Taking on tomorrow Africa oil & gas review



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Executive summary



PwC's Africa oil & gas review looks at activity and developments in the oil & gas industry and analyses potential future scenarios for national oil companies.

This eighth edition of the *Review* departs from our survey format and instead focuses on the expert opinions of a panel of industry players from across the value chain who share their views of oil & gas in Africa. We also provide an overview of the industry in Africa, looking at challenges and opportunities in the sector against the backdrop of a growing population and rising energy demand.

The role that national oil companies (NOCs)

play as operators and custodians of the orderly development of the hydrocarbon industry in their respective countries **cannot be underestimated**. Consequently, we have taken a deeper dive into the NOC landscape to provide a perspective on the future that NOCs could face in the form of four discrete scenarios. We believe this will provide food for thought for all industry participants, whether already operating in Africa or aspiring to do so at some point in the future.



This is an exciting time for oil & gas in Africa as well as globally. Companies have largely adapted to a lowcost environment, which promises to be even more beneficial given the currently recovering oil price. They have restructured portfolios with a focus on established regions, less exploration, higher value plays with low break-even cost, and projects with shorter lead times and lower risk – above the ground, geological and operational.

The industry has also renewed its focus on delivering projects on-time and on-budget. Supporting this effort have been better prices offered by service companies due to spare capacity, often with their best performing individuals on offer. A new discipline in service and oil companies was visible through tighter planning and project management, coupled with avoiding unnecessary spend on new infrastructure by using fitfor purpose equipment standardisation, simplification and eliminating customised designs.

As the oil price is steadily rising towards pre-collapse levels, the outlook is positive. It

is, however, important for companies to avoid falling into the cost inflation trap that could eat into the profitability gains that should follow from the rising oil price. Keeping up capital discipline and further improving productivity will yield sustained results for the industry.

Despite positive developments, the industry still faces numerous and persistent challenges. With an uptick in activity, the **workforce reductions** implemented since the price collapse in 2014 will become a constraint for the industry. Many of the highly-qualified employees that were made redundant will have now moved on, either to new industry jobs or to more stable industries meaning that they are not available for rehire. Those companies that have invested in **technology and automation** will be best-placed to thrive in the current environment. The industry experts we interviewed confirmed, as in prior years, that **challenges persist around regulatory uncertainty, political instability, corruption and fraud, and lack of infrastructure**.

Despite the challenges, Africa does offer plenty of opportunities in the form of unexplored acreage and ever-increasing hydrocarbon demand fuelled by population growth, urbanisation and the emergence of a growing middle class.

While alternative energies and electric vehicles

are already a near-future scenario in many developed countries, many countries in Africa lag behind due to the lack of power infrastructure and transmission networks. This situation gives hydrocarbons the reign over the transport sector for the foreseeable future. The construction sector will also continue to contribute reliably to hydrocarbon demand considering the projected infrastructure development in Africa over the next decade.

Notably, 2017/18 has seen a **significant increase in the number and size of final investment**

decisions (FIDs), demonstrating a renewed confidence in the sector. Looking at the location and nature of these FIDs, it is fair to say that the renewed focus is more concentrated and targeted at high-quality, bankable projects, rather than the free-for-all approach we saw during the growth-at-all-costs phase preceding the 2014 price collapse.

New finds are much smaller and leaner than they were in 2016 or 2015. In Africa, the recovery rate of capex (7% year-on-year growth) is expected to surpass global growth (5% year-on-year growth). But one must remember that while there are plenty of project sanctions waiting to happen in Africa, some of them are dependent on regulatory certainty as a prerequisite. **Exploration spend in Africa and globally is starting to pick up as well**. It is safe to assume that this trend will continue if the current higher price environment is sustained. It will present the opportunity to discover and develop new fields, while also deploying state-of-the-art technology applications.

The current oil price recovery reflects a **tight supply and demand balance** as well as an indication that we are heading towards a potential global supply crunch in the early 2020s. Venezuela's greatly reduced production rates, and sanctions on Iran, are only two of the factors currently influencing this scenario. While OPEC is discussing a production increase, there is likely not enough sustainable spare capacity in current reserves to level the demand over the medium to long term.

Inadequate reserves replacement rates over the last few years due to exploration spending cuts contribute to the potential future supply crunch. With long lead times required prior to new fields coming on-stream, we are moving towards an era of supply constraint that will have a sustained effect on oil prices if not averted.

The need for a transition to a lower-carbon economy remains a key driver for the **decarbonisation** of the global economy. Gas continues to play a significant role as a transition fuel in Africa.

The application of technology also has the attention of the industry in Africa and the rest of the world. Algeria's Sonatrach has identified technology as a key focus in its 2030 strategy. While some players, like Sonatrach, have publicly announced a shift in focus to automation and artificial intelligence (AI) to support their operations, others see themselves more as fast followers, keeping a close eye on developments in the industry and relying on robust technology partnerships to drive the required change.

Amid all of these developments is the need for African countries to support their growing economies through building skills and local value chains in support of the oil & gas industry and other sectors. **Local content** therefore continues to be a key discussion point on the African agenda.

Africa's almost 30 NOCs have a crucial role to play in building this local content capacity.

They are involved at various points of the value chain and at different levels of maturity. They are commonly the resource holders mandated to participate in the oil & gas market at different stages, or even all stages, of the value chain.

Incoming companies have to partner with NOCs, which hold the key to unlocking access to the market. It is therefore important to understand where NOCs might be going and how companies in the industry need to position themselves. Our **future scenarios for NOCs** describe four potential NOC futures along two axes: the level of regulatory stability and the level of diversification within a country's economy. We have defined the scenarios through a set of drivers that determine the state of the NOC in the respective scenario, and we have painted a picture of how the NOC of the future could look.

Through our scenarios we are not trying to predict the future, but rather provide some food for thought on potential factors that could influence it. Will it be condemned or constrained; will it evolve or even excel to be the Super National Energy Company (NEC) of the Future? And wherever the NOC finds its place, will the other players have considered their options and how they need to respond to take on tomorrow?





Industry insight Jon Harris – Sasol



Jon Harris Executive Vice President: Upstream Sasol Limited

Jon Harris is responsible for Sasol's coal mining business in South Africa and global exploration and production oil and gas business. Prior to joining Sasol, Mr Harris was Executive Vice President, *Technical at BG Group, a British multinational Oil* and Gas FTSE 10 company. He has wide-ranging experience in the upstream oil and gas industry, including liquefied natural gas (LNG). His work background covers asset management, business turnarounds, business development and functional excellence. Jon has a master's degree in Fuels and Energy Engineering (M.Eng) from Leeds University and started his career as a Petroleum Engineer with *BP* in the United Kingdom. During his career he has worked in Kazakhstan, United States, Egypt, Trinidad & Tobago.

Sasol

Sasol is a global integrated chemicals and energy company. It develops and commercialises technologies, and builds and operates world-scale facilities to produce a range of high value product streams, including liquid fuels, chemicals and lower-carbon electricity. It employs more than 31 000 people working in 32 countries.

Q Where in Africa is Sasol active?

South Africa is an important established market for Sasol, and we have a growing retail, performance chemicals, and exploration and production (E&P) business. We continue to supply the growing need for gas by businesses in South Africa. Our E&P activities in Mozambique are designed to meet our needs in Mozambique and in South Africa. We will continue to build the retail business in Southern Africa and performance chemicals beyond South Africa.

We have invested in Gabon in a small oilfield development. West Africa is attractive as it offers proven resources and high rates of return without the significant capital infrastructure investments associated with emerging gas plays. Ø

Q How is technology and digital transformation impacting your business?

Technology and digital transformation are key enablers of growth and operational efficiency. Sasol has invested extensively in technology, and makes use of technology for condition monitoring. Condition monitoring can be used ultimately to feed into a maintenance system to reduce or avoid shutdowns without affecting safety.

Data analytics allows for the assessment of exploration opportunities and optimising production from oil and gas fields. The future possibilities for Sasol are enormous: for example, applying artificial intelligence in upstream to feed basin input and get predictions on where to drill.

Q What is the role for NOCs in Africa?

When signing up for acreage these days, skills transfer is a given. Most NOCs would want to copy the Equinor/ Statoil model, first being a custodian and upskilling, partnering and maximising your own resources and eventually operating locally and worldwide.

An NOC should satisfy itself that it does the best for the country. It can do that as a regulator and understand the business. But there is the feeling "if you can make money out of it, so should the NOC". A NOC should add as much value in country as it can, so the country benefits the most. This is enabled by a NOC that is partnering and exploring eventually, but getting in somebody to find hydrocarbons first also bearing the initial risk.

Q What are the biggest challenges for the oil industry in Africa?

Typically, a lack of capabilities stops people from doing what they want to do. Local content is important, but it needs to be determined what is realistic and how upskilling must happen. The regulatory framework needs to be enabling with attractive investment terms that still achieve a country's objectives. They should allow for small and big field developments and also different environments to cover a holistic approach.

Collaboration is necessary in the regulatory space. For example, in Norway, the regulatory body has set up a uniform health, safety and environment (HSE) system that everyone must use. Why hasn't the rest of the world followed suit? We should be looking for common answers to manage the same problems worldwide. The development banks should be able to help to set up best practice regulatory and fiscal regimes.

Growth & development

Africa snapshot



--- Oi

Africa's **proven reserves** at **126.5 billion bbl**, 7.5% of the world's proven reserves with no changes since prior year.

Production was **8.1 million bbl/d**, 8.7% of global production, up 0.3% from prior year.

Consumption at **4.0 million bbl/d**, 4.1% of global, same as prior year. But regional growth at 2.5%.

Exports from Africa at **6.8 million bbl/d**, 10.1% of global exports.



Discoveries

Global oil & gas discoveries approximately **7.5 billion boe** with average offshore discovery at roughly 100 million boe. The start of 2018 sees exciting recovery with discoveries up by 30% compared to 2017.

Africa had two major gas discoveries in Senegal totalling **1.5 billion** boe.

Refineries

Refinery throughput at **2.1 million bbl/d** which is similar to last year and amounts to 2.5% of global, same as in prior year.

Refinery upgrades or new builds considered in Angola, Equatorial Guinea, Uganda, Nigeria, Republic of Congo, Ghana, São Tomé & Príncipe, and Zambia.

Gas

Africa's **proven reserves** at **487.8 tcf**, 7.1% of the world's proven reserves only marginal changes since prior year.

Production was **7.95 tcf**, 6.1% of global production, up 0.3% from prior year.

Consumption at 5 tcf, up 0.3 tcf. 3.9% of global.

Pipeline exports from Africa at **1.6 tcf**, decrease by 3.3% making up 6.1% of global exports, down 0.4% compared to last year.

Deprating capacity utilisation at **64%** compared to 84% globally. Global utilisation is up

by 2% whereas Africa's utilisation increased significantly by 13%.

Liquefaction capacity was at **68.3 mtpa**, 19% of global.

LNG exports 41 mtpa with **37 mtpa** from Nigeria, Algeria, Egypt and Equatorial Guinea, up by 10%.

Bidding rounds 2018



Algeria, Cameroon, Congo, Cote d'Ivoire, Egypt, Gabon, Gambia, Ghana, Kenya, Madagascar, Nigeria, Senegal, Sierra Leone, Somalia, South Africa and Sudan.

Source: BP Statistical Review 2018, Rystad, IGU World Gas LNG Report, Global Data

Reserves and production

After several years with a bleak outlook, the oil & gas industry looks more optimistic with the Brent oil price having broken through the US\$80 mark at time of writing.

The oil price collapse has reshaped the oil & gas industry globally as well as in Africa. Oil companies have adapted their portfolios to lower risk, focusing on high value plays and on reducing operational costs, while eyeing technologies in a quest to further streamline their businesses.

Energy transition is also gaining momentum, and low-carbon developments are on the agenda for most players. International oil companies are investing in alternative energies and low-carbon solutions. African NOCs have the opportunity to focus on gas as a transition fuel by exploiting the abundant finds on the continent.

Africa's share of global oil production has slightly increased by 0.3% since last year to 8.7% standing at 8.1 million bbl/d. The main contributors continue to be Nigeria, Angola, Algeria and Egypt. Libya doubled production in 2017, promoting it to the fourth-largest oil producer in Africa with an 11% share, moving Egypt into fifth position. Among the top five, Nigeria and Libya were the only countries to increase production. The others declined, mostly in line with production cuts agreed to by OPEC members. South Sudan experienced another drop of 7.4% in production in 2017, but recent mediations in peace-deal negotiations led to the resumption of the pumping of crude from suspended fields in September 2018, hopefully pointing towards a turning point for the country.

Proven oil reserves in Africa have stayed at the same level of 7.5% of global reserves. Exploration activity continued to decline in 2017.

Africa was reported to have 487.8 tcf of proven gas reserves at the end of 2017, unchanged at 7.1% of global proven reserves. Two significant gas finds by Kosmos Energy in the Senegal-Mauritania basin in 2017 added an additional 1.5 billion boe of gas to their portfolio. The Yakaar discovery coupled with the Teranga discovery in 2015 creates the foundation for another LNG hub in the basin according to Kosmos and joint venture partner BP.

It was another record low year for the discovery of conventional resources globally in 2017, totalling only 7.5 billion boe according to Rystad. The average offshore discovery in 2017 held 100 million boe compared to 150 million boe in 2012. One African country, Senegal, made it to the top three.



We have seen a change in global oil & gas discovery trends in 2018, which are already up 30% in the first six months of the year, compared to 2017. There is still some way to go to replace what is being produced. What has certainly assisted in changing the trend has been a sustained drop in break-even prices over the last four years.

The Middle East is leading the pack at 44%, and West Africa offshore stands at the lower end with an average of 17% reduction in break-even prices since 2014.

This suggests that cost-cutting measures have not been addressed as aggressively in West Africa as in other parts of the world, and there is likely additional scope for optimisation measures to be applied by means of technology, for example. Breakevens have come down across major basins with West Africa delivering more modest gains





Source: Rystad, PwC Strategy&



Industry insight Paul Eardley-Taylor – Standard Bank



Paul Eardley-Taylor Director, Oil & Gas, Southern Africa Standard Bank

Paul Eardley-Taylor is responsible for Standard Bank's Oil & Gas sector activities for Southern Africa (11 countries), across upstream, midstream, downstream, services and process industry clients. Paul has 20 years' corporate and investment banking experience in the energy sector. Paul has extensive experience of the South/Southern African energy environment, as adviser, banker and financier. Prior to joining Standard Bank in 2009, Paul worked for HSBC for more than ten years where he gained extensive experience of transactions across EMEA and select global markets in Asia/Australasia. Paul holds degrees from Birmingham University; London University and an MBA from Henley Management College.

Standard Bank

Standard Bank is one of the largest banks in Africa with an on-the-ground presence in 20 countries. Its corporate and investment banking business has a deep specialisation in natural resources, including oil & gas, where it offers extensive financial solutions clients require across the oil and gas value chain. These range from financing (investment banking and advisory services) and global markets (foreign exchange and commodities trading) to transactions (working capital, cash management and forex solutions).

) What are the main developments affecting oil & gas in Africa?

Three themes are coming through, aside from businessas-usual challenges that all companies face in Africa:

- Substantial FIDs in Africa: In southern/ east coast Africa FIDs of approximately 70-80 US\$ billion will be taken over the next 12 months. These will be followed by other large-scale projects, including the refinery development in Uganda, storage facilities, domestic gas developments in Mozambique (fertiliser, gas to liquids), etc.
- Legislation and regulatory certainty: It is important that governments are able to respond to changing dynamics in the global oil & gas market to remain relevant and attractive, especially given the lack of industrial precedent in each underlying market.
- Developments in LNG technology: Floating LNG and small-scale LNG will influence the development of the LNG market, especially as a tool to open basins or broaden gas penetration.

From a mid- and downstream point of view, it is more a matter of business as usual: car parks growing, investment in storage is more popular, and there are discussions on new refineries and the effects of MARPOL on product specifications that all need consideration.

Q Are investors concerned about changing energy mixes and are there question marks on funding hydrocarbon investments?

Investors are not yet concerned about changing energy mixes in Africa. With weak power grids, a lack of supply and huge distances, this is not an issue yet. There is the potential for gas as a transportation fuel, but the market for liquid fuel will remain and grow, per all major projections. The transformational FIDs mentioned earlier will also create significant demand for liquid fuels during the development and construction phases, further anchoring the current energy mix.

Q What are the challenges with project funding?

Upcoming projects in Africa are very complex in nature. Size and scale is huge, some are across borders and all are taking place in frontier territory, also dealing with non –commercial policy objectives of their host countries. This results in project finance in Africa tending to be more expensive than anywhere else in the world but the big point is it is available and is typically a major percentage of underlying GDP.

Q From a bankers point of view, do you see the need for any changes on the part of host governments/ NOCs and private-sector companies to drive development?

For the oil sector, where there are unique emerging plays (e.g. Uganda and Kenya) it is important that host governments ensure that the fiscal interests of IOCs are looked after so they keep (and / or others) drilling and ensure that the development pipeline remains full. The gas sector needs to consider the different policy and stakeholder perspectives at play. Tanzania may be a success story down the road, but the question is whether Tanzania is focused on the technical realities of the deep water gas it has or on social dynamics around the domestic use of gas.

For South Africa, there is a question whether or not it can develop an exploration industry by the early 2020s.

Angola has clearly generated significant cash flows from its single source of oil, but it badly needs to diversify its economy, bringing in more gas, making sure players active in its market are not just in the Gulf of Mexico or increasingly Guyana, Brazil or Mexico.

Q How should the development of industry in these emerging markets be supported?

The development of local content is very important, but the sector must remain competitive. A detailed industry screening is necessary to understand what is possible in an individual location. Single-play prospects like Uganda, are different to Mozambique, which will see a ramp up over 20 years, providing more opportunities and possibilities for local industry development.

Q Does oil & gas have a future in Africa?

Oil & gas most certainly does have a future. The challenge is creating an attractive fiscal and regulatory regime. We have seen examples of minimal investment as a result of poor regulatory and fiscal decisions (e.g. Iran, Iraq, Libya, Venezuela). There are enough other places with hydrocarbons and reasonable jurisdictional risks, with particular examples of interest being Senegal/Mauritania or Guyana. What is going to impact development is poor governance and related issues. Otherwise, it is down to geology and fiscal requirements and the ability of individual policy and legislative environments to respond quickly enough to the changing global market.

Q What does the future NOC look like?

Big IOCs have been in business for more than 100 years. NOCs like Saudi Aramco and Petronas have a history going back 60–80 years. For the next generation of African NOCs we have to be quite respectful of the direction of the journey they have to follow and overall scale, depth and breadth of resources that are needed for these activities, which will be influenced by the individual national resource finds and how they grow/ diversify after the initial deals.

Taking on tomorrow: Africa oil & gas review – November 2018

Merger & acquisition activity

Figure 2: Deals across the oil & gas value chain in Africa

Another indication that portfolio readjustments are moving to lower above-ground risk as well as mature vs frontier plays is the decline in M&A activity in Africa. Overall upstream deal value declined by 70% between 2013 and 2017. Over the same period, Africa's share of global upstream oil & gas transactions declined from 16% to 4%.

25 35 30 20 25 20 **billions)** No. of deals 15 10 10 5 5 0 0 2017 2016 To 20 Sep 2018 Corporate deals Value Asset deals

Source: IHS Connect, PwC Strategy&

M&A in Africa witnessed a decline in overall deal values and share of global transactions

Figure 3: M&A upstream activity, 2013 vs 2017



Source: IHS Connect, PwC Strategy&

Top 10 oil & gas discoveries globally in 2017

Africa, with substantial gas discoveries in Senegal by Kosmos Energy, holds two places in the top 10 oil & gas discoveries in 2017. This continues the gas find trend that we have seen over the last years. Notably, Senegal is the only African country represented on the list in contrast to previous years when a number of African countries could boast substantial discoveries: 2016 Senegal and Angola; 2015 Egypt, Mauritania, Angola and Congo; 2014 Angola, Senegal, Congo, Gabon and Tanzania; and 2013 Mozambique, Angola, Nigeria, Congo, Tanzania and Egypt.

Asset	Country	Region	Operator	Principal resource	Location	Resources (Million bbl)	% Liquids	% Gas
Yakaar Phase II, SN	Senegal	West Africa	Kosmos Energy	Gas	Offshore	887	6%	94%
Yakaar Phase I, SN	Senegal	West Africa	Kosmos Energy	Gas	Offshore	692	5%	94%
Payara, GY	Guyana	South America	ExxonMobil	Liquids	Offshore	487	90%	10%
Zama, MX	Mexico	North America	Talos Energy	Liquids	Offshore	468	95%	5%
Snoek, GY	Guyana	South America	ExxonMobil	Liquids	Offshore	438	89%	11%
Willow (GMT), US	United States	North America	ConocoPhillips	Liquids	Onshore	399	100%	
Whale (G35153), US	United States	North America	Shell	Liquids	Offshore	393	89%	11%
Ixachi, MX	Mexico	North America	Pemex	Gas	Onshore	381	40%	60%
Gaoshiti, CN	China	East Asia	PetroChina	Gas	Onshore	299		100%
Vaca Muerta Shale Neuquen Province, Pan American Energy, AR	Argentina	South America	Pan American Energy	Gas	Onshore	141	7%	93%

Source: Rystad Energy

Africa has had a further decline in onshore discoveries, which might be attributed to above-ground risk reduction measures

Figure 4: Africa discoveries by type, 2013–2017



Source: Rystad Energy, PwC Strategy&

Recovery in exploration spending and a slight increase in capex spend expected

Projections for capex and exploration spend in Africa are looking up. Africa experienced a massive drop in exploration spend of 71% between 2014 and 2017. However, a slow and then robust recovery at an average 18% year-on-year over the next 12 years is projected. The major driver of the expected growth is from the East African region. Globally, Rystad Energy predicts an average 15% year-on-year increase.

Exploration spend declined by 70% but forecast to recover over medium term

Figure 5: Africa oil & gas exploration spend by region, 2010–2030



Source: Rystad Energy, PwC Strategy&

Capex spend in Africa experienced a 42% drop between 2014 and 2018 but is expected to more than double between now and 2030. Six countries represent 65% of the overall expected spend with West Africa and North Africa driving the growth.

Year-on-year increases are predicted at 7% in Africa and at 4% globally.

Figure 6: Africa oil & gas capex



Top countries' cumulative spend, 2018 – 2030 (%)

between now and 2030.



Mozambique represents an 8% share in the total cumulative spend of US\$857 billion

Source: Rystad Energy, PwC Strategy&

Supply and demand

The consequences of modest recovery in exploration spending and a continued decline in new discoveries are unavoidable and imminent.

The International Energy Agency and various players in the oil industry have warned of demand exceeding supply as oil demand continues to grow and investment in projects is deferred.

Global oil production in 2017 picked up slightly by 0.7% compared to 2016. This follows concessions by OPEC to allow for a recovery to previous levels and mitigate against the negative impact on certain African economies. Africa stands above average with an oil production growth of 5%, driven by Libya doubling its production. Oil consumption increased by 1.8% globally in 2017 and by 2.5% in Africa, with West Africa and East Africa driving this growth.

Gas production grew by 4% globally and by 8% in Africa with the majority of growth contributed by Egypt. Gas consumption in Africa increased by 6.8% compared to 2016, driven by the Northern African countries.

Oil supply growth globally has declined for various reasons, including the slow rise in exploration spending, decline in new discoveries as well as supply disruptions due to geopolitical issues and deferred maintenance in an attempt to cut costs.

In November 2017, OPEC extended a supply cut of 1.8 million bbl/d to remain in place until Q1 2018 that has since been extended to the end of 2018. Libya and Nigeria, who were previously exempt, have now been included and agreed to collectively cap their output at 2.8 million bbl/d. There is growing concern whether OPEC can offset declines in output from its member countries. Sanctions on Iran that will kick in fully in November 2018, and deteriorating infrastructure and political uncertainty in Venezuela, are the two biggest factors limiting OPEC supply.

Global demand has remained fairly stable, and oil inventory levels in developed countries have been drawn down recently, supporting a view that we are heading towards a potential supply crunch in the 2020s.

A supply crunch will likely keep prices high and ensure a market for Africa's oil and gas. This is an opportunity for producing African countries to maximise returns while keeping the focus on cost management. It also provides investment justification for new oil & gas plays on the continent. African countries should invest these returns wisely into the diversification of their economies.





Source: IEA Oil Market Report, December 2017, PwC Strategy&



Industry insight James Josling – Trafigura



James Josling Head of Africa Oil Trading Trafigura Group Pte Ltd

James Josling was appointed as Head of Africa Oil Trading for Trafigura in September 2017 having joined the company in 2015 as a trader on the Africa Desk. Prior to joining the company, James spent six years between London and West Africa, managing West African product flows and the Nigeria business for a global commodity trading firm. Before this James lived in Nigeria and worked for a small family office trading firm. He started his career in London at Wood Mackenzie, a consultancy business for global energy, chemicals, metals and mining industries. James has a degree in Genetics from University College London where he graduated on the Dean's List.

Trafigura

Trafigura is a leading independent multinational commodity trading and logistics company with a significant presence in Africa. Trafigura has achieved substantial growth in recent years, growing revenue from USD18 billion in 2004 to USD136.4 billion in 2017. The Group's primary trading businesses are the supply and transport of crude oil, petroleum products, renewable energies, coal, refined metals, ferrous and non-ferrous ores and concentrates.

Q Why are you investing and operating in Africa and what is your outlook?

Africa is a continent with incredible potential with regards to growing demand and development, and is an important market for a global trader like Trafigura. As a demand centre alone it is important for Trafigura to be represented here.

Q How did the oil price impact you?

In oil exporting countries (Nigeria, Angola) access to product is gained by providing credit facilities – modelled at conservative oil prices when deals were put together. The oil price drop created some stretch around these facilities. Conversely, when oil prices rise, this places strain on the liquidity of importers. Managing of credit exposure in Africa is a constant challenge.

Q How is digital disruption affecting you?

The commodities trading industry has traditionally been notoriously opaque, trading on knowledge of pricing and supply and demand information. Access to high-speed internet and the ubiquitous spread of smartphones allows buyers to be connected at all times. This means that more transparency and more data is available on markets.

This is great for buyers and consumers but makes it harder for larger trading houses to make a margin. It does, however, add efficiency to the market, which is exactly what should happen.

It just means that critical mass and economies of scale are more important than ever. Having a wide and interconnected business and large flows globally makes Trafigura more competitive and it is important to maintain this size.

Blockchain has not yet turned disruptive but has massive potential. The trade cycle around commodities is very outdated and has not moved with the times. There is huge potential to make the process more secure and make it quicker and less clunky, while also streamlining the back office.

Q What is your view on energy mix disruptions?

There is huge investment and focus around renewables. There is so much opportunity on the power generation side for renewable projects, which will impact hydrocarbon demand. Africa is, however, grappling with the execution of long-term infrastructure projects, and political instability makes it harder to execute them. It is still premature to talk about electric vehicles and changes to traditional transport methods in Africa.

Q What do you see as the biggest challenges to operating in Africa?

Commodities have a history of opacity, and there are many cases of corruption in the industry. Operating to a strict code of conduct is essential for Trafigura.

Political and regulatory instability is an issue. When developing infrastructure projects, you need to know that the regime is stable, that people will honour contracts and deals, and that you have a fair legal system to contest any disputes. Due to those concerns, many infrastructure projects are often delayed or don't happen.

Lack of infrastructure is a challenge, but also an opportunity.

Trafigura is a high revenue, high turnover, low margin business – credits and spiralling debt is a major concern for Africa.

Q What do you think the role of national oil companies should be in Africa?

NOCs should develop resources as quickly, sustainably and at the best value for the population of the country as custodians of those resources. They have a great responsibility to bring the resources to market in an efficient, transparent and fair-value way.

Lines between regulators and NOCs are often blurred, but they should be separate.

NOCs in many places want to play a controlling role in midstream, downstream and retail sectors. There is not a historical record to suggest that this is a good outcome for countries. Deregulating as much as possible and allowing the private sector to invest and efficiently supply downstream markets is much more successful and results in a lot more inward investment. NOCs have a much stronger role to play in upstream than downstream.

It is interesting to contrast landlocked NOCs with coastal NOCs. In landlocked countries, security of supply is an important consideration due to the long supply chain and economic impact if a country runs out of fuel. In this case, the NOC has an important role to play in respect to security of supply.



2017 saw a significant increase in FIDs

While we have seen a significant increase in FIDs, the industry is not what it was. The average project size at 376 million boe is significantly smaller than in both 2015 and 2016. Deepwater oil has been given preference over gas, and oilfields offering the highest rates of return attract the investment dollars.

There is also a preference for brownfield over greenfield developments. Mozambique's Coral FLNG (floating liquified natural gas) is one of the few gas-focused FIDs that was recently taken. It was sanctioned in June 2017 when the Brent oil price stood at a mere US\$48/ bbl. It will be the first FLNG unit in Africa and only the third globally. Africa is certainly taking its place on the global stage.

Figure 8: Global proved reserves, 1980–2017



Source: BP Statistical Review of World Energy June 2018, PwC Strategy&

The oil price

Tightness in supply also continues to drive up prices, and the return to threedigit oil prices is already being predicted. As prices rise, OPEC and leading non-OPEC producers will be under pressure to unwind supply cuts and boost output.

The announced headline of a one million bbl/d increase is probably not achievable. Many OPEC producers have seen production decline over recent years and are pumping at close to capacity levels. This will likely mean a return to increased investment in exploration and production, and the industry needs to be careful to avoid cost inflation creeping in again.

The price decline and sustained low oil price of the last few years had a severe impact on oil economies, and some countries (like Angola) had to introduce austerity measures. The recovery in the oil price will give some reprieve, but it will have a negative impact on consumers. In emerging markets with weaker currencies, where oil prices will be driven even higher in local currency terms, further increases in cost may lead to demand destruction. It may also mean that alternative energy sources will become competitive against hydrocarbons.



Medium and long-term oil price forecasts are consistent in their view of a sustained increase over the forecast period

Figure 9: Brent crude price, 2004–2040 (US\$/bbl)

Source: EIA-AEO-January 2018, Rystad Energy, PwC Strategy&



Digital disruption in Africa, and beyond

As reported in our 2017 *Review*, digital disruption is a game changer for the oil & gas industry. We set out below selected examples of new technologies that have been deployed across the value chain. Digital disruption is here to stay, and African players must embrace this to reap the rewards. They should also ensure that they recruit digitally-savvy staff and enable their workforces to operate in this fast maturing space to remain competitive. In our experience, however, Africa is a follower in this domain.



O Technology	Impact	Applications by Industry
Drone	Use of drones to inspect remote facilities. Reduced health and safety risks and man hours	 Eni contracted Sky-Futures to inspect platform facilities globally using drones Crusade, service provider to Chevron's Caltex in South Africa, uses drones to give fuel-hauling truck drivers visual cues and electronic journey plans to improve safety, fuel efficiency and customer reliability
3D printing	Potential rise of digital manufacturing reduces need to ship goods around the world. Decentralised production/reduced inventory	 BP has undertaken a study of disruptive impact BHGE exploring 3D printing of parts such as manifold choke valves and has also produced a drill bit
4D seismic	Improved understanding of the reservoir through data that can be used to locate unproduced oil and gas	 ExxonMobil applied 4D seismic technology for monitoring of water and gas sweep in deepwater production wells in Angola
Automation	Use of robots to undertake monitoring and safety checks. Reduced safety risks for human operators	 WeST Drilling Products created a robotic oil rig that will reduce drilling time by 50% NNPC is in the process of completing the automation of all crude oil supply and marketing operations. The automation and removal of paperwork has led to US\$1bn in savings over the year
Digital twin	Creating like-for-like digital representations of operations for improved precision and optimisation	BP piloting their Digital Twin, APEX, in multiple locations for production optimisation
Virtual reality	Simulation of drilling to reduce costs	 Shell used VR to drill a simulation well for \$5.4m (down from \$15m)
Blockchain	Growth of digital trading platforms offer promise of reduced costs and raising capital	 Venture to develop blockchain-based digital platform to manage energy commodity transactions. Includes BP, Shell, Statoil, Gunvor, Koch, Mercuria, ABN, ING and SocGen

Regulatory developments in Africa





Regulatory uncertainty continues to be a major barrier to the development of the oil & gas industry in Africa. Governments are, however, beginning to recognise that to attract investment in the industry, they have to adjust their frameworks to balance risk and reward. If they get this right, oil revenues in their countries can increase again and their broader economies can benefit. Below we highlight the notable developments in Africa that demonstrate that leaders are reacting to the new environment. After all, a big share of nothing is still nothing. Overall, there are some positive developments that demonstrate that governments are responding positively to the new reality, although regulatory uncertainty remains a concern in a number of jurisdictions.

Notable developments

Algeria

Sonatrach has a new development strategy, SH 2030, that focuses on using technologies based on partnerships with technology firms to reduce costs and optimise recovery, double its oil & gas production capacity and develop the petrochemical industry. Hydrocarbon laws are expected to be finalised early next year to attract foreign investors.

Angola

Angola created the National Agency of Petroleum and Gas to manage and sell oil blocks with an aim to reduce bureaucracy and increase investment. It is expected to start operations in January 2019 and be fully operational by the end of 2020. Angola is also aiming to reverse the drop in oil production following technical problems in mature fields and declining investor interest.

Egypt

The July 2017 Gas Market Law established the Natural Gas Regulatory Authority. Its role will be dealing with licence matters, ensuring market competition and setting service prices. The government intends to liberalise the gas market through collaboration with different market players and aims to make Egypt a regional hub for LNG trade.

Equatorial Guinea

The country is enforcing a local content policy and is threatening to ban companies that are non-compliant.

Gabon

Gabon declared revisions to its hydrocarbon codes to improve recovery and encourage exploration activities in deepwater offshore. Policies are under development to boost local content together with a special economic zone to support the local industry.

Ghana

Following the resolution of a maritime border dispute with Côte d'Ivoire in favour of Ghana in September 2017, Tullow has continued its drilling operations (that were halted for almost two years) on Ghana's multi-billion-dollar TEN deepwater oil & gas project.

Kenya

Development has stalled with political uncertainty and a delay in signing the Petroleum Bill, which also sets out the revenue sharing between national, county and communities. Security concerns are another factor halting operations.

Mozambique

The government agreed for future gas production to be exported, and developments are going ahead. Mozambique successfully attracted investment with Eni taking FID on Coral South FLNG.

Nigeria

Some elements of the Petroleum Industry Bill (PIB) have been passed, but the industry is still awaiting the passing of all legislation. The associated uncertainty has likely caused the deferment of FIDs for a host of upstream and midstream projects.

Senegal

The government presented its draft new oil sector law in April 2018. A draft for local content legislation is underway, and environmental legislation is also being reviewed. The NOC, Petrosen, will become a purely commercial entity and withdraw from its regulatory duties. Conversations on good governance of mineral resources are perceived to be lacking by civil society groups.

South Africa

The proposed Amendment Bill to the Mineral and Petroleum Resources Development Act (MPRDA) may be withdrawn, and there are plans to split oil & gas from mining, resulting in separate legislation.

South Sudan

South Sudan resumed pumping out production in August of 2018 after years of civil unrest. Negotiations are now underway for new partners. Contracts haven been extended to China's CNPC, Malaysia's Petronas and India's ONGC.

Tanzania

Government's regime governing first exports and mandatory domestic obligations has slowed down development in the industry.

Uganda

Uganda passed the new local content policy in 2018. The government plans to achieve middle-income status by 2040, backed by the timely production start of the 6.5 billion bbls of crude in the Lake Albert Basin. Crude production is expected in 2021 at the earliest. FID is expected for the refinery as well as the crude export pipeline by the end of Q1 2019.



Industry insight Sandy Stash – Tullow Oil



Sandy Stash Executive Vice President – Safety, Operations, Engineering, and External Affairs Tullow Oil, plc

With over 30 years in the oil & gas and mining industries, Sandy Stash has vast, global leadership experience in operations and engineering; business, risk and crisis management; external affairs and communications; sustainability, safety and health; complex litigation; and organisational transformations and start-ups.

A petroleum engineer by training, Sandy started out as a drilling engineer and well site supervisor at ARCO locations across North America. She subsequently worked across safety, engineering and operations in roles at Talisman Energy, BP, TNK-BP and Arco. She joined Tullow in 2013.

Tullow Oil

Tullow Oil is a leading independent oil and gas exploration and production company. The Group has interests in more than 80 exploration and production licences across 16 countries.

Q What are your plans for Africa?

Tullow is an Africa operator and has been for more than 36 years. We have two facilities in Ghana which we operate, exploration activities in a number of countries, a non-operated portfolio in West Africa and a focus on East Africa. A large part of our new business development is in Kenya, where we are one year from making a final investment decision, and Uganda where we are in the process of transitioning from an operating interest to a non-operating interest.

Our focus is on investing in low-cost production plays, irrespective of location. It is therefore important for countries in Africa to offer competitive commercial and fiscal terms to attract investment and be low-cost destinations that will attract investment.

) What makes Tullow successful in Africa?

We operate from the countries we work in and localise where possible. We build long-term relationships based on trust with our host countries and communities. Tullow's general managers in Africa are all African and we have a medium-term vision of localised staff and leadership, including in technical parts of the business.

Q What role does technology play for Tullow to achieve this low-cost outcome?

Technology has an important role to play in achieving low-cost production plays. While it is still maturing, the use of technology as an enabler is very much on the radar screen. We have five work streams looking at the use of technology in areas such as production operations, well development, etc., and we are actively pursuing more automation initiatives.

Q What are the major challenges for oil companies in Africa?

Many African countries would like to see more fabrication and other value add work take place in Africa. There is, however, a lack of skills and infrastructure to achieve this everywhere. While infrastructure investments will enable the oil & gas industry, more widely felt benefits to the broader economy can also be realised through investments in, for example, port infrastructure.

A key challenge to overcome the infrastructure weaknesses is funding. Inbound investment from places like China has successfully addressed some of this challenge, but it is important that these investments must also benefit the local economy more extensively through the development of local skills and expertise.

Q What drives the opportunities in oil & gas?

Africa offers opportunities to access significant underexplored basins on the continent.

Q Do hydrocarbons have a role to play in Africa's future?

There is a huge demand for power in Africa, and there is a lot of potential for gas in Africa, more so than elsewhere in the world because of the energy deficit. For oil, Africa just must be globally cost competitive. Hydrocarbons will play a huge role in satisfying the continent's energy needs due to projected population growth.

Q What role do you see NOCs play in the future?

Many countries are still in the process of separating the regulatory functions from national oil companies. NOCs will have a role but it is still early days. There needs to be a process first to separate business aspects from the regulatory aspects.

Q How would you describe the future of oil & gas in Africa?

If countries are open for investment and offer competitive commercial terms, the African oil & gas industry will compete very favourably with the rest of the world.

A look to the future





Africa towards 2030

Africa is the world's fastest-growing economic region. The combined real (inflation-adjusted) gross domestic product (GDP) of the continent's 54 countries is forecast to grow by more than 4% per annum towards 2030. This will result in economic activity in Africa increasing by 60% between 2018 and 2030. In comparison, global real GDP growth will average only 3%, resulting in world economic activity increasing by only 45% over the same period.

The continent is home to nearly 1.3 billion people and has the youngest population of any continent. Many of its economies are benefitting from the kind of demographic dividend often considered as a key driver of the 'Asian growth miracle' seen in the 1990s.

Transformational change

The African population is expected to increase onethird by 2030, reaching more than 1.7 billion. By this time, the size of Africa's vehicle fleet is expected to have doubled as households with rising income levels embrace the mobility offered by private transport. The growing population is also becoming more urbanised. By 2030, it is expected that six of the world's 41 megacities will be in Africa: Cairo, Dar es Salaam, Johannesburg, Lagos, Luanda and Kinshasa. By 2035, half of the African population will live in urban areas. This brings with it energy demand for cooking, heating, communication, transportation and industrial production. Africa's energy consumption has already increased by almost 50% since 2000.

The continent's primary energy demand was 5.1 billion boe in 2014, accounting for 4% of the world's total energy consumption. Looking ahead, Africa's total energy demand is forecast to increase a further 60% by 2030.

Based on different potential trajectories for economic development, energy access policy and climate mitigation strategies, researchers have put forward various alternative scenarios for energy production and consumption on the continent in the decades ahead. Hydrocarbons will likely play a significant role in the energy mix that will satisfy Africa's growing energy needs. Major gas finds on the continent, including those in Mozambique, Nigeria, Angola, Tanzania, Senegal and Mauritania, could augment the key position of gas as an energy source for Africans. Whether as a source for power generation, transportation fuel or for cooking and heating, gas also has the potential to reach rural areas where it can run off-grid or mini-grid solutions.

In the low-carbon context, gas also plays the role of a transition fuel before a wider switch to renewables and electricity – a development which is likely to take longer in Africa than on other continents. In this context, a large-scale transition to electric vehicles is not imminent, and hydrocarbons will remain the largest energy source for transportation in the near future.

The population and fleet growth will mean increased demand for liquid fuels, and many African countries are 'thinking refineries' at various scales. Countries that are considering new refineries or upgrades include Angola, Equatorial Guinea, Uganda, Nigeria, Republic of Congo, Ghana, São Tomé & Príncipe, South Africa and Zambia.

Given projected population growth and refined fuels consumption, an estimated additional 3.4 million bbl/d of refined fuels will be needed to meet Africa's needs by 2030. This is in addition to current refinery throughput with largely ageing equipment that is not running at full capacity nor producing fuels that meet international standards.

The additional demand could warrant approximately seven 400 000 bbl/d refineries once current projects are deducted, which includes the 650 000 bbl/d Dangote refinery planned in Nigeria.

Africa's energy future



Total energy usage in Africa rising 60% by 2030

Real (inflation-adjusted) GDP increase by nearly 60% by 2030



Almost 50% of growth in electricity generation in Africa up to 2040 is due to come from renewables

By **2040**, around **700** million people in sub-Saharan Africa will be without electricity access as population growth outstrips electrification efforts

By **2040**, four regions will have similar **LNG** exports: Asia-Pacific, Middle East, North America and Africa

Population increase by

a third to 1.7 billion by

2030. Vehicle fleet

doubles by 2030

By 2050, Africa's oil & gas production is set to increase by **74%** mainly driven by gas production

Africa's oil & gas consumption is predicted to increase by **45%**, increasing its global share **5.1%** by **2050**



Africa's liquids demand driven by transportation and chemicals, to grow by 30% to 2040, as emerging economies advance

Strategy& calculations based on Business Monitor Internal (BMI) data.

International Monetary Fund (IMF), 2014. Africa Rising: Harnessing the Demographic Dividend. https://www.imf.org/external/pubs/ft/wp/2014/wp14143.pdf

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N.S. Ouedraogo, 2017. Africa energy future: Alternative scenarios and their implications for sustainable development strategies. Energy Policy 106: 457-471.

NOC scenarios

Based on our analysis of developments in Africa, industry insights and the macro-economic outlook, we believe that there will be a strong case for oil & gas in Africa for the foreseeable future. NOCs play a critical role in the industry, and the way they evolve will also determine how the industry as a whole will have to respond to local circumstances in the countries where they operate.





The NOC's role is dependent on the country's resource status and the organisation's maturity level. We have identified four stages of maturity and roles for a hydrocarbon–rich and a hydrocarbon-poor NOC.

Resource-rich NOCs at different levels of maturity

The role of NOCs in hydrocarbon-poor countries



Source: PwC Strategy&

Within the context described earlier, there are factors that will drive how successful NOCs may be, and we have developed four scenarios to play this out.

For our scenarios we take a step back and try to imagine a few possible futures for NOCs in Africa. The intention is not to predict the future, but with these scenarios we depict a number of possible future pathways and provide industry players with some options with regard to how they might respond to these potential outcomes and their impact on operations.

To do this, we picked two factors we felt complemented one another well, reflecting the African context and generating distinct and compelling outcomes.

The first factor we evaluated is **regulatory certainty**, which is plotted on the vertical axis of the future scenario graphs that follow. Regulatory uncertainty is cited as one of the top-three challenges facing companies operating in Africa, as borne out in previous editions of the *Review* and further confirmed by interviews with industry experts presented in this report. Regulatory uncertainty is also a key parameter that determines investment decisions and has a direct impact on oil & gas activities.

The other factor we looked at is the **degree of economic diversification in an economy**, which is plotted on the horizontal axis of the graphs below. At one end of the spectrum are national economies that are highly dependent on the resources sector for growth. At the other end are economies in which multiple sectors (from industrial to services) contribute to overall economic growth.

A nation with large hydrocarbon resources may find itself in a hydrocarbon resource-based economy, or in a diversified economic position across the horizontal axis. Countries with few hydrocarbon resources will more than likely find themselves on the diversified economy side of the spectrum, with their NOCs playing the role of product purchaser, product aggregator, refiner or nation builder.

In the scenarios set out below, we take a step back and try to imagine a few possible futures for NOCs in Africa. The intention is not to predict the future, but with these scenarios we depict a number of possible future pathways and provide industry players with some options with regard to how they might respond to these potential outcomes and their impact on operations.

Key themes and four possible scenarios

In each scenario, we assessed the impact by looking through a consistent lens of key themes:



Whether the NOC has a domestic and/or international focus for its operations

The maturity level of the NOC's operating model – whether it is an emerging NOC or an advanced NOC with mature operations and acting as a resource custodian, for example

The potential to build partnerships with key third parties to develop capabilities



How technological innovation might evolve depending on the operating environment



The different implications of a low-carbon focus on an NOC depending on the scenario 4



The potential for foreign investment in the oil & gas sector and how local content initiatives might evolve

Based on this analysis, we identified four possible scenarios for African NOCs, which we discuss in the following pages.





Source: PwC Strategy&

The Condemned NOC

Scenario for an African NOC operating in a diversified economy amid regulatory uncertainty

We describe this as the 'condemned NOC' scenario as it depicts the worst outcome of two worlds colliding: a world in which regulatory uncertainty makes it difficult for an NOC to attract investment and skills and a world in which economic diversification means the oil & gas sector no longer plays a pivotal role in driving the growth of the nation's economy.

In this scenario, we see the NOC focusing more on domestic operations, and there is limited scope for growth. As the oil & gas sector is competing with other sectors in a diversified economy, there is less urgency for the NOC to expand domestically and even less so internationally.

Moreover, regulatory uncertainty hampers foreign investment. Only the larger investors have the risk appetite to invest (and only if the payoff is sufficiently large to warrant the risk), such as the oil majors and international NOCs. This in turn limits the overseas aspirations of the NOC. Moreover, private-sector players are active in the oil & gas sector and further erode the NOC's market share.

Against this backdrop, it is difficult to imagine the operating model of the NOC evolving into a mature player such as a resource custodian (with mature operations across the value chain) and even less so as a national champion (playing a socio-economic development role). The African NOC is likely to be an emerging producer or a market developer and is limited in moving up the maturity curve of operating models - nor does it need to do so. Regulatory uncertainty hampers its evolution into a fully-fledged



resource custodian or national champion. Moreover, if the oil & gas reserves base in the country is small, it is questionable if an NOC is really required to exist or whether it will survive in the long term.

Partnerships will be few and far between. Regulatory uncertainty inhibits the interest of IOCs and, to a lesser degree, other international NOCs. There may be some potential to explore collaboration in the African NOCs' domestic operations such as upstream, but given the sector's lack of strategic importance in a more diversified economy, this potential is limited.

The lack of sector evolution also suggests fewer opportunities to advance technology partnerships. whether it is to address digitalisation or operational technologies like enhanced oil recovery (EOR).

Technological innovation is also limited in this context. With the sector's importance diminished in a diversified economy, the NOC is under less pressure to innovate. Regulatory uncertainty and fewer partnerships also suggest innovation will be challenging. That said, other technologically successful sectors across the diversified economy may be able to seed their innovation into the oil & gas industry.

As for low-carbon, it is difficult to envisage significant progress in this area. Regulatory uncertainty suggests there is little pressure on the NOC to conform and improve its environmental footprint. There is also unlikely to be a regulatory push to develop a strategy for low-carbon energy production. However, lowcarbon developments across other sectors (reduced carbon emissions, installation of solar panels) may provide impetus for the NOC to adopt some emission reduction policies.

Finally, there is an incoherent approach to local content due to the regulatory uncertainty. Some African NOCs may exercise a more lenient approach to local content for the sake of commercial expediency when dealing with the IOCs. Also, there is the risk that regulatory uncertainty means the government fails to enforce compliance. Nevertheless, diversification across the national economy suggests there may be a transfer of skilled people from other sectors to support the oil & gas industry.



The Constrained NOC

Scenario for an African NOC operating in a resource-based economy amid regulatory uncertainty

We describe this as the 'Constrained NOC' scenario because on the one hand the African NOC has the potential to be in the driving seat. In a resource-based economy, the oil & gas sector is of strategic importance to the nation. However, the lack of regulatory certainty puts the brakes on this potential.

In this scenario, the NOC is wholly focused on domestic operations, as its imperative is to generate revenue from producing assets. International aspirations are secondary and not pursued. However, while there is an incentive to grow the upstream sector, regulatory uncertainty hampers the scope for partnerships and foreign investment. Larger IOCs and NOCs, and some of the independents with a higher risk appetite, may be keen to participate in the upstream sector, but there will be concerns about regulatory stability.

This lack of clarity around regulation also dilutes opportunities for partnerships to advance technology. As a result, this is a medium-tech world in which there are limited applications for digital technologies. The focus is more on production and less on efficiency. However, while the NOC may not be responsible for technology evolution, the investing IOCs will bring innovation given the sector's importance to the economy.

From an operating model perspective, the NOC is likely to be immature, ranging from an emerging producer to perhaps a sector developer. While the NOC has a major strategic role to play, the lack of regulatory certainty impacts its skills building capabilities. Local content



is a major focus as the NOC looks to develop skills and accelerate knowledge transfer. Nevertheless, the uncertainty of regulation discourages major foreign investment, as regulation is inconsistently enforced or vague. The net result of limited investment and restricted capabilities is a constrained NOC.

In this scenario, there is minimal pressure on the NOC to address the low-carbon agenda. In a resource-based economy, the focus is on oil & gas production and accelerating that growth. As a consequence, there is hardly any requirement for the NOC to demonstrate 'green' credentials such as by reducing carbon emissions from its operations. Developing a low-carbon energy portfolio, such as diversifying into solar, is a remote option.

The Evolving NOC

Scenario for an African NOC operating in a resource-based economy with regulatory certainty

We describe this as the 'Evolving NOC' scenario as it has a mostly positive outlook. In this context, the NOC benefits from being the primary focal point of the economy and is supported by regulatory certainty, which helps foster investment and capability building.

In this scenario, we see the African NOC building a strong domestic operational footprint. It may have some international aspirations with occasional overseas forays, but the focus is domestic. As the primary generator of revenue for the economy, the NOC is focused on increasing production. Given the importance of the sector and the regulatory certainty, foreign investment is forthcoming and partnerships are easily built. Large and small investors from IOCs to private equity are comfortable making investments in this stable regulatory environment. The NOC partners with other IOCs, NOCs and major oil services companies to enhance production.

In this context, the NOC is very much a sector developer. It has a growing upstream business and is also exploring downstream growth. Moreover, the NOC is on the path to evolving into a resource custodian and national champion. From a technology perspective, the importance of oil & gas to the state, combined with a stable regulatory environment, are conducive to technology investments. In this scenario, NOCs range from early adopters to aggressive promoters of digital transformation.

The greater regulatory certainty means the NOC is under pressure to reduce carbon emissions in its operations. As a result, there is greater focus on methane losses in infrastructure, as well as selective investments in renewable energy (such as solar powered pumps in the field) to establish greener credentials. Similarly, the regulatory certainty supports local content development, which is critical for the NOC as it develops capabilities. However, there is a risk that more stringent local content requirements may undermine IOC collaboration.

We also see some NOCs replicating what Eni is doing in Africa – adding solar photovoltaic (PV) to its portfolio to move from oil & gas to energy but still not as a fullyfledged NEC.



The Super National Energy Company of the Future



Scenario for an African NOC operating in a diversified economy with regulatory certainty

We describe this as the 'Super NEC' scenario as it is in many ways the ideal position for an African NOC. In this context, the NOC benefits from regulatory certainty, which helps foster investment and capability building. While oil & gas is no longer the central focus of the nation, a diversified economy brings other benefits such as investment and skills development.

In this scenario, the NOC has a strong domestic operational footprint with a stable regulatory environment encouraging different investor groups. However, a diversified economy also means the NOC can expand internationally. At this point, we see an NOC playing the role of resource custodian or national champion. This is a mature and sophisticated operator that has strong capabilities and is well-funded and innovative.

The partnerships it seeks are with IOCs looking for new downstream outlets for its crude. As a mature player, it will also be more cost conscious and seeks partnerships with technology providers to improve performance, such as through digital applications. It will also work with oilfield service companies to optimise production. This NOC is a high-tech player investing significantly in digital technologies to improve performance and the safety of operations, exploring data lakes, artificial intelligence and robotic process automation. From a low-carbon standpoint, this is a more advanced player. Regulatory pressures combined with other sectors promoting low-carbon means this NOC is focused on reducing emissions in its operations. Moreover, it will invest significantly in a range of technologies from solar and wind to carbon capture and storage (CCS), as other sectors maintain the lowcarbon momentum. In this context, the NOC becomes a national energy company, paving the way for future revenue streams that are not hydrocarbon based.

Despite the regulatory certainty, we see local content as a weakening priority as the diversified economy and rising foreign investment mean technical skills are built domestically. There is a transfer of knowledge and skills across the national economy that the NOC can tap into in order to build capabilities.

What these scenarios mean for NOCs and other industry players

Our scenario-based approach can serve as an aid to strategic planning. NOCs should map themselves against the scenarios and understand where they fit and whether their strategies are designed to avoid the pitfalls identified. We do not wish to suggest that every NOC should aspire to become a Super NEC but want to prompt conversations about appropriate strategy for each environment and positioning. Equally, our scenarios can serve other industry players to contemplate whether they are well- positioned to deal with different playing fields.





Industry insight Josephine Wapakabulo – UNOC



Dr Josephine Wapakabulo Chief Executive Officer UNOC (Uganda National Oil Company)

Dr Wapakabulo is the first woman inaugural CEO of a National Oil Company in history. She has more than 18 years' professional experience in multinational companies in various sectors including, oil & gas, defence, aerospace and IT consulting. Her executive level experience was gained in the UK, Germany, Australia and Uganda.

Josephine is a Chartered Engineer and holds a PhD in Information Science focused on big data. She published a book on the adoption of data-exchange standards and knowledge management technologies in defence and oil & gas companies. She has a Global Executive MBA from INSEAD business school in France.

UNOC

As the national oil company of Uganda, UNOC's purpose is to handle the state's commercial interest in the oil and gas sector and ensure that the resource is exploited in a sustainable manner. It seeks strategic partners who have the risk appetite, financing, technology and the necessary tools to enable it to deliver profitable projects and promote national content.

Q How did the low oil price impact your timeline and how do you respond to the oil price scenario?

The oil price collapse and resultant spending cuts have resulted in services being offered at much lower rates to willing buyers. As an emerging, pre-production player Uganda has not felt the downside impact of lower oil revenues. We have, however, been able to take advantage of the lower costs of services. We are therefore very incentivised to reach FID and first oil as quickly as possible and lock in these services at the lower price.

Q How do you see relationships between NOCs and IOCs? What is win-win?

Strategic partnerships with IOCs are key for UNOC to succeed. Our upstream interests are usually carried, but we are full equity partners in the refinery, pipeline, industrial park and storage projects. The key to a winwin is trust and transparency to achieve the desired results.

Q How do you see the role of NOCs in Africa?

The vision for UNOC is to have commercial interest across the value chain, in high barrier to entry, high skill areas, generating as much revenue as possible for the country, and separated from regulating and licensing.

UNOC has a critical role in building, empowering and supporting the local supply chain beyond the core oil & gas sector, so that even if UNOC is not there, they should continue to operate successfully across other sectors.

UNOC needs to find the right balance to gain as much value as possible from the sector on behalf of the state, ensuring that enough supporting sectors beyond the very core high barrier to entry are left to Ugandans to develop. This will fulfil the strategy of country at large.

NOCs should be cooperating on a skills and knowledge transfer level among themselves and IOCs. They should also share potential commercial opportunities, such as resource-rich countries collaborating with countries with refining capacity. UNOC has already started developing relationships with other African NOCs and even beyond Africa.

Q What role do you see hydrocarbons playing in Africa in future?

There is continuing investment in the hydrocarbon industry in Africa. In Uganda, hydrocarbon consumption rates are growing at 6-7%, and the population growth rate is at 3-4%. There will be alternative energy, but there will also be a place for hydrocarbons. Emerging economies need to move at a pace so they do not get left behind in developing their hydrocarbons. Africa is lagging behind the rest of the world – with limited electricity infrastructure, power generation and distribution capacity – and there will therefore be a longer lifespan for hydrocarbons on the continent.

Q How do you see the impact of digital transformation in Uganda?

UNOC relies on good credible partners at this stage to implement best-fit technologies, and we are fully engaged and up to date with developments in the digital transformation space.

Q What do you see as current and emerging challenges of operating in Africa?

Access to state funding to develop an emerging industry is a key challenge. The demands for funding competes against basic education, healthcare and other social needs of the country. This will remain a challenge until production starts and UNOC has a revenue stream of its own.

A lot of international development funding bypasses UNOC due to its company structure of being a truly commercial limited company with shareholders, which is a challenge that needs to be addressed.

Conclusion





The African oil & gas sector has been through a torrid few years in the wake of the oil price crash. However, the industry has restructured itself and is much more competitively placed in terms of operational performance. With the oil price now tracking above US\$70/bbl, interest in African oil & gas exploration is once again growing and project FIDs are gaining momentum.

However, it is critical that the sector retains its capital discipline and adopts digital technologies if the hardearned wins in cost savings are to be retained. Progress in addressing corruption and improving corporate governance will also need to be maintained. Moreover, in the longer term, the energy transition will continue to impact the sector's dynamics with implications for oil demand. Against this fluid backdrop, African NOCs will need to chart a course through increasingly turbulent waters. Whether it is an emerging producer looking to create an upstream capability or an established resource custodian, NOCs on the continent are facing an array of challenges. These range from implementing successful local content strategies to deciding what kind of lowcarbon energy company an NOC aspires to be. Having a clear strategy and understanding of differentiated capabilities will be key to developing a transformation road map that allows NOCs to transition to a new energy reality.

List of acronyms



bbl	Barrels
bbl/d	Barrels per day
boe	Barrels of oil equivalent
btu	British thermal units
CAGR	Compound annual growth rate
CCS	Carbon capture and storage
FID	Final investment decision
FLNG	Floating liquefied natural gas

GDP	Gross domestic product
IOC	International oil company
LNG	Liquefied natural gas
M&A	Mergers and acquisitions
NOC	National oil company
OPEC	Organisation of the Petroleum Exporting Countries
tcf	Trillion cubic feet



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