investment into distressed assets have likely declined as the majority of attractive assets have already been picked up, and players are not looking to add struggling assets to their playbooks given current conditions.

Companies' growth prospects also remain uncertain, and it appears that fewer organisations are interested in inorganic growth at this time.

It's also important to note the failed mega-merger between oilfield services giants Halliburton and Baker Hughes. This US\$28 billion merger was called off after resistance from regulators in the US and Europe over antitrust concerns.

Figure 6: Main drivers of M&A activity



Source: PwC analysis

While levels of M&A activity have been low, we do expect that they will begin to pick up again as early as late 2016, and Africa will likely be an important target area given its recent exploration successes.

The number of bidding rounds planned is also seeing a slump, as it did in 2015. This is largely due to the fact that companies are focused on maintaining production on already discovered assets. Exploration in a time of strained oil prices is just too

risky. Despite this, there are a few countries where we still expect to see bidding rounds in 2016.

Angola is planning to hold a bidding round in 2016. This comes as no surprise as the country's current account deficit is significant, and a successful bidding round could provide a nice injection of cash. At the same time, new discoveries continue to take place in Angola, so it could also be a good opportunity for industry players to pick up cheaper acreage.

Bidding rounds

Countries	Expected bidding rounds
Angola	Offshore round planned for 2016
Cameroon	Onshore and offshore round on-going
Egypt	Oil round already started in 2016; Gas round still planned for 2016
Equatorial Guinea	Onshore and offshore planned for 2016
Republic of Congo	Onshore and offshore planned for 2016
Somalia	Possible round planned for 2016
Tanzania	Offshore round possible for 2016

Source: PwC Research

Discoveries

Of the top-20 discoveries made globally in 2015, 11 of them were in Africa, most of which were gas.

Most significant oil and gas discoveries in Africa, 2015

Global Ranking	Discovery	Country	Operator	Resource	Estimated resources (million BoE)
1	Zohr Phase 2	Egypt	Eni	Gas	2 220.7
2	Ahmeyim	Mauritania	Kosmos Energy	Gas	1 147.1
3	Zohr Phase 1	Egypt	Eni	Gas	1 006.4
4	Katambi	Angola	BP	Gas	835.6
6	Marsouin	Mauritania	Kosmos Energy	Gas	446.4
10	Zohr (LNG)	Egypt	Eni	Gas	301.2
14	Nkala Marine	Congo	Eni	Gas	190.7
16	Mdaldasini	Tanzania	Statoil	Gas	163
17	Atoll Phase 1	Egypt	BP	Gas	138.2
19	Pandora	Angola	BP	Liquids	131.4
20	Nooros	Egypt	Petrobel	Gas	103.6

Source: Rystad Energy (chart updated after initial document publication)



Eni made over one-third of these discoveries, including the Zohr discovery and its subsequent phases as well as the Nkala Marine discovery in the Republic of Congo.

Almost half the discoveries were made in Egypt. The Ahmeyim discovery made by Kosmos in Mauritania is a play-opening discovery, which is something special to note, especially considering the market at the moment.

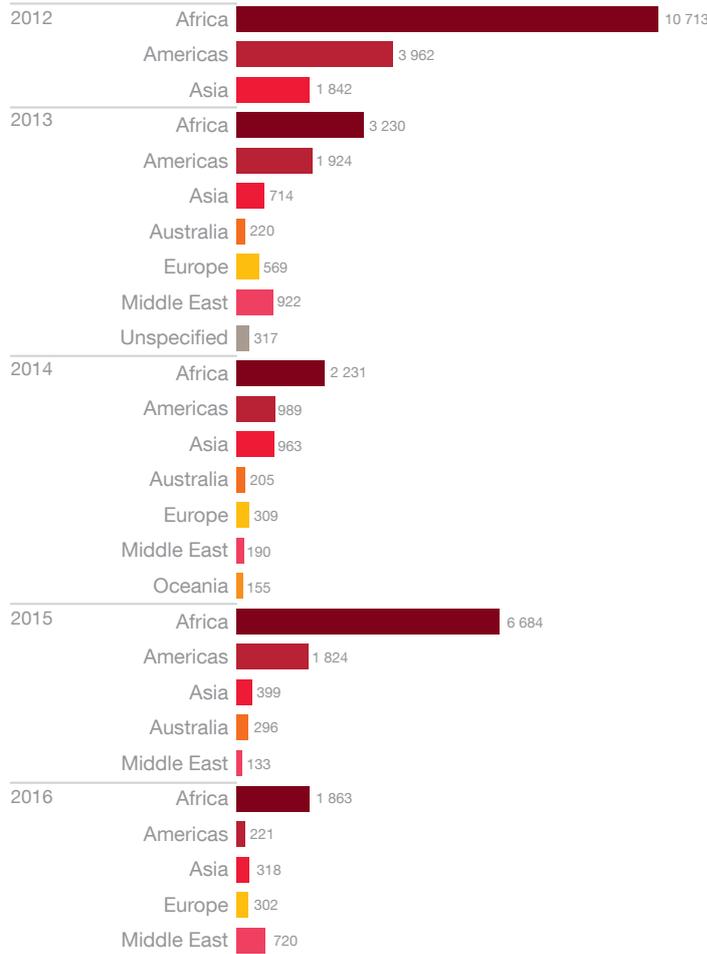
Africa is also leading the pack with several of the top discoveries to-date in 2016. Again, they are mostly gas, and they were split equally in number between Angola, Egypt and Senegal.

Most significant oil and gas discoveries in Africa, to July 2016

Global Ranking	Discovery	Country	Operator	Resource	Estimated resources (million BoE)
1	Teranga	Senegal	Kosmos Energy	Gas	538.8
3	Ahmeyim	Senegal	Kosmos Energy	Gas	435
4	Zalophus	Angola	Cobalt	Gas	397.6
5	Golfinho	Angola	Cobalt	Liquids	296.4
8	Nooros East	Egypt	Petrobel	Gas	122.2
11	Baltim South West	Egypt	Eni	Gas	73.1

Source: Rystad Energy (chart updated after initial document publication)

Figure 7: Million BoE of oil and gas in the top-20 discoveries of the year



Of the top-20 discoveries globally in 2015 and 2016, Africa had the greatest contribution compared to any other area – a trend that we’ve seen every year since we started this analysis in 2012. Key to this were discoveries in Angola and Mozambique, which account for 56% of the total top-20 discoveries in Africa since 2012 (by volume) and 33% of the total top-20 discoveries globally (by volume) since 2012. Most of these Angolan and Mozambican discoveries have been gas (77%). In addition, 95% of Africa’s discoveries in the top-20 since 2012 were offshore.

Another notable country on the African discovery list this year is Senegal. Significant offshore discoveries were made by both Kosmos Energy (gas) as well as Cairn Energy (oil). This activity has the potential to be play-opening for Senegal, and the country does offer relative political and economic stability. We would expect to see more international oil & gas players entering this area.

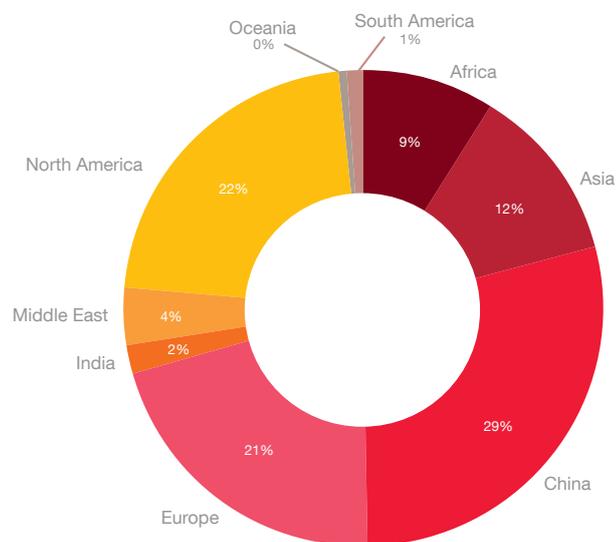
Source: Rystad Energy (chart updated after initial document publication)

Foreign direct investment

Respondents expect foreign direct investment (FDI) to originate from three main regions: China, North America and Europe. This is the same as in the previous year; although, there has been a shift in emphasis towards investments from the Far East.

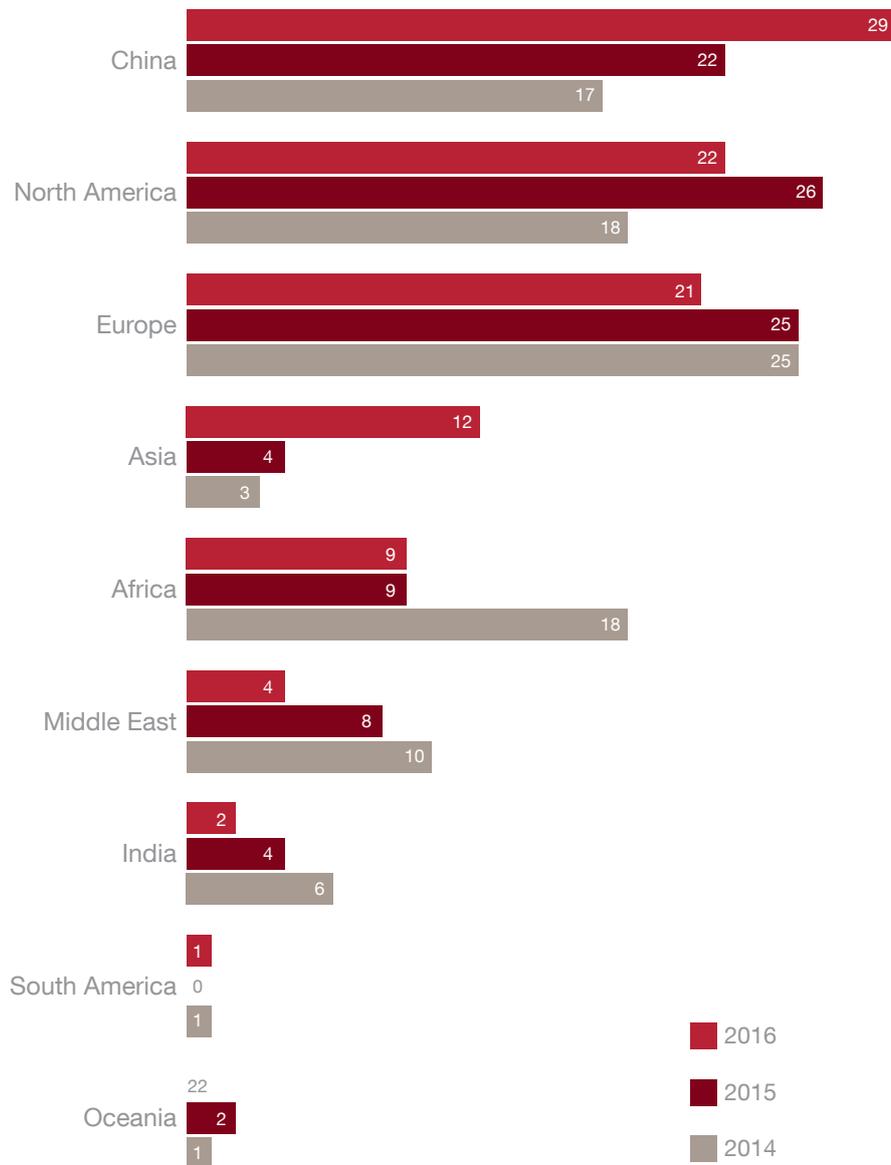
While the industry outlook may not be entirely optimistic, there is reason to invest in Africa – particularly as it accounted for 57% of the reserves discovered in this year’s top-20 discoveries.

Figure 8: Sources of foreign direct investment, 2016



Source: PwC analysis

Figure 9: Contribution to FDI in Africa by region, 2014-2016



Source: PwC analysis

There are no other significant changes from the previous years' reviews; although, the expectation is that China's FDI into Africa will increase over the coming years.



Capital spending

We know that oil & gas companies have tightened their belts in an effort to reduce costs, but the question of how much costs have been reduced by remains.

Looking at overall capex spend and exploration in 2015 compared to 2014, we see that the total is only down by 16.4% year on year.

Pure exploration capex, however, is down by 38.4%. North Africa actually saw a slight increase in capex spend compared to 2014, while East Africa, Southern Africa and West Africa all saw sharp declines in exploration spend. The largest exploration spend in 2015 was in Angola, Egypt, Morocco, Mozambique and Nigeria.

Capital spending, 2010-2015 (US\$ millions)

	2010	2011	2012	2013	2014	2015
East Africa	2 422	2 272	4 656	4 770	4 301	2 597
Capex	566	571	613	761	751	951
Exploration capex	1 856	1 701	4 043	4 009	3 550	1 646
North Africa	27 281	22 255	22 353	21 323	19 311	18 179
Capex	21 321	15 606	17 539	17 425	15 910	14 740
Exploration capex	5 960	6 649	4 815	3 898	3 401	3 439
Southern Africa	322	398	1 346	2 574	1 232	283
Capex	180	282	388	398	206	122
Exploration capex	142	115	957	2 176	1 026	161
West Africa	47 024	49 508	45 950	51 599	62 013	51 548
Capex	40 923	43 077	37 738	43 282	51 239	45 248
Exploration capex	6 101	6 431	8 213	8 317	10 774	6 301
Total	77 050	74 433	74 305	80 266	86 857	72 608

Source: Rystad Energy

Tough questions to ask about the future

- Is there an opportunity to undergo a merger or acquisition in order to drive improved efficiencies through a new group?
- Should you invest in LNG infrastructure? This includes LNG processing facilities or assets to stimulate demand for LNG.
- How widely are you looking to see how your industry could be disrupted? Have you undergone a scenario planning exercise in which you consider how trends such as changing consumer attitudes to energy, a shift in the transport industry, rapid urbanisation (and many other changes) could disrupt the energy industry?

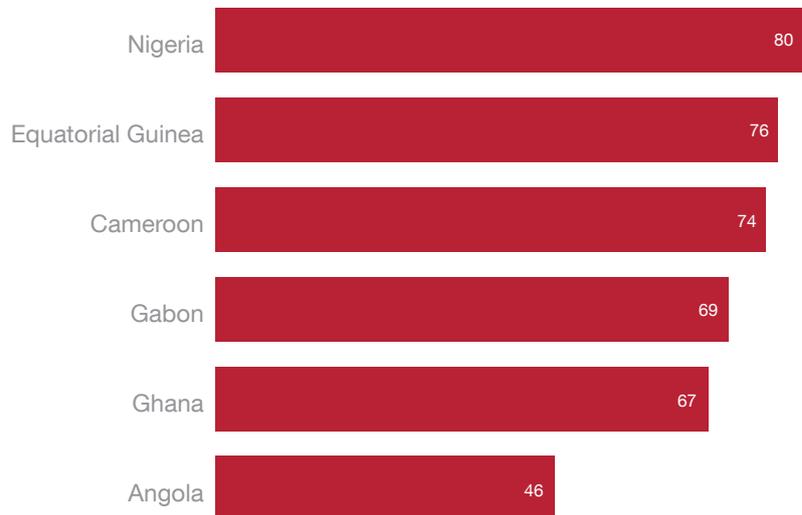
Dependencies

Oil price impact on oil-rich African nations

The low oil price has afforded some gain to crude oil importers like South Africa, Kenya and Ethiopia and end consumers, but the African exporters have been hit hard. A number of Africa's top oil producers, including Nigeria and Angola are being significantly impacted since the majority of their fiscal revenues originate from crude sales, and they are struggling to cope with the low oil prices.

A critical consideration is the break-even oil price that sits at almost US\$80 for Nigeria, which is far above where we are at today.

Figure 10: Break-even oil price (US\$/bbl)



Note: The break-even (BE) oil price indicates at which flat real oil prices the continued operation of the assets is commercial, as seen from current year, i.e. the oil price required for a positive NPV of continued operation. The BE price is calculated at the asset-level, meaning the particular asset's ownership (NOC vs Majors) would determine whether it refers to the country's or the company's budget.

Source: Rystad Energy (cube)

While some nations are taking advantage of the low oil price environment to fill up their strategic stocks, most African countries have not developed the infrastructure capacity to stockpile, and the exporters of crude can expect to carry high stocks.

The upside for oil & gas companies is that the cost of services in the oilfield sector is believed to have dropped by approximately 30%, which at least softens the blow of low oil prices to a degree.

Nigeria

Nigeria, as the biggest African oil exporter, is not only affected by the decline in the oil price, but also by the reduced production due to the severe security issues onshore and increased piracy incidents. This is adding an additional layer of complication, causing hesitation among oil Majors to invest further. Consequently, many are considering postponing additional investment.

Considering Nigeria's dire situation, the newly-elected president made promises to wean the Nigerian economy off its dependence on oil revenue and to cut corruption. There are plans to improve tax collection and cut costs within government. Fuel subsidies were cut, which hiked the fuel price by 67.7% in May 2016.

The country has imposed limits on the availability of foreign currency and has used reserves to control inflation of the currency. However, with no additional revenues flowing into the government coffers, this is only a short-term solution.

The Nigerian Content Development and Monitoring Board (NCDMB) has made a clear statement that despite the substantial drop in crude oil prices, the Nigerian content requirements for new and current oil & gas projects will not be reduced.

Angola

Angola has the least diversified economy in the world after Iraq, and approximately 95% of its exports are crude oil. No less than 80% of the country's consumables are imported. The National Bank has limited foreign currency; the Kwanza has devalued considerably, and the shelves in the shops are empty, while fuel prices have gone up.

Public services have been cut to reduce government spend, resulting in rubbish on the streets and a yellow fever outbreak. With the finance ministry borrowing additional funds this year, the total debt of Angola is equivalent to just under 60% of GDP, and the outlook is grim.

Angola has very prospective acreage in the deepwater, ultra-deepwater and pre-salt areas, but due to the nature of such fields, they can all be defined as high-risk, high-reward plays. In a low oil price environment, the appetite for risk is lower, and capital expenditure is cut back, which might result in a slowdown in exploration activity despite the prospectivity of the acreage.

Mozambique

Mozambique, with its impressive projects outlook, undertook reforms to the country's fiscal and licensing regime to address some investor concerns. The recent fifth bidding round has received six successful bids with participation from oil Majors. This is a show of confidence in the local oil & gas sector despite the current downturn.

Government has also approved ENI's development plans for the first phase of its Coral Floating Liquefied Natural Gas (FLNG) development, and the final investment decision (FID) is expected to be made in 2016.

Timing for the onshore Afungi terminal is still uncertain, and low oil and LNG prices as well as infrastructure challenges will most likely delay FID. It is, however, expected that exploration and development will proceed slowly due to the low oil price environment and that the license holder is waiting for the export projects to come online before proceeding.

It has recently been rumoured that additional Majors are taking an interest in entering Mozambique despite the recently uncovered debt scandal in the country. Back in May this year, donor nations and donor institutions that contributed to Mozambique's state budget decided to temporarily freeze funding due to the US\$1.4 billion in hidden debt that was uncovered.

Overall, low oil prices and a general expectation of a slow recovery over the next five years will reduce the commercial attractiveness of high capital ventures in the foreseeable future. This, combined with political instability, an uncertain regulatory outlook and widespread corruption, makes Africa a high-risk region, despite its substantial resource base.

Tough questions about areas of play

- Do you have the right strategy to deal with a low oil price environment? To what degree have you considered operational excellence, asset management and optimisation?
- What changes are you making to your growth strategy in emerging and frontier economies to take into account key structural and political issues in these countries, as well as their dependency on oil?

Sustainability

Consumers' attitudes to energy are changing: the green economy is finding its momentum.

New discoveries are not the only basis for sustainability

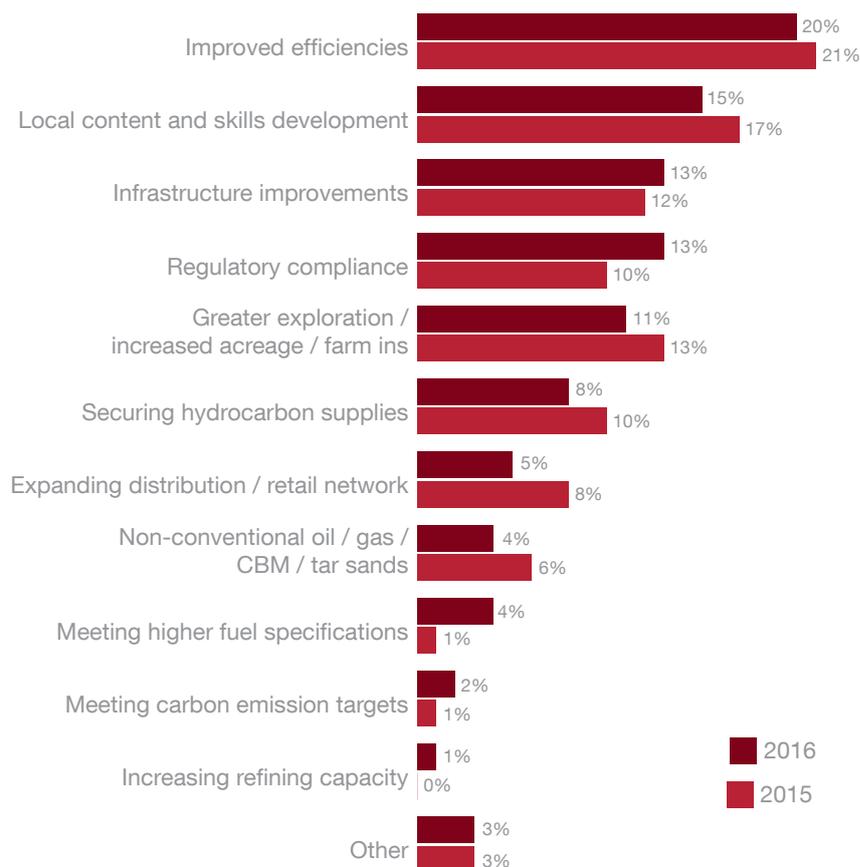
We asked respondents which key areas they would invest in to realise growth over the next 3-5 years. Improved efficiencies ranked highest, followed by local content and skills development, and infrastructure improvements – similar results to the previous year.

Greater exploration / increased acreage / farm ins have decreased as a key investment driver since last year – down two positions. This is likely in response to low oil and natural gas prices.

In order to remain sustainable, companies are needing to look beyond new discoveries. Improved efficiencies and operational excellence is a path many respondents are considering.

However, the sustainability of the industry will be affected by a number of drivers. These include the price of oil, impact of renewable and alternative energy sources, emergence of new competitors, environmental consequences of the industry, legislative frameworks and government takes.

Figure 11: Key investment drivers over next 3-5 years



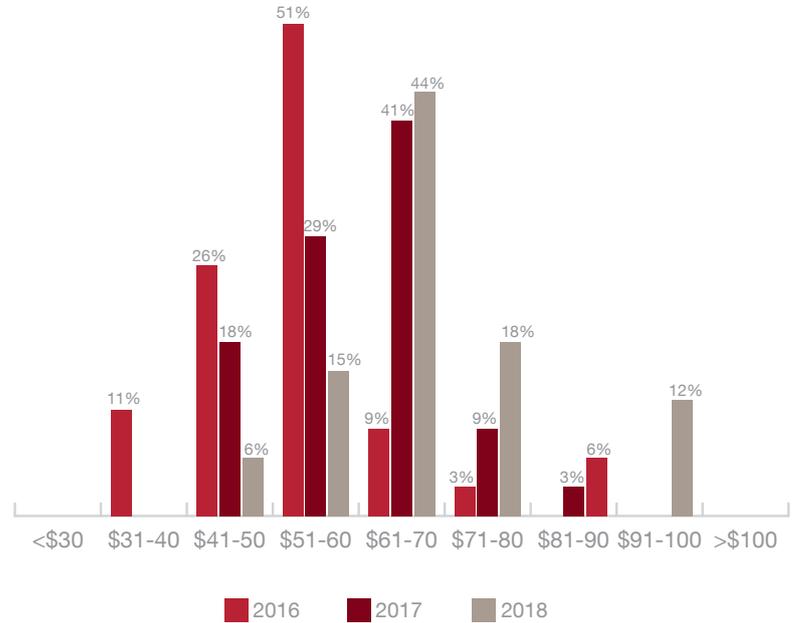
Source: PwC analysis

The bottom of the barrel

Respondents expect the oil price to increase in the future – the distributions are shown in Figure 12. The average expectation is also shown, with respondents expecting the oil price to reach US\$52 by the end of 2016, US\$60 by the end of 2017, and US\$69 by the end of 2018.

Figure 12: Average expected crude oil prices (US\$), 2016-2018

Q: What oil price do you expect at the end of the next three years?

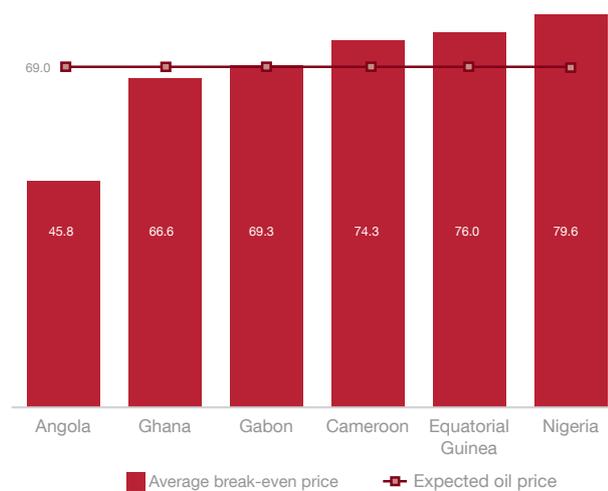


Source: PwC analysis

While an increase in oil price is good news for the industry, the average expected increase is worrying for many oil producers. Figure 13 shows the average break-even price in certain African economies (in 2016), compared to the expected oil price in 2018.

Clearly, there is reason for concern. Without an unexpected increase in oil prices, companies operating in many countries will need to look at improving their operational efficiency and/or cost cutting.

Figure 13: Average break-even price in 2016 compared to expected oil price in 2018 (US\$)



Source: Rystad Energy and PwC analysis

Infrastructure

Basic as well as technological infrastructure is essential to a thriving oil & gas industry. Twenty percent of respondents think that inadequacy of basic infrastructure will have a significant impact on their business over the next three years – with 73% expecting it to have an unchanged impact or no impact.

Similarly, 20% of respondents expect technology to have a significant impact on their business over the next three years, but only 3.43% rated technology infrastructure as a top strategic focus area over the same period. This might indicate that while many companies acknowledge the importance of technology, not all are able to exploit digital opportunities or are uncertain about the best way forward.

LNG as an option

LNG is the cleanest-burning hydrocarbon (as it is primarily methane), meaning that it has potential to be used as a bridging fuel as the world moves away from high-carbon fuels to renewable energy.

According to the latest *BP Statistical Review of World Energy*, Africa accounted for 6% of global gas production, and 3.9% global gas consumption in 2015. However, this could change as energy giants such as Total and Royal Dutch Shell are considering building infrastructure in new markets, in order to create a market for LNG.

As the growth in gas slows and prices decrease, supply could exceed demand. Companies are considering creating new markets by building gas-fired power plants, pipelines, storage terminals and other gas facilities in countries such as Côte d'Ivoire and Ghana.

Overall, Shell's CFO, Simon Henry believes that the number of markets buying LNG could double by 2030.²

In terms of LNG supply, the top-20 discoveries of 2016 in Africa have been primarily gas. According to the IEA's *Oil Medium-Term Market Report 2016*, Angola is expected to increase gas liquids capacity by 70 kb/d to 140 kb/d in 2021. This is after the much anticipated start-up of LNG in Angola in 2016, after the plant was shut down in 2015 because of a gas leak.³

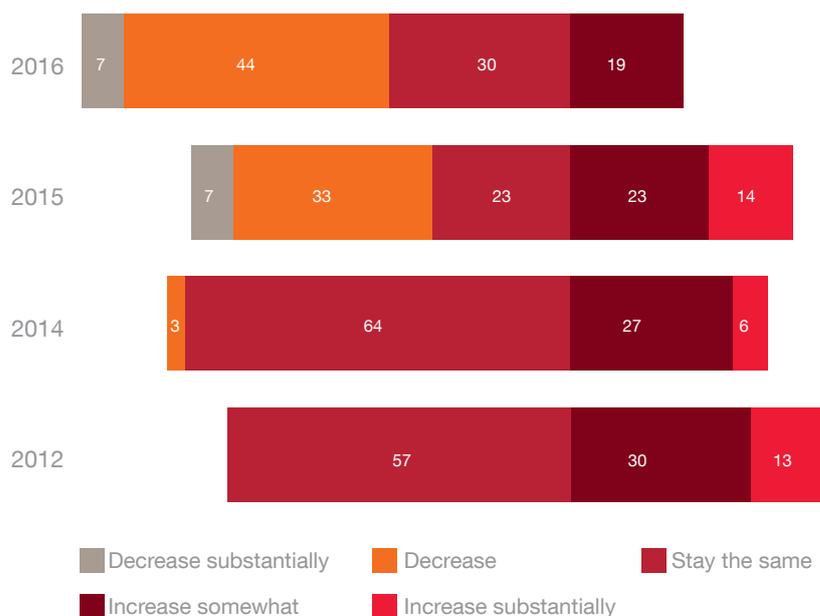
Acreege and licence costs

Acreege and licence costs form a key part of the business case when deciding whether to develop a field. This year has seen the most positive response since this survey started with the lowest percentage of respondents anticipating price increases. Just over half expect the price to decrease or decrease substantially. This is likely due to the decreased oil price, ultimately devaluing acreege/licences.



Figure 14: Expected changes in acreege and licence costs

Q: Over the next year, what do you expect to happen to acreege / licence acquisition costs?



Source: PwC analysis

² Ron Bousso and Oleg Vukmanovic. "Coming wave of gas puts focus on finding new shores". LNG World News. www.lngworldnews.com/coming-wave-of-gas-puts-focus-on-finding-new-shores/

³ "Oil Medium-Term Market Report 2016". IEA. http://www.iea.org/bookshop/718-Medium-Term_Oil_Market_Report_2016

Impact of renewables / alternative source

The expected demand for alternative or renewable energy has reached its highest position among the 23 factors that will impact business over the next three years since we started this analysis in 2012.

Just over a quarter of respondents (27%) believe that this will have a significant effect on their business over the next three years.

While global demand for affordable, reliable energy will continue to grow for the foreseeable future, the world is transitioning to a low carbon energy system. Peak demand for oil and gas may well be on the horizon, with fossil fuels representing a declining proportion of the energy mix. Market dynamics have also changed; OPEC is focused on protecting market share and US shale represents a substantial source of new, and flexible, supply. Given these rapidly evolving industry dynamics, looking beyond the near term has become much harder, but this has never been more important.

At PwC, we created four future scenarios (which we call the 'new energy futures') – and we believe that a combination of government intervention and consumers will play a role in a greener energy industry.

These possible futures look very different. Some aspects of each of the four perspectives represents a significant move away from the current position, while others continue current trends. In practice, of course, no single perspective is neatly 'ring fenced'. Nevertheless, by thinking carefully about and expanding upon these different perspectives, companies will be able to evaluate their current strategy and plans, as well as consider the implications for their operating model, partnering strategies, resourcing and technical capabilities.

Consumers' attitudes to energy are changing; the green economy is finding its momentum. We're seeing a more connected and informed consumer – which includes a growing number of middle-class consumers in developing nations – that are demanding more transparency and information on the environmental impact of products.

Furthermore, individuals are choosing to make greater use of low-impact transport options. For example, shared consumption is a trend that is becoming more and more prevalent. Car-sharing is one part of this sharing economy that has increased in popularity. Although this trend is not yet occurring across Africa, it is becoming more popular in South Africa and is expected to pick up in popularity as economies develop. Another social movement is being facilitated by social media with consumers applying pressure through media campaigns to 'name and shame' energy companies viewed as environmentally damaging.

Governments are also playing a role. Globally, we've seen activity by China in driving a green agenda. In 2014, China published the *Energy Development Strategy Action Plan (2014-2020)*, which aims to establish more efficient green and innovative energy production and consumption.

In 2014, the largest renewable energy investments were made in China – a record of \$83.3 billion (nearly a third of global renewable energy investments). The Chinese Government also invests more than any other government in R&D for renewable energy.

A more specific example is how China promotes electric vehicles. Growth in electric vehicles (EVs) is being stimulated by the Chinese Government through regional investment subsidies for EV manufacturers, and through tax exemptions on the purchases of EVs. However, government influence does not need to be so extensive. For example, in South Africa, government housing projects typically require that the new houses are equipped with solar geysers.

In a world where consumers and governments are driving the green agenda, it's no surprise that this factor has risen so dramatically in significance. Companies are asking themselves questions like: Will upstream oil companies end up with stockpiles of 'unburnable' reserves? If so, when? And does it make sense to decrease or abandon exploration activity?

Downstream players have started to consider whether they will need to alter their infrastructure to accommodate more biofuels, or implement emission abatement. Lastly, will the capability to process natural gas as a transition fuel become a key strategic asset?

There are no easy answers to these questions.

We believe that companies need to review their business strategy and focus on their core capabilities and where they can outperform the competition. As demand for fossil fuels decreases, it's crucial that organisations do not over-invest in legacy areas. This is not to say that companies should radically change their portfolios.

We don't think exploration and production oil companies will be out of business in 20 years, but we do believe that these companies will need to focus on reducing their environmental footprints in the short term.

For example, Statoil has launched an ambitious internal project to review every turbine and compressor it operates on the Norwegian continental shelf, intending to upgrade or replace equipment as needed to increase energy efficiency, and ultimately decrease its carbon footprint.

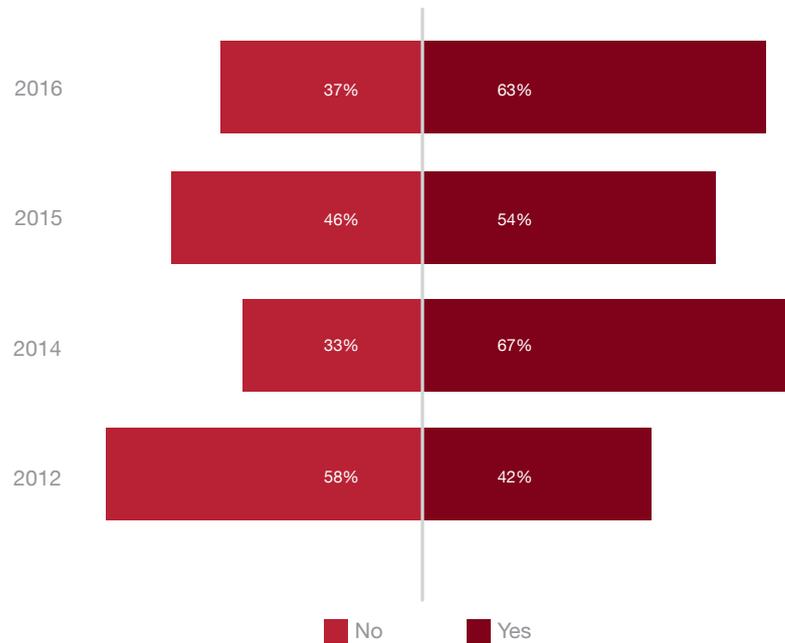
Furthermore, oil & gas companies should consider linking their investment programmes to options that are suitable for a more carbon-constrained operating environment. This may be best achieved through incremental diversification into low-carbon technologies. This will help companies to remain profitable as fossil fuels are phased out.

A recent example is the purchase of BG Group by Royal Dutch Shell in November 2015 – making RDS the world’s largest LNG trader. Consideration should also be given to acquiring or managing renewable energy sources such as wind, solar and biofuels.

Change in competitive environment

Figure 15: Expected changes in the competitive environment

Q: Do you anticipate a change in the competitive environment with new competitors entering the region in which you operate in the next five years



Source: PwC analysis

New competition has consistently been ranked as one of the least significant perceived challenges in our survey. This year, it ranks 13 (2015: 14). However, this view does differ across the value chain, with 75% of service companies concerned about competition.

While we don’t foresee the emergence of a group of new oil producers in the short term, the industry is changing. Competitors may emerge from different industries, or from another part in the energy ecosystem.

The use of oil in transport is probably most under threat. Vehicles are becoming more efficient, and there is an emergence of electrical vehicles and vehicles powered by biofuels. While the transport industry may not revolutionise in the next five years, we expect to see radical changes in the longer term. The trends strongly suggest that electrical transport or biofuels will become a significant part of the future, which is a significant competitive threat.

Perhaps the most well-known in the space is Tesla. Tesla is widely known for its electric vehicles, but they are also involved in battery manufacturing, creating relatively large batteries that will be used for energy storage in homes and businesses.

The Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil.

Sheikh Ahmed Zaki Yamani, former Saudi Arabian Oil Minister

The CEO of Tesla, Elon Musk, recently mentioned that he thinks the company could also sell grid battery services, which would use software to help optimise the grid.⁴ While this is not formally planned, it shows an intention to create an ecosystem that will support the sustainable/renewable energy sector, and so such activities should not be underestimated.

Prioritising environmental and development imperatives

This year, scarcity of natural resources dropped eight places among the factors expected to have the most significant impact on business over the next three years. This might not be because this factor is not important, but because it is not as urgent as others, as 79% of respondents think that it will have the same impact as it does today.

Other research findings share this view. In the *PwC's 19th Annual Global CEO Survey*, we asked CEOs to what extent they are making changes in how they minimise social and environmental impacts of their business operations in response to changing stakeholder expectations. Only 8% said they were making no change.

In the same survey, we asked oil & gas CEOs in which of a number of areas they thought their business should be doing more to measure/communicate impact and value for wider stakeholders. Thirty-five percent think they should do more to measure environmental impact (ranked 3rd out of 10 categories).



Perhaps most telling is the attitude of oil & gas CEOs to the profit imperative: 70% agree that business success in the 21st century will be defined by more than just financial profit – suggesting an acknowledgement of prioritising environmental sustainability.

There has also been new commitment by nations across the globe to move away from fossil fuel production and consumption. In June 2015, the G7 called for the phasing out of petroleum-based energy by the end of the century.

In December 2015, the Cop21 summit in Paris agreed to a goal to limit global temperature increases to less than two degrees Celsius above pre industrial levels and to reach net-zero greenhouse gas emissions by 2050.

Tough questions about sustainability

- Should you alter your investment portfolio to include (more) renewable/alternative sources of energy? What is the right mix?
- How do you respond to changing customer needs, particularly to those who expect greener energy and increased transparency?
- To what degree should you invest in making your operations more 'green'?
- With the possibility of competition emerging from a variety of industries, and emerging business models often enabled by new technologies, how do you ensure your future in the energy sector of tomorrow?

⁴ Katie Fehrenbacher. "Elon Musk Says Tesla Will Likely Sell Power Grid Services". *Fortune*. July 28, 2016. <http://fortune.com/2016/07/28/elon-musk-tesla-grid-services>

The Africa diagnostic

Policymakers' understanding of the industry

For the third year in a row, the uncertain regulatory outlook again ranks among the top-five challenges to developing an oil & gas business in Africa. Forty-five percent of respondents rated it as their biggest challenge, and 70% rated it as one of the five biggest issues they experience.

There has been an appreciation from various governments that in the current climate, a fair and competitive regulatory framework is needed more so than in a high oil price environment.

Local and foreign investors carefully consider where to spend their reduced budgets, but it seems that not enough has happened on the part of authorities other than inklings of reforms being planned and discussed. There is likely still a need to educate decision-makers in government to facilitate a platform that assists growth and development and instils investor confidence.

Policy developments

South Africa

There have been commitments to address industry concerns since 2015, and the intention of Government to separate regulations for oil & gas from the mining industry was communicated. The fact remains that the Minerals and Petroleum Resources Development Act (MPRDA) has not yet been changed and approved to reflect such modifications.

Nigeria

The Government has failed to pass the Petroleum Industry Bill (PIB), but there appears to be new impetus under President Buhari to achieve operational, fiscal and regulatory reforms. Until the PIB is passed, however, regulatory uncertainty remains.

Tanzania

The regulatory environment remains uncertain despite the promulgation of the Petroleum Act in 2015. The Act allows for increased involvement of central government, fuelling investor fears of further project delays. The likelihood of increased local content requirements due to violent protests in 2013 over the Mtwara pipeline, very limited infrastructure and an insufficiently skilled labour market emphasise the need for a stable regulatory environment if Tanzania is to avoid further delays and stay on the map for future LNG developments.

Libya

A recent announcement that the two opposing sides are progressing towards unifying the National Oil Company by signing a memorandum of understanding is a positive step. But there are still severe concerns over security, damage to existing infrastructure and poor fiscal and licensing terms, despite the country holding the largest proven oil reserves in Africa. Regulatory reforms are crucial for the country to attract investment.

Egypt

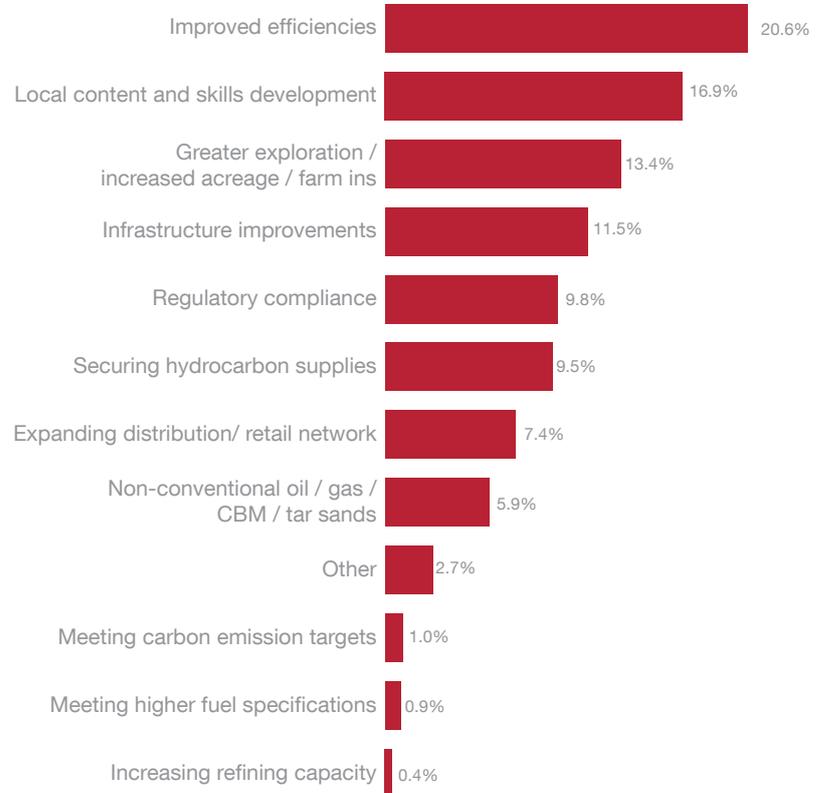
Considerable investment was committed over 2015, which seems to indicate that the Government intent to create a conducive environment for investment is succeeding. The Government is seen to have streamlined its approval processes, has committed to paying back its debt to the oil & gas companies and has allowed gas pricing structure negotiations based on field conditions. Gas produced from new concessions can be sold directly without going via Government.

Compliance with local regulations are an acknowledged requirement to operate in the sector, and it comes as no surprise that respondents once again listed regulatory and environmental compliance among the top-five areas in which they will invest to grow their operations over the next 3-5 years.

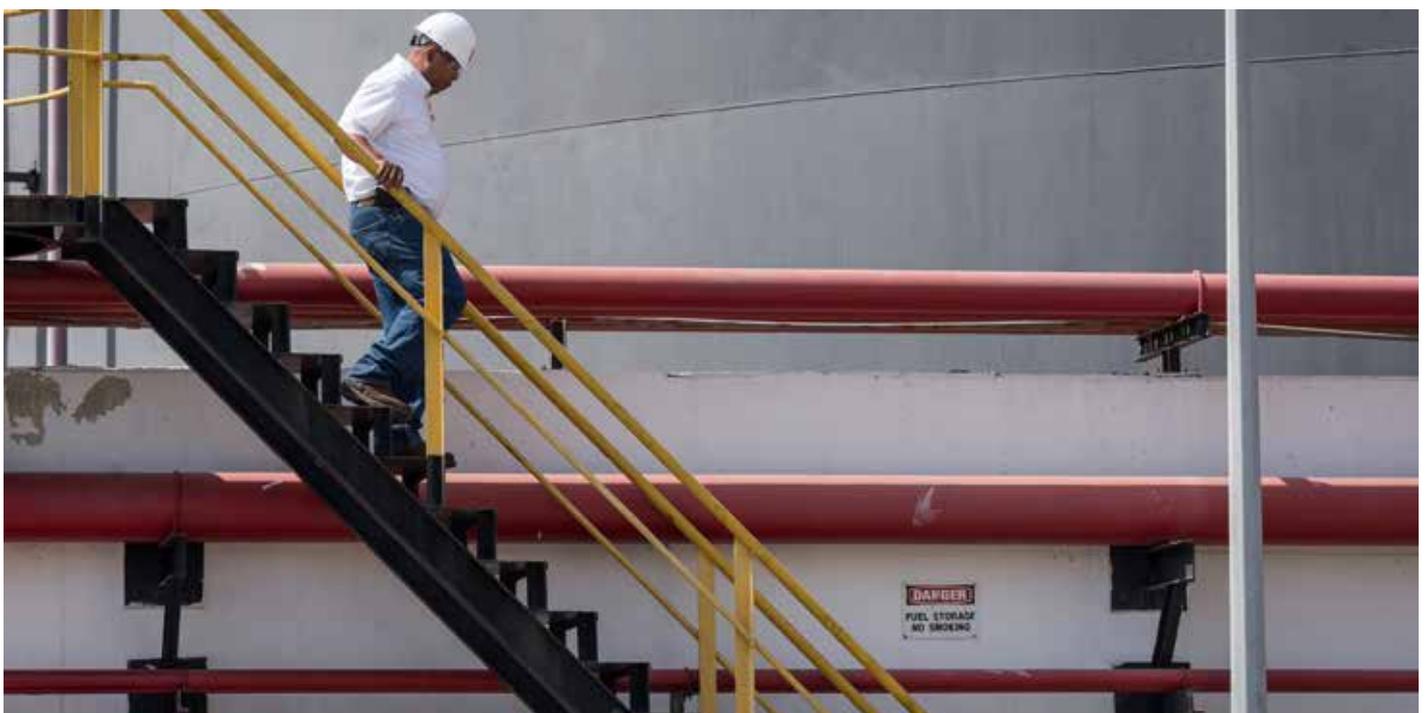
More than 59% of respondents believe that regulatory compliance will have a significant impact on their businesses over the next three years.

Figure 16: Key focus areas for capital expenditure

Q: In what key areas will you focus your capital expenditure over the next three years?



Source: PwC analysis



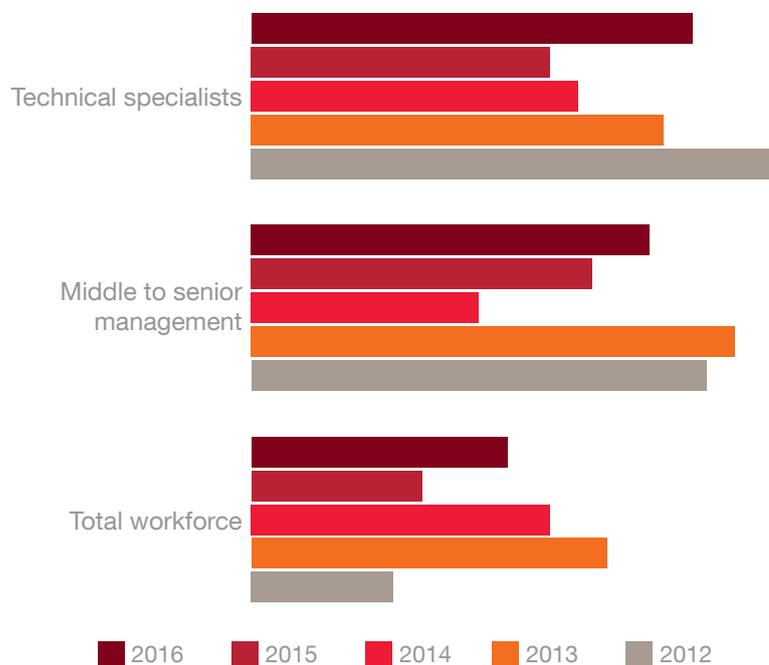
Regulating local content and skills development in a complex world

A skilled local workforce and suppliers nearby makes business sense and is in the interests of any Government. How to best achieve this goal is different for every country. Country-specific local content regulations dictate the path but are not necessarily achievable. In addition, skills shortage on all levels of the workforce remains an issue.

The presence of more expatriates in middle and senior management and among technical specialists remains consistent with the past findings.

Figure 17: Percentage of expatriates in the workforce

Q: Approximately what percentage of your workforce are expatriates?



Source: PwC analysis

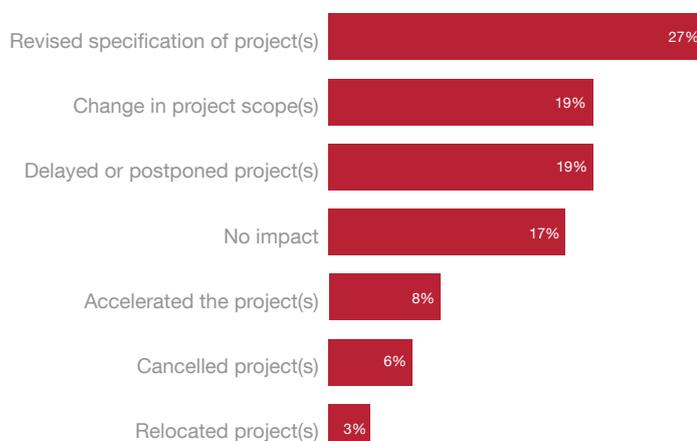
The impact of local content on investment decisions

Respondents' feedback suggests that revised specifications for projects are a frequent consequence of local content requirements, which also suggests that companies know how to deal with the varying rules in different countries and can adjust where necessary.

Few respondents indicated that local content regulations led to cancelling or relocating their projects, but about one-fifth confirmed that projects have been delayed or postponed as a direct consequence of localisation requirements.

Figure 18: Impact of local content requirements and regulation on investment

Q: How have current / proposed local content and regulatory policies affected your investment decisions?



Source: PwC analysis

Compliance with local content requirements

More than 60% of respondents indicated that they are more than 75% compliant with local content regulations in their countries of operation. The level indicating full compliance remained steady at 52%.

The established oil & gas players in Africa recognise the importance of local capacity development programmes, and emerging players are following suit, taking into consideration lessons learned from their peers.

Reaching for quality higher education

Local content has been a requirement for many years in resource-rich countries with low skills and industry participation levels, and it's here to stay. One of the challenges in the oil & gas sector is a generally higher entry barrier because technology and jobs tend to be more complex, highly specialised and costly.

In addition, international certifications such as ISO, API and ASME, concerns for environmental integrity of the work and the insurance requirements are heavily burdensome.

Lastly, the scale required by oil & gas projects usually surpasses local capacity. A lack of access to funds to upscale, a missing track record and a non-existent credit history with the client are other aspects hindering local entities from entering the oil & gas value chain.

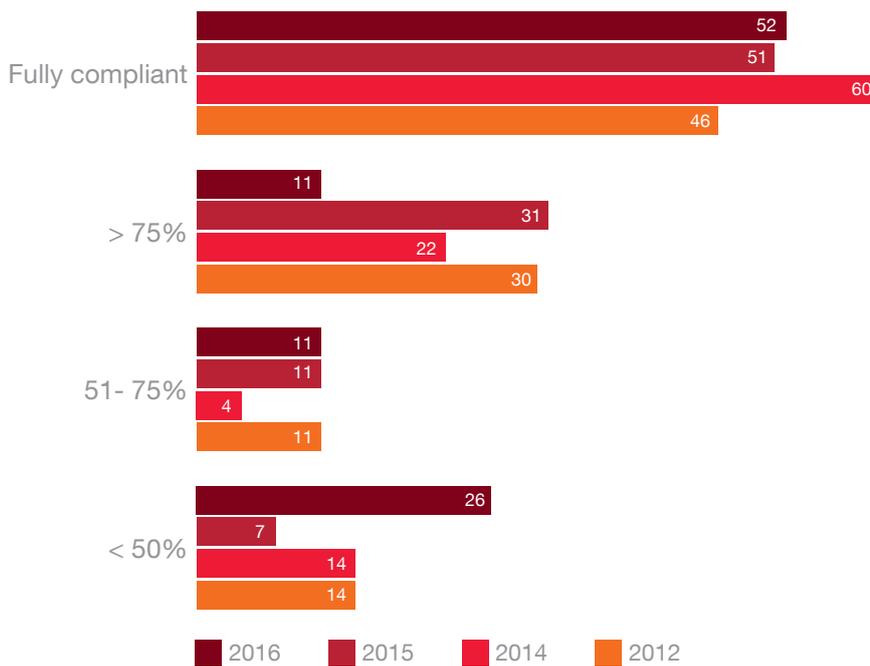
The opportunity for easier entry lies in the construction stage of oil & gas projects where there might be a chance for semi-skilled trades, such as electrical, welding, fitting and transportation services.

For countries whose economies are built on their hydrocarbon resources, however, it is essential to also focus on higher education. There are a few good examples where oil companies team up with national governments to offer tertiary oil & gas tuition at local universities to allow for these higher qualifications to be home-grown.

One example is Nigeria's Institute of Petroleum Studies at the University of Port Harcourt, which evolved from collaboration with the IFP School in France with sponsorship from Total E&P Nigeria and the Nigerian National Petroleum Corporation (NNPC).

Figure 19: Level of compliance with nationalisation and local content requirements

Q: How compliant are you with the local content regulations and charters in respect to nationalisation and local content of your business?



Source: PwC analysis

Respondents identified local content and skills development as the second most important investment driver over the next three years, much in line with last year's survey results.

Another unique approach to the development of sustainable petroleum education programmes is the formation of the master's degree programme in petroleum engineering (MSPE) at the University of Eduardo Mondlane (UEM) in Maputo, Mozambique. The programme was launched in February 2014 and is sponsored by Anadarko and the Area 1 participants. It is a collaboration between UEM, Anadarko subject matter experts and US professors from leading petroleum engineering programmes.

Most oil rich countries have introduced and are pushing their local content programmes. Angola, for example, has introduced a training fund to which foreign companies have to contribute.

Ghana has regulations outlining employment, training and procurement requirements as well as monitoring and enforcement mechanisms, while Nigeria has established a Content Development and Monitoring Board (NCMDB) to monitor compliance of the oil companies with their local content acts.

It is suggested that individuals working for local content policy implementers also require adequate qualifications so that they fully understand the challenges and opportunities in the sector to assist in creating an enabling environment that attempts to achieve common goals with international players, rather than following a rigid road that does not achieve the desired end result.

A government that is serious about local content development should create an enabling environment. Conducting a skills, capacity and funding gap analysis to understand the country's limitations is a first step.

Once shortcomings are identified, training local businesses on standard operating procedures like quality, health & safety, acquiring international certifications, teaming up with the industry to provide fit-for-purpose skills development and providing local sector intelligence by informing local companies about opportunities in the sector is the way forward to building a sustainable local component in the oil & gas value chain.

Tough questions about skills and local content

- How are you getting the visibility that you need to ensure that skills are being deployed effectively in your organisation?
- Do you fully understand the local content requirements for the countries in which you operate?
- Do you understand and utilise the oil & gas value chains in your countries of operation?
- Are you measuring how diversity and inclusiveness contributes to your bottom line?
- How are you ensuring that your organisation has access to the skills it needs now and in the future?
- What strategies do you have in place to ensure that you are looking as widely as possible for talent?
- How are you working with government to create better outcomes for customers and employees?

The digital oilfield

The oil & gas industry operates in a challenging environment.

With depressed oil prices, it is not surprising that many businesses are looking to cut costs and increase operational efficiency.

Strategy&⁵ analysis showed that revenue from the 18 leading upstream, midstream and oilfield services companies in the US decreased by 40% between Q3 2014 and Q3 2015.

Over the same period, operating expenses declined only 9%, and we believe that the reason for this is that traditional methods of cost optimisation are reaching their limit, due to the high fixed costs associated with the industry. Digital transformation may be the answer.

What is digital?

At PwC, we think of digital as an **enabler**. It's a way of doing things underpinned by the technology trends of social media, mobile computing, analytics (big data), cloud computing and cyber security (SMACC).

Digital means that companies and individuals can use new technologies to achieve a variety of outcomes in a variety of ways previously unimaginable or non-feasible.

Digital in oil & gas is not just about technologies. It's about redefining the operating model, simplifying underlying systems, empowering people and enabling deep organisational change.

Digital will be broader than the historical digital oilfield concept, which has a strong focus on oil and well production optimisation.

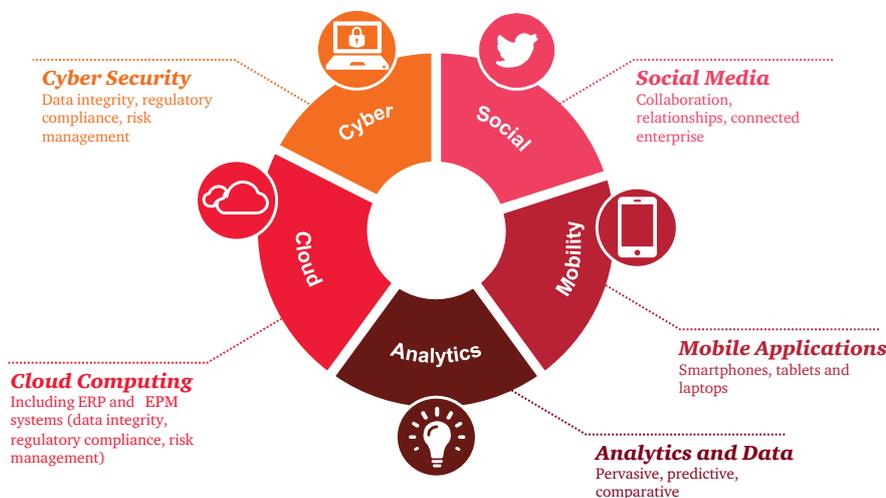
Some of the areas that are and will be affected include:

- Asset tracking;
- Safety alerts;
- Drilling data;
- Fleet management;
- Operations data;
- Inventory management;
- Equipment performance;
- Field data capture;
- Problem area scanning; and
- Facility optimisation.

Overall, digitisation is a key mechanism that companies can use to improve efficiency and margins. The industrial Internet of Things (IoT) makes digitisation work and generates tangible returns by creating several opportunities:

- Improving asset reliability;
- Boosting throughput; and
- Optimising field recovery.

The five elements of SMACC



*Digitisation is **not** an IT transformation programme – it's about rethinking your business.*

Source: PwC

⁵ Strategy& is PwC's global strategy consulting group

Digital technology in oil & gas

Inertia

Research has shown that oil & gas companies are slower to use new technologies – particularly in digital. For example, PwC's 19th Annual Global CEO Survey found that oil & gas companies are much less likely to use social media than the total survey sample (35% vs 50%, respectively).

In the survey, oil & gas companies rated data and analytics as the top connecting technology (59%), followed by CRM systems (52%). Crucially, oil & gas CEOs do not rate these technologies as highly as the total survey population (68% and 65%, respectively). In contrast, industries such as financial services rank these significantly higher at 70-80%.

We've seen that the energy industry is inherently conservative. Given the high capital investments, long payback periods and regulatory landscape, it's not surprising that the industry prefers proven solutions and has a long history of using one operating model.

This approach is similar to how the financial services industry behaved prior to 2008. IT organisations used the 2009 downturn as an opportunity to move to an asset-light and application on-demand model – a move which shifts fixed costs to variable costs that align to changing business environments.

Research by the Everest Group in 2014 showed that 45% of respondents in the financial services sector had existing cloud solutions, compared to a meagre 7% in energy and utilities.⁶ Furthermore, cloud spend in financial services has now grown from US\$4 billion in 2010 to more than US\$27 billion in 2015.⁷

6 "Cloud Connect Enterprise Cloud Adoption Survey". Everest Group. 2014. <http://www1.everestgrp.com/ccevent2014.html>

7 TowerGroup, Destination 2015: Spending on Cloud Computing in Financial Services, Arlington, VA, 2011

Themes of digital transformation in the industry

The digital revolution and technological breakthroughs that we are seeing are affecting businesses across all industries in a number of ways. While there are similarities in the way industries are being disrupted, there are also differences.

We believe that there are five major market themes that will have an effect on digital transformation in the oil & gas industry:

Themes shaping digital transformation in oil & gas

	The internet of things (IoT)	Falling costs of sensors and actuators along with the need for operational data that enable predictive analytics is driving the network of "things".
	Building alliances	A reduced appetite for M&A is forcing companies to partner effectively to build end-to-end solutions.
	Simplification and standardisation	Process and equipment standardisation across regions as a lever to streamline costs related to maintenance, repair and operations
	Solution-based buying	Companies are shifting from buying discrete services to solution-based buying thereby reducing risks with disparate interfaces and data.
	Knowledge transfer from international oil companies (IOCs)/NOCs to oilfield services (OFS) companies.	OFSs are investing in R&D to mitigate acquired risks and are collaborating with independent oil companies (IaCs) and NOCs.

Source: Strategy& / PwC

Capabilities

In order to make the most out of digital transformation, companies need the right capabilities to gain the right win. To become a digital player, oil & gas leaders need to assess their businesses' abilities in data management, operational analytics, asset optimisation, field surveillance, integrated field planning and delivery, and operations automation.

These capabilities will be needed across the entire oil & gas value chain.

Consider the capability of field surveillance: while this is normally considered for offshore surveillance, it is applicable throughout the extraction to refining lifecycle. For example, Shell has used remotely-operated aerial vehicles (ROAVs) to inspect plants.⁸ Inspection of a flaring stack typically required engineers to abseil down a 70m tower and forced the plant to shut down for two weeks. Today, the process takes hours and is significantly safer.

8 Shell, "Eye in the Sky". www.shell.com/inside-energy/eye-in-the-sky.html.

In our experience, there are six digitisation capabilities that companies should explore and apply to the oilfield.

Digitisation capabilities that can be applied to the oilfield.

Capability	'New oilfield' paradigm
Data management	<ul style="list-style-type: none"> • Use of well data in real time structured and meta data driven analysis • Automated decision-making and controls • Engineering information management
Operational analytics	Predictive alerting on issues Best/worst case scenarios defined and modeled automatically Analytics-as-a-service for repeatable solutions
Asset optimisation	Vastly improved asset utilisation by integrating asset tracking, sensor data , 3D modeling and the supply chain Proactive intervention through integration of ops, projects and financials
Field surveillance	Drone/Unmanned vehicle monitoring "All the data in the cloud" – but with ownership/control concerns Core processes driven by mobility Advanced alarming and safety alerts
Integrated field planning and delivery	Increasing convergence between traditional information and operational technology Integrated sub-surface, surface, and back office technologies Integrated supply chain operations and 3D printing for service parts
Operations automation	Automation of continuous processes (process control steps in daily operations) Automated monitoring (e.g. equipment monitoring) to predict maintenance and shutdowns Real-time work scheduling

Source: Strategy& / PwC

Example: The digital oilfield

Digital oilfields – also known as the online field – are one of the more promising applications of digital technology in the industry. According to Dr Nick Warren (former Group Facilities Engineering Manager for Tullow Oil):

A digital oilfield provides robust data aggregation and formatting resources capable of sending real-time reservoir, wellhead and plant operating data to one or more remote locations via satellite (if needed) and then over the internet. Its main advantage derives from multi-discipline end-use software than can be used to transform business performance and productivity. This software is extensive and powerful. It can be used for production reporting, to monitor KPI performance, spot adverse trends, evaluate possible solutions and identify the very best optimal solutions/outcomes by modelling them using predictive software. It makes competent end-users immensely more productive. They can, for example, identify in-fill drilling opportunities much more easily and future test them economically in advance using simulators.

Remote end-users can be located anywhere as long as they have internet access. Location in lower-cost regions is very doable and attractive to a small, dedicated but affluent/aspiring workforce.

During the drilling phase, experts can be engaged from any location on the planet, advising drilling teams on the rig itself on difficult wells in real-time. Once operations commence, the same applies in corollary, operations experts can again be engaged anywhere on the planet to help solve operational problems.⁹

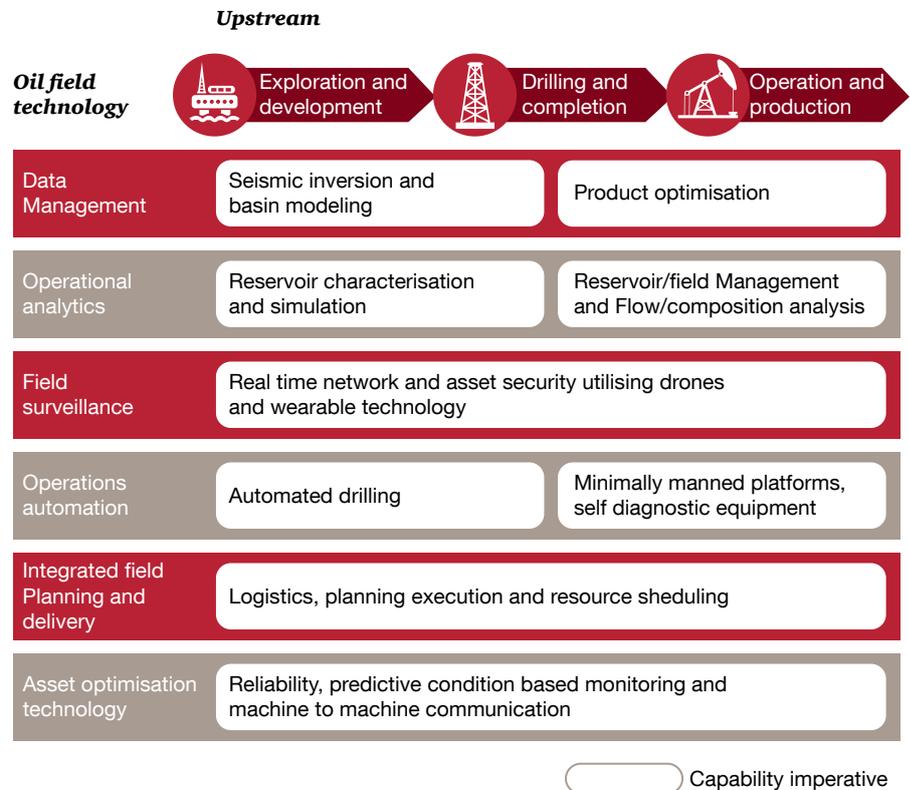
⁹ Nick Warren, "Upstream in peril? Has Digital Oilfield finally arrived?". Energy Global Oilfield Technology. June 2016. <http://www.energyglobal.com/upstream/drilling-and-production/27072016/Upstream-in-peril-Has-Digital-Oilfield-finally-arrived/>

Despite this, only 13% of upstream exploration & production companies and 17% of service companies in our survey cited digital oilfield applications as a factor that will play a role in the direction of their business over the next three years.

As discussed previously, digital technology is not only applicable to upstream operations, but the digital oilfield is one of the ‘standard’ digitisation journeys.

If we consider the capabilities discussed previously and apply them to upstream, we can define the capabilities more specifically.

Areas of digitisation that offer significant value creation opportunities



Source: PwC

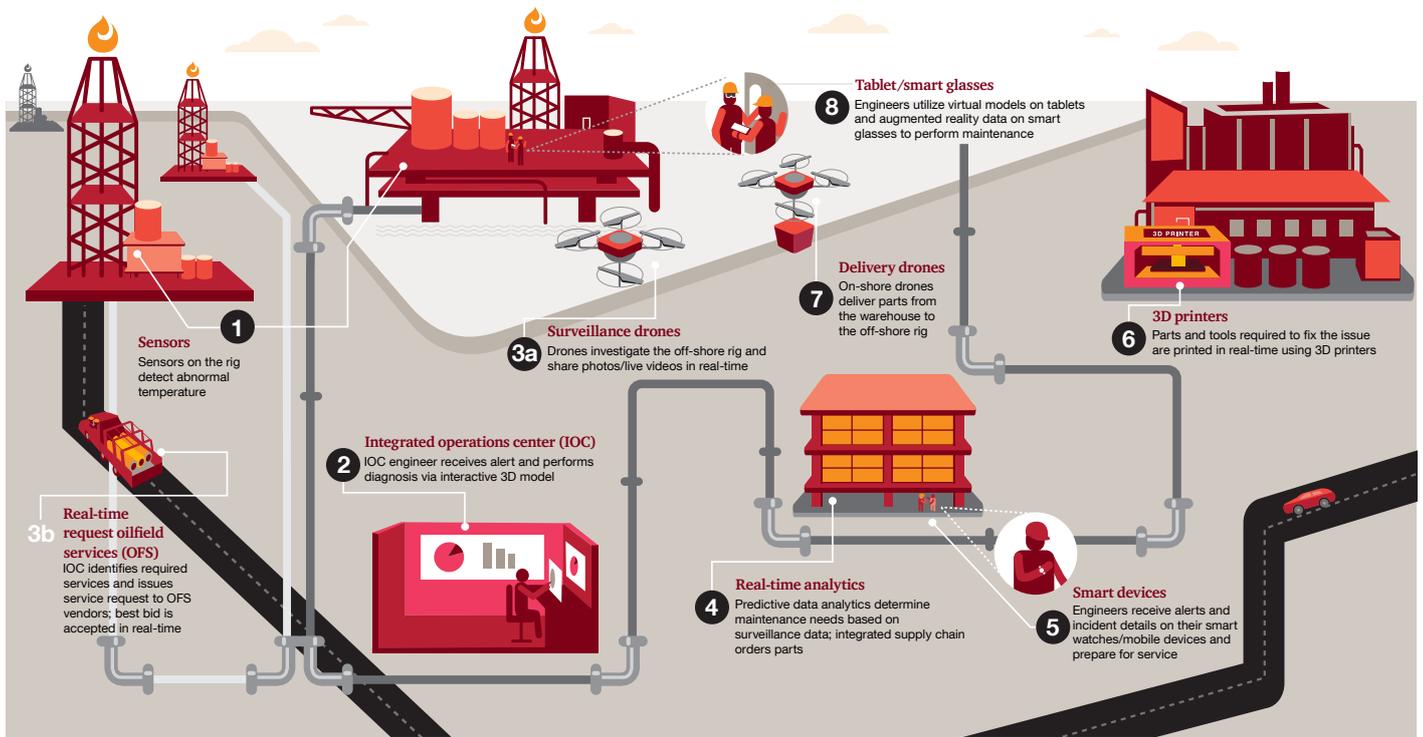


When these capabilities are present and working as a system, the digital oilfield becomes a reality. An example is shown in the illustration that follows.

“We used technology to change what we do, rather than optimise what we have always done”

Jim Williams
A key manager in Chevron’s digital oilfield transformation

Making the digital oilfield a reality



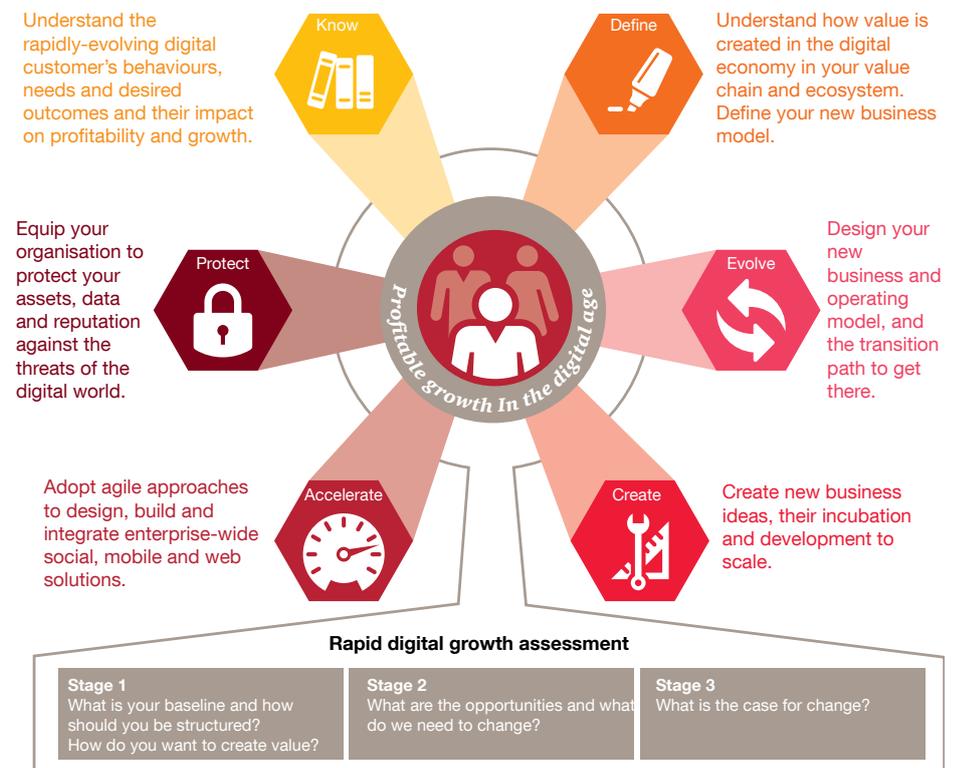
Source: PwC

Are you ready?

At PwC, we refer to digital fitness when assessing whether an organisation has the right capabilities to succeed in a digital world.

We consider an organisation's maturity across six areas: Know, Define, Evolve, Create, Accelerate and Protect. These areas are summarised in the diagram that follows.

PwC's six areas of digital fitness

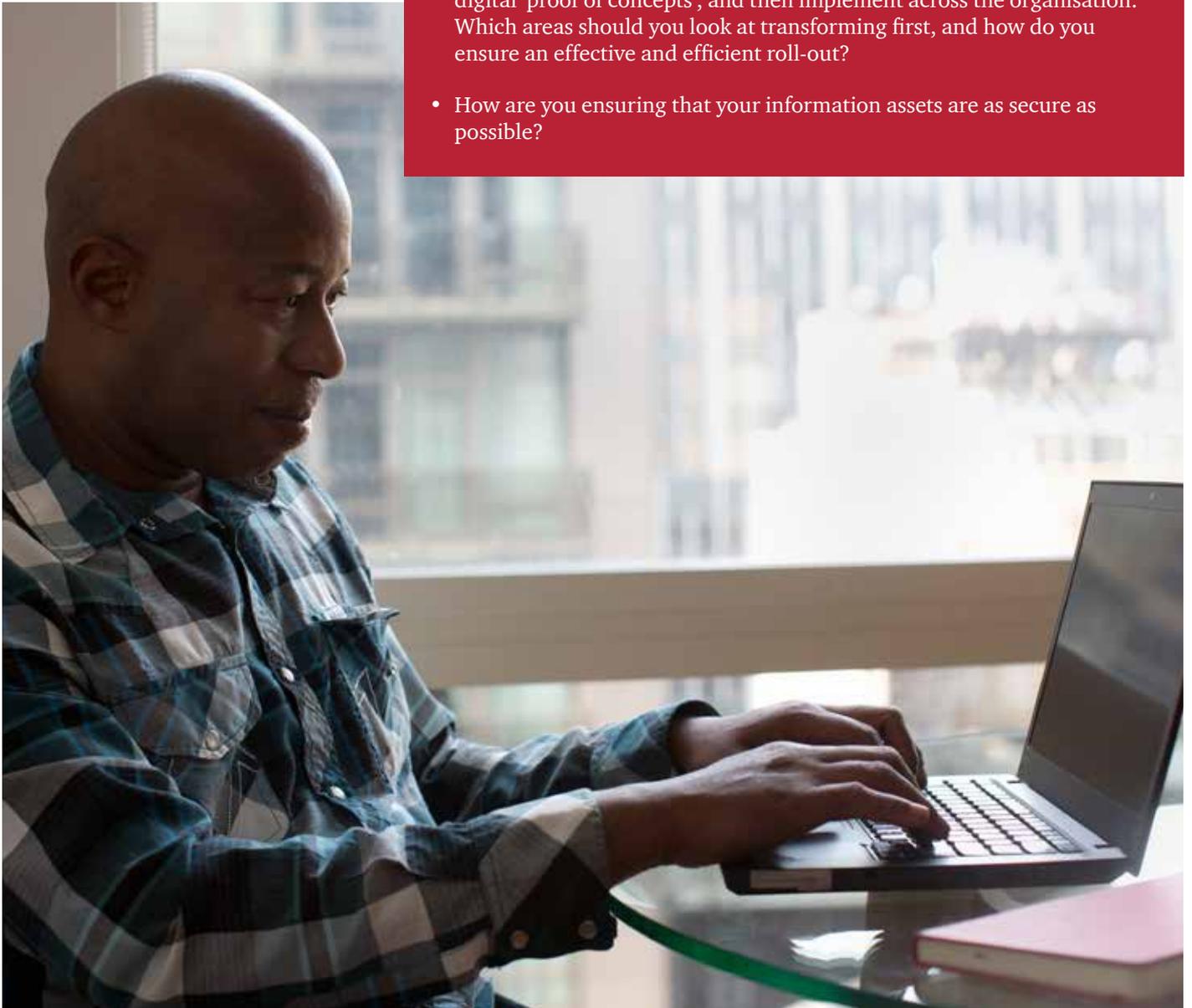


Source: PwC Digital Fitness Assessment

Ultimately, technology is no longer an enabler, but a game changer. Oil & gas organisations that respond to the need for greater efficiencies by building digital capabilities will be well positioned to win in the market.

Tough questions about the digital fitness of your organisation

- Is your organisation ready culturally, and does it have the resources to undergo a digital transformation?
- What capabilities do you need to build in order to be a digital player?
- Should you be a digital leader or fast-follower? Can you afford to take the risk of lagging behind competitors?
- Will your organisation take a siloed approach to digital or look to unlock more value through an enterprise digital transformation?
- Do you view digital transformation as ‘applying a new coat of paint’ and helping your organisation to be more efficient, or do you see it as part of a wider business transformation?
- Before making large investments, it can be a worthwhile exercise to test digital ‘proof of concepts’, and then implement across the organisation. Which areas should you look at transforming first, and how do you ensure an effective and efficient roll-out?
- How are you ensuring that your information assets are as secure as possible?



Leading enterprise advisory playbook (Leap)

Each oil company is different and unique in its requirements and focus areas. PwC has developed a 'leading enterprise advisory playbook' (Leap) model to assist in addressing the varied individual strategic and operational needs of companies in the extractive hydrocarbon sector.

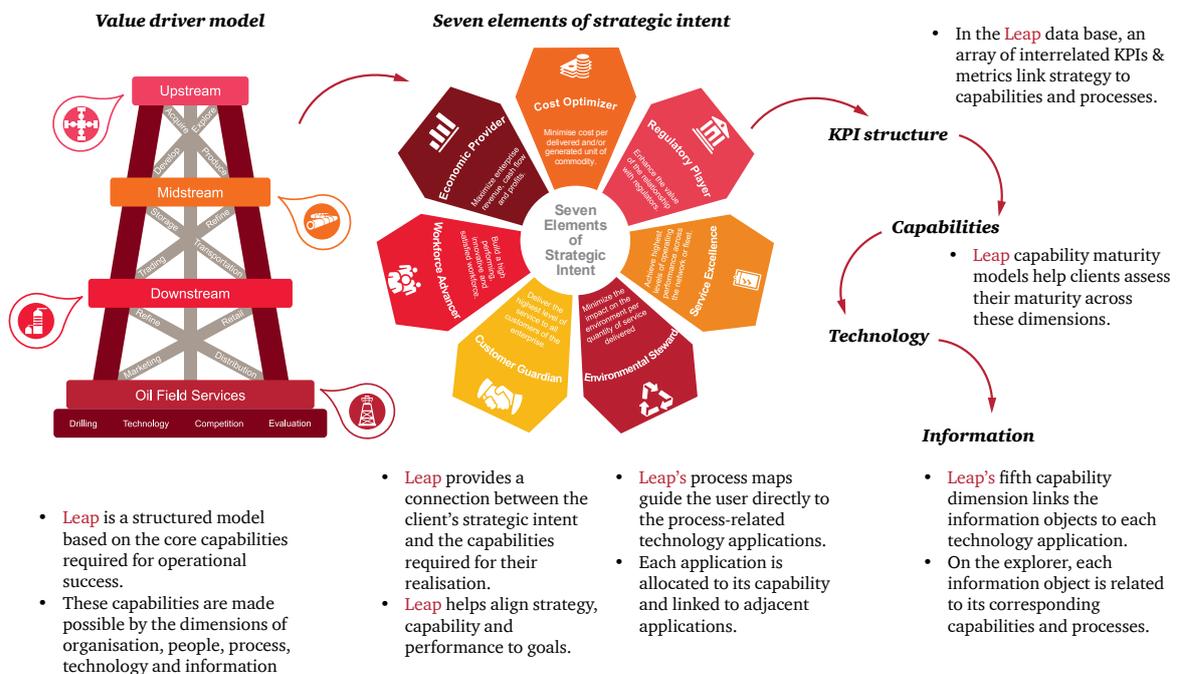
Leap is a structured model based on the core capabilities required for operational success based on leading practices in the industry. It provides a connection between the client's strategic intent and the capabilities

and processes required for the realisation of a sustainable successful business or project.

An oil & gas-specific capability maturity model, operational key design templates and performance metrics form the baseline to develop a fit-for-purpose operational excellence solution.

The model helps clients to define projects that deliver measurable benefits while minimising potential risks.

Figure 20: The Leap model



Source: PwC

Tough questions about operational excellence

- Do you have clearly identified strategic goals?
- Does your business achieve operational excellence across your capabilities? How do you minimise risk and maximise performance?
- Do you measure performance effectively?
- Are your key roles staffed with the right capabilities to execute processes successfully? Are process steps documented and controls put in place?
- Do you recognise and take advantage of the interlinkages between the dimensions of your business: organisation, people, process, technology and information?

Conclusion

We don't know what the future holds, but we know that change is inevitable.

The oil & gas sector is still a very exciting space and will continue to be economically vital for years to come. The complexities and challenges faced have become daunting, but time and again, successful operators have demonstrated the ability to respond to challenges by taking a long-term view, innovating, adapting and gauging major trends as they define medium- to long-term investment plans.

We are convinced that they can do so again.

Instead of despair, players must look at the current state of the industry as an opportunity to reinvent themselves. The key challenge will be to look beyond the here and now to envision an organisation that is built to withstand the cycles of commodity pricing.

Africa represents a new frontier and brings with it a number of unique challenges, but the players that can overcome these successfully will not only reap the monetary benefits, but will also deliver the benefits to a continent hungry for energy and economic growth.

As uncertain regulatory frameworks, taxation requirements and corruption continue to rank at the top of industry's challenges in Africa, it is also high time that governments in resource-rich nations make significant changes. What's worse than the resource curse? The inability to attract investment on any level! These challenges are working together as a trifecta which is driving industry players to invest their money elsewhere.

For countries whose economies are heavily reliant on oil & gas revenues, this does not bode well for government revenues. More importantly, it doesn't create an environment in which local skills can be developed and local people can be elevated socio-economically.

There are signs that some governments are beginning to intervene in the industry to facilitate development. Egypt, for example, has made a positive effort to reform its oil & gas sector and has managed to spur investment and commitment in the country. In both Nigeria and Angola, drastic changes have been made at the national oil companies in an effort to drive more efficiency, transparency and accountability.

There are many moving parts to consider when trying to plan the way forward to a flourishing and profitable oil & gas industry in Africa. Adaptability and flexibility are proving to be critical organisational capabilities as we move forward into a future characterised by changing demographics, rapid urbanisation, shifts in economic power and technological breakthroughs.

We don't know what the future holds, but we know that change is inevitable.

For Africa, future economic development depends on solving the continent's energy challenges. The role that oil & gas will play in these solutions will be informed by a wide range of drivers, as well as clarity about the relative priorities for governments in the competition between oil and gas and renewable energy solutions.

Given the state of the industry, we think that stakeholders must make changes to their business models. Change is the way to survive in the 'new energy future'. We need to see new business models, new products, new energy sources and new strategies to meet the new reality.

As the ancient Chinese philosopher, Lao Tzu, said, "If you do not change direction, you may end up where you are heading". For many oil & gas businesses, this means they may be acquired or close their doors if they do not choose to change and to realign themselves to the new direction of the energy sector.

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Acronyms

API	American petroleum institute
ASME	American Society of Mechanical Engineers
bbl/d	Barrels per day
Bcm	Billion cubic metres
BoE	Barrels of oil equivalent
CFO	Chief Financial Officer
COP21	21st annual conference of the parties of the United Nations Framework Convention on Climate Change
E&P	Exploration and production
EIA	Energy Information Administration (USA)
EV	Electric vehicle
FDI	Foreign Direct Investment
FID	Final investment decision
FLNG	Floating Liquefied Natural Gas
G7	Group of Seven
GDP	Gross Domestic Product
IOC	International oil company
IPPs	Independent Power Producers
ISO	International Organization for Standardization
LEAP	Leading Enterprise Advisory Playbook
LNG	Liquefied natural gas
M&A	Mergers and Acquisitions
MOU	Memorandum of understanding
MPRDA	Mineral and Petroleum Resources Development Act (South Africa)
MSPE	Master's Degree Program in Petroleum Engineering
NCDMB	Nigerian Content Development and Monitoring Board
NNPC	Nigerian National Petroleum Corporation)
NOC	National Oil Company
OFS	Oilfield services
PIB	Petroleum Industry Bill (Nigeria)
ROAVs	Remotely-operated Aerial Vehicles
SHEQ	Safety, Health, Environment and Quality
SMACC	Social, Mobile, Analytics, Cloud, Cyber
Tcf	Trillion cubic feet
UEM	University of Eduardo Mondlane
UNCTAD	UN Conference on Trade and Development
US\$	US dollars

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