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How Did Africa's Prospective Petroleum Producers Fall Victim to the Presource Curse?

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Abstract

This paper reviews resource sector developments in 12 countries in Sub-Saharan Africa that made their first (major) petroleum discoveries during the most recent commodity boom. The analysis, which goes back to 2001, looks at sector forecasts of international organizations, governments, and companies and compares them with the results that emerged. The paper finds that a third of the countries did not make any commercially viable discoveries. Among those that potentially had commercial finds, the latest timelines from discovery to production are 73 percent longer on average than initially expected. In the six countries for which there are comparable data, revenue collected thus far or the most recent revenue projections for countries yet to reach production are 63 percent lower on average than the initial forecasts. All 12 countries experienced a disappointment in at least one of the three dimensions analyzed—and these disappointments are likely to be exacerbated by the recent price crash. The paper also documents the various policies adopted in response to the discoveries and—with the benefit of hindsight—finds that, in some cases, this over optimism contributed to the 'presource curse': suboptimal policymaking that did not align with the new realities. Some recommendations are provided on how better to navigate the inherent uncertainties in developing the sector.

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How Did Africa's Prospective Petroleum Producers Fall Victim to the Presource Curse?*

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1. Introduction

About a decade ago, as a result of new petroleum finds and with commodity prices at all-time highs, a group of countries in Sub-Saharan Africa were identified by experts as being on the brink of becoming wealthy from their oil or gas deposits. These countries went from being described as resource poor to "prospective exporters" (International Monetary Fund, 2012a) or "new producers" (Chatham House, 2019). Such hopes were reflected in policy documents published by major institutions such as the Africa Progress Panel (2013), African Development Bank (AfDB) (2015) and the International Monetary Fund (IMF) (2012). Our analysis, which covers the period from 2001 to June 2020, looks back at the historical oil and gas sector forecasts of international organizations (namely the IMF and World Bank), governments and companies across 12 countries, and compares them with the actual results that emerged in terms of resources discovered, sector development and government revenues.

We find that all 12 countries fell short of the forecast expectations. The economic outlook of these countries has changed following these disappointments, especially following the slump in commodity prices that began in late 2014. Our study takes stock of the lessons and provides some recommendations to help countries navigate the path to becoming resource rich without succumbing to the 'presource curse' (Cust and Mihalyi, 2017; Frynas and Buur, 2020). These lessons and recommendations are even more important after the recent price crash, with oil prices reaching a record low in March 2020.[1]

2. Countries of focus

We identified our focus countries by using two criteria. The first criterion measures whether countries are truly new producers, as opposed to established ones. We defined such countries as those for whom the share of oil and gas resource volume discovered between 2001 and 2018 represents at least three-quarters of the total oil and gas resource volume discovered since 1945 in said country (based on data from Rystad Energy's Ucube). This criterion excluded all countries that were already deemed significant producers, while allowing us to include countries such as Ghana, Mozambique and Tanzania, which already had modest production but made potentially transformational discoveries. Using resources found rather than proven reserves allowed us to include countries like Liberia, whose oil finds were ultimately found to be commercially unviable.[2]

The second criterion measured whether the resources found would, if extracted in their totality at the price average over the period, be large enough to significantly alter the country's economic future. We measured this by multiplying the total size of the resources found between 2001 and 2018 by the average Brent oil and US gas prices from 2001 to 2018 measured in 2000 real USD.[3] We divided this value by 20 years to account for the fact that the GDP reported is for a single year, whereas production typically happens over an extended period of 15 to 30 years.[4] Where the resulting amount is equivalent to at least 5 percent of the country's GDP in 2000 (before our study period), we included the country in our sample.[5] This allowed us to distinguish between countries

[1] Our study is based on information that was public up to June 26, 2020.
[2] This measure comprises of proven, probable, and possible recoverable economical volumes at the time of discovery, as measured by Rystad Energy's Ucube database.
[3] The average Brent oil price was $52.4 per barrel (bbl) and average US gas price was $3.87 per million British thermal units (mmBtu).
[4] This is clearly a simplification as it ignores what amounts of resources found are recoverable, the costs and profits of extraction, etc. However, it provides a ballpark estimate of their maximum revenue potential.
[5] We had to use 2011 data for South Sudan because it did not exist before then.

based on both the size of oil and gas discoveries and the size of the economy. For example, initial finds in São Tomé and Príncipe were small in absolute terms but big for such a small country. Conversely, there were some finds in Botswana, but they are very small compared to the size of the economy.

These two criteria clearly delineate the 12 countries at the center of our study, which we present in Table 1. As we show in more detail in Table 5 in the appendix, our selection of countries is robust to adjusting these thresholds in different ways, as there is a large gap between the countries included and excluded from our study for both indicators.

Table 1. Countries of focus against the selection criteria[6]

Country	**Share of oil and gas resource wealth discovered in 2001-2018**	**Forecast average annual gross value of resources discovered in 2001 to 2018 as percentage of 2000 GDP**
Ghana	97%	44%
Guinea-Bissau	100%	8%
Kenya	99%	12%
Liberia	100%	22%
Mauritania	100%	76%
Mozambique	97%	480%
Niger	90%	31%
São Tomé and Príncipe	100%	85%
Senegal	88%	77%
Sierra Leone	100%	42%
Tanzania	96%	46%
Uganda	100%	54%

Source: Rystad Energy's Ucube database; authors' calculations

In each of the 12 countries reviewed, we identified a trigger event—the announcement of a specific discovery, sequence of discoveries or field reevaluation—that led to a significant shift in expectations regarding oil or gas prospects in the country.[7] As we will discuss in later sections, shortly after these trigger events, companies, governments and international experts showed increased interest in further exploration, started planning for the quick ramping up of petroleum production and began preparing for a transition to a petroleum-producing economy. Table 2 sets out some of the details of these events.

[6] These criteria are based on resources found rather than proven reserves.
[7] This list of events builds on the discoveries presented in the World Bank Africa's Resource Future dataset.

Table 2. Trigger events identified in the countries of focus

Country	Time of event	Event type	Name of discovery	Location of discovery	Operating company
Ghana	2007	First giant oil discovery	Jubilee	Deepwater	Kosmos Energy
Guinea Bissau	2004	First oil discovery	Sinapa	Shallow water	Premier Oil
Kenya	2012	First oil discovery	Ngamia	Onshore	Tullow Oil
Liberia	2012	First oil discovery	Narina	Deepwater	African Petroleum
Mauritania	2001	First oil discovery	Chinguetti	Deepwater	Woodside Petroleum
Mozambique	2010	First giant gas discovery	Windjammer	Deepwater	Anadarko Petroleum
Niger	2005	First commercial oil discovery	Jaouro	Onshore	Petronas
São Tomé and Principe (incl. Nigeria JDZ)	2006	First oil discovery	Obo	Deepwater	Chevron
Senegal	2014	First commercial oil discovery	SNE	Deepwater	Cairn Energy
Sierra Leone	2009-2010	Sequence of oil discoveries	Venus, Mercury	Deepwater	Anadarko Petroleum
Tanzania	2010	First giant gas discovery	Pweza	Deepwater	Ophir Energy, BG
Uganda	2006-2008	Sequence of oil discoveries	Mputa, Waraga, Kingfisher	Offshore (in Lake Albert)	Tullow Oil, Hardman, Heritage

Source: Cust, Mihalyi, Rivera-Ballesteros (2020); authors' desk research of company announcements

In six of the countries, the trigger event was the first discovery that put them on the map. For example, in Kenya, after intermittent exploration activity since 1954, oil was finally discovered by Tullow in March 2012. This first find was large enough for it to highlight the country's potential. At the time, Tullow described as an "excellent start" (Tullow, 2012) and the Kenyan president called it a "major breakthrough" (Kibaki 2012, cited in BBC, 2012).

Uganda's first oil discovery in June 2006 was quickly followed by two more discoveries that year and a string of discoveries in 2007 and 2008. The key event was the discovery of fields with better quality reservoirs in the north of Lake Albert in 2008. The following year, Tullow described Uganda as having a "world-class basin" and declared that the commercial threshold had been exceeded (Tullow, 2009, p. 1).

In four of the countries, oil and gas had been discovered much earlier than the identified trigger

event, but these discoveries were small and not viewed as transformational even when some were actually exploited. It was the giant nature of subsequent discoveries (real or imagined) that drastically changed expectations.[8] Oil was discovered and had been produced in small quantities in Ghana since the 1970s. However, in 2007, Kosmos and Tullow discovered the "world class" Jubilee field (Tullow, 2008, p. 15). After drilling the first exploration well, the Ghanaian president said that oil could turn the country into an "African tiger" (Kufuor 2007, cited in BBC, 2007). In Mozambique and Tanzania, limited onshore gas production had been taking place since 2004. Then in 2010, Mozambique made a giant offshore discovery that provided a "strong indication of the potential of the [Rovuma] basin" (Anadarko, 2010). Tanzania's breakthrough discovery also came in 2010 in the Pweza field. After relatively large offshore discoveries in 2010 and 2011, Ophir Energy made its largest-ever discovery in 2012, which "substantially exceeded pre-drill expectations" and was a "major step closer" to a liquefied natural gas (LNG) project (Ophir Energy, 2012).

In Niger, exploration of the Agadem basin had taken place since the 1970s and had yielded multiple small oil discoveries. Petronas then made a larger discovery in 2005, but decided it was not commercially viable and abandoned the block. However, encouraged by high oil prices, China National Petroleum Corporation (CNPC) acquired the block in 2008. It announced a $5 billion investment plan to develop the resources that same year, which in turn triggered hopes of an oil-rich future.

Following these trigger events, all 12 countries started preparing to become petroleum rich. In the following section we review this journey.

[8] A giant discovery is one exceeding 500 million barrels (mbbl) and giant fields are those with estimated ultimate recoverable reserves of 500 mbbl of oil or gas equivalent. See Horn (2011).

3. The challenging road to becoming resource rich

The sector can have many benefits and costs for a country. Our analysis is focused on the direct economic impacts and the expectations surrounding them. We analyzed the sector's development and impact across three dimensions: resources discovered; timelines from discovery to production; and government revenues. Resources discovered and timeline to production underpin all other opportunities that a sector provides to a country; while the generation of government revenue tends to offer it the greatest potential source of benefits (Natural Resource Governance Institute, 2014) and should be an indicator of any wider disappointments. These dimensions are also easiest to measure and assess.[9]

Each of the 12 countries we looked at has suffered from at least one disappointment on its road to benefiting from its perceived resource wealth. We now discuss these disappointments in more detail.

3.1 Resources discovered

Economists often depict countries as being resource rich or resource poor based on a snapshot and using a single indicator. For example, Sachs and Warner (2001) use the single measure of resource export to GDP, Venables (2017) uses resource rent to GDP and Arezki et al. (2017) use the net present value of oil finds to GDP. In practice, the reality is more complex. Only known resource wealth can be readily assessed, but countries differ substantially in the amount of exploration undertaken (Arezki, van der Ploeg, and Toscani, 2019). Given that countries with weaker institutions are much less explored (Cust and Harding, 2019), estimates of known wealth mask how much more may be found if institutions improve. The certainty and commercial viability of resources found also varies significantly and may change over time. For example, a gas field once seen as non-viable may become lucrative once the necessary infrastructure is in place to utilize it.

In this section, we review how much the perception of the 12 countries' resource endowments changed in the period of study.

In five of the twelve countries—Ghana, Mauritania, Mozambique, Niger and Senegal—discoveries have attracted a final investment decision (FID). Three countries—Kenya, Tanzania and Uganda—are still awaiting an FID. The initial oil discoveries in the other four countries—Guinea-Bissau, Liberia, São Tomé and Príncipe and Sierra Leone—have already been deemed to be non-commercial and abandoned by the companies. Kenya has also suffered from disappointment in this area. While its oil discoveries may still attract an FID, discoveries of gas have already been abandoned. Current estimates of oil and gas reserves in the 12 countries are provided in the appendix.

Resource growth

Initial discoveries in the East and Southern African countries of Kenya, Mozambique, Tanzania and Uganda led to further discoveries and production plans. For example, after Uganda's first oil discovery in 2006, 20 subsequent discoveries were made in blocks 1, 2 and 3A. These blocks now comprise the Albertine Graben project planned by China National Offshore Oil Corporation (CNOOC), Total and Tullow. Similarly, offshore gas discoveries in Mozambique and Tanzania in 2010 were followed by multiple others, with LNG projects now planned in both countries.

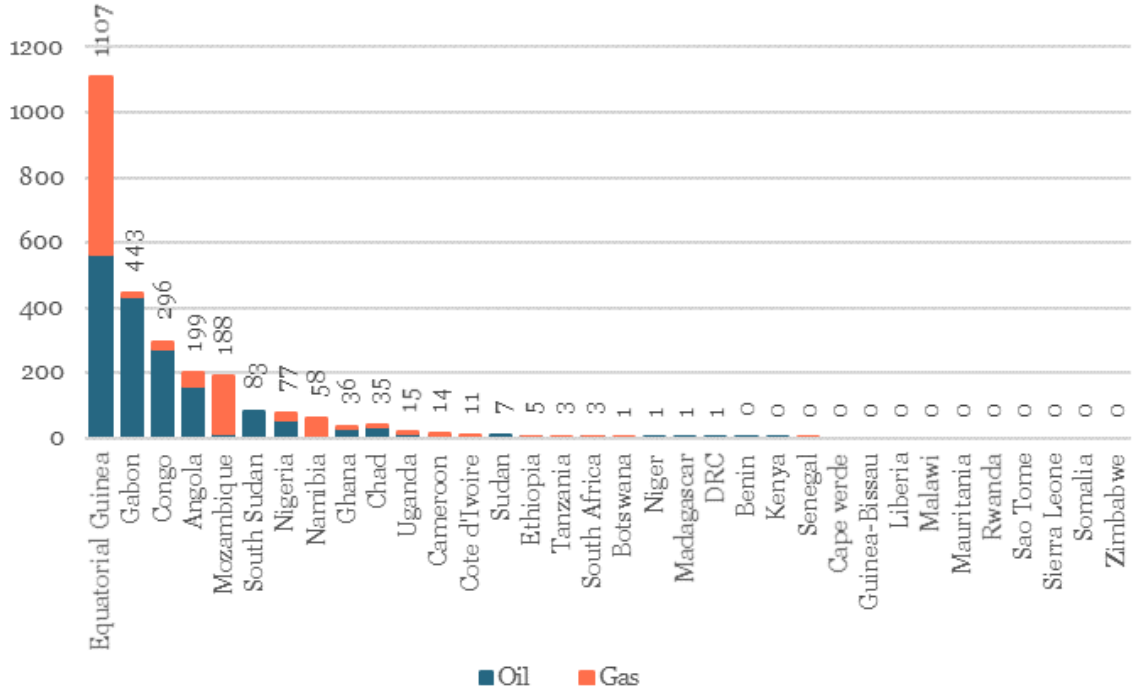
Similar success has been experienced in the West African countries of Ghana, Mauritania, Niger and

[9] For example, government revenue forecasts are more common than, for example, employment forecasts. It is therefore easier to determine whether government revenue has disappointed rather than whether job creation has disappointed.

Senegal. For example, Petronas and Esso's 2005 oil and gas finds in Niger's Agadem Basin were initially deemed unviable and abandoned. However, China National Petroleum Corporation (CNPC) acquired the assets in 2008, and explored further. They discovered around 1 billion barrels and built a local refinery with capacity to produce 20 thousand barrels per day (mbd). In Ghana, an initial oil discovery in the Jubilee field in 2007 was followed by 29 further discoveries of which 15 are currently considered commercial (though none as significant as Jubilee). In total, around two billion barrels of oil equivalent (BOE) of oil and gas have been discovered to date.

Initial discoveries therefore did represent the emergence of concrete potential for oil and gas production in these eight countries. But it is useful to keep in mind that, other than Mozambique, reserves per capita found to date fall well short of the "established" oil producers in the region. As discussed in a later section, expectations in these countries and among policy experts have not always accounted for this fact.

Figure 1. 2018 2P reserve value (barrel per capita)[10]



Source: Rystad Energy's Ucube database

Promise unfulfilled

Guinea-Bissau, Liberia, São Tomé and Sierra Leone have all suffered disappointment after initial discoveries. For example, Guinea Bissau discovered oil in Premier Oil's Block 2 in 2004 (and previously at Dome Flore in the late 1960s), but subsequent results were disappointing. Sierra Leone made three oil discoveries between 2009 and 2013. However, they were all found not to be commercially viable and no further exploration has occurred since.

From 2011 to 2016, five oil discoveries were made in Liberia, including one that was announced as a "significant oil discovery" by African Petroleum in 2012 (African Petroleum, 2012). For a period, the country attracted the interest of super majors such as Chevron and Exxon. However, none of the

[10] 2p reserves are proven and probable reserves.

discoveries was commercially viable. By 2014, optimism had begun to diminish. Initial prospects being found to be non-commercial was compounded by investor concerns about a devastating Ebola outbreak and falling global oil prices. Some companies decided to relinquish or not renew their expiring licenses in 2016 and 2017. In 2016, Exxon found a once-promising prospect to be dry, which effectively signaled the end of the wave of interest in Liberia's waters. By the end of 2017, most companies had left and are yet to return.

In 2001, São Tomé established a joint development zone (JDZ) with Nigeria in the vicinity of major Nigerian oil discoveries. After the first licensing round attracted companies such as Chevron, Exxon and Total, in 2004, the IMF stated that the country stood at "the threshold of the oil era" (2004, p. 4). In 2006, Chevron reported a discovery in Block 1. While the company's announcement indicated that it was premature to determine whether it was commercially viable, it referenced large oil field analogues in Nigeria. As a result, rumors emerged of at least 1 billion barrels being discovered: a significant find for such a small country (see, for example Shea, 2006). However, these rumors were not substantiated, and it was later confirmed that the discovery was not commercially viable. In all, seven wells were drilled between 2006 and 2012 that yielded six discoveries, none of which were deemed to have the potential to be commercialized. Due to the disappointing exploration results, all the major companies pulled out of the JDZ by 2013. Exploration activities only picked up again in 2019, but in São Tomé's Exclusive Economic Zone.

Despite the oil discoveries in its Turkana Region leading to modest production plans, Kenya has also suffered from discovery disappointment. An onshore gas discovery in Block 9 by CNOOC in 2010 was abandoned the same year. After further exploration of the block by Africa Oil, a discovery was announced in 2014, only to later yield disappointing results. Gas discoveries in offshore Block 8 in 2012 and onshore Block 4 in 2018 have also been deemed non-commercial.

Reasons for unfulfilled promise

Deposit size determines commercial viability. In remote, deepwater basins, large discoveries are needed for a company to deem a discovery commercially viable.[11] Individual discoveries are often not of this size, and therefore it may take several wells to prove or disprove the commercial viability of a find. Several disappointments, such as those suffered by Liberia and Sierra Leone, arose when companies announced early findings without offering a caveat on commerciality.

Misleading announcements by companies. Sometimes smaller listed companies, such as African Petroleum, are incentivized to emphasize positive results to inflate their share price. This can mislead governments as well as other companies exploring in the same basin. In Sierra Leone and Liberia, companies' lack of transparency on technical results obfuscated the true value of their discoveries, which led to companies continuing to drill in other blocks after the geological area had been shown to be unviable (Myers, 2019).

Inadequate pre-qualification criteria to select companies. While Liberia managed to attract some highly qualified companies like Exxon and Chevron, it also granted licenses to companies with no track record in exploration or tainted histories, like African Petroleum.[12] As Liberia's experience highlights, the use of less qualified companies can not only reduce the likelihood of exploration success, it also makes discovery announcements less credible.[13]

[11] For oil discoveries in Africa, this is about 300 mbbl (largely irrespective of the fiscal regime) (Myers, 2019).
[12] In 2009, African Petroleum was blocked from listing on the London Stock Exchange due to concerns about the founder (Fortson, 2009).
[13] For example, a company that previously had the same ownership as African Petroleum published misleading statements on its oil reserves (Armitstead and White, 2009).

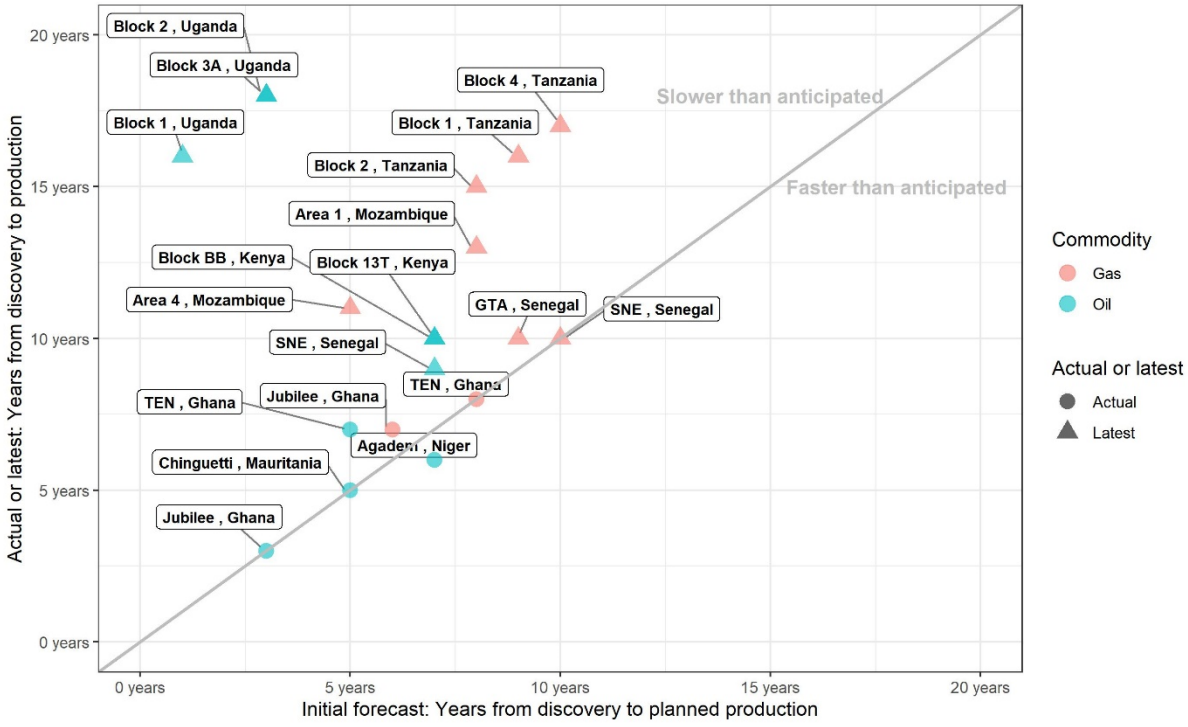
3.2 Timeline from discovery to production

Oil and gas projects are capital intensive and difficult to execute. This is why so many fail to be ready on-time and on-budget, as reported by industry studies (EY, 2018). Despite such evidence, scholarly economic studies tend to assume that discoveries will take equal time to reach production across contexts. In estimating economic impact, Arezki et al. (2017), for example, rely on the assumption that it takes five years for a giant oil discovery to turn to production.

However, differences in timelines and delays matter for the short-term impact of oil and gas finds. We therefore document the changes in timelines set for reaching first oil or gas across the fields discovered in the countries of study.

As Figure 2 shows, of the eight countries to make commercially viable discoveries, three—Ghana, Mauritania and Niger—have reached production, and reached it on schedule. However, five other countries—Kenya, Mozambique, Senegal, Tanzania and Uganda—are still some years from reaching first oil or gas. For Senegal, which had its discoveries more recently, delays are minimal, though the President has suggested delays should be expected as a result of the pandemic (Pilling and Munshi, 2020). For the others, current timelines are in stark contrast to initial projections—and are likely to be further delayed as a result of the recent price crash. All projects above the 45-degree line in Figure 2 are delayed.

Figure 2. Initial forecast versus actual or latest timeline from discovery to production[14]



Source: Authors' collection from company, government and IMF statements and reports. See Table 6 in appendix for more details.

[14] For projects that are yet to reach production, we report the latest estimate of first oil or gas. Data are current as of June 2020, but expected delays as a result of the recent price crash are yet to be factored into publicized estimates.

While initial timelines across the eight countries forecast production to commence an average 6.4 years after discovery, even if the most recent timelines are met, the average would actually be 11 years. The differences are more marked for oil (forecast of 4.8 years versus actual/latest of 10.2 years) than for gas (forecast of 8.1 years versus actual/latest of 11.9 years).

Timely production

After oil was discovered in Mauritania's Chinguetti field by Woodside Petroleum in 2001, the country successfully reached first oil in 2006 as forecast. Ghana and Niger also reached first oil on schedule, and extremely quickly by international standards. Ghana took around three years to get from the first discovery in its large Jubilee field in 2007 to first oil in 2010, meeting Tullow's ambitious timeline and, according to the company, setting a "new global benchmark" for the development of major deepwater projects (Tullow, 2011, p. 52). In Niger, development of the Agadem oil field by CNPC, and construction of a refinery and pipeline to connect the two by CNODC, were also completed in three years. First oil was reached in 2011 rather than in 2012 as expected. All three projects targeted oil rather than gas, and Mauritania's Chinguetti and Ghana's Jubilee fields were offshore and developed from floating facilities (known as floating production storage and offloading or FPSO facilities), though Niger's Agadem was onshore. All three benefitted from high/increasing commodity prices through most of their development timeline.[15]

Delayed projects

Kenya, Mozambique, Tanzania and Uganda have taken much longer to reach production than expected. Each of these countries should have been producing by the end of 2020 according to early forecasts, and some should have already been producing for several years by now. The reality has been very different.

In Tanzania, the first publicized timeline for the development of the planned LNG project comprising blocks 1, 2 and 4 was from the IMF in 2012, which suggested that first gas by 2020 was achievable (IMF, 2012b). This prediction was subsequently echoed in company and government statements. However, delays in passing key legislation and identification of a site for the planned LNG plant and a fall in gas prices caused this timetable to slip. Sweeping legislative reforms in 2017 and a government review of existing production sharing agreements (PSAs) (including for blocks 1, 2 and 4) in 2019 have complicated negotiations and pushed back the timeline further.[16] In early 2019, the government stated that it hoped to agree to key terms by September 2019, reach an FID in 2022 and first gas in 2028 (Ng'wanakilala and Dausen, 2019). However, with key terms still yet to be agreed and negotiations currently suspended, further slippages are almost certain (Materu, 2019b).

Uganda's journey to first oil has been similarly challenging. The first operator, Tullow, initially targeted first oil in 2009, and this timeline was reflected in IMF reports. However, it was soon pushed back to 2010 and then repeatedly delayed thereafter. The IMF, for example, has changed its first oil estimate eight times since its initial projection (see Figure 3). The most recent estimate is first oil in 2023 to 2024 (IMF, 2019b, p. 8), but this is likely to also prove over-optimistic with an FID unlikely before 2021 (Perkins, 2020).

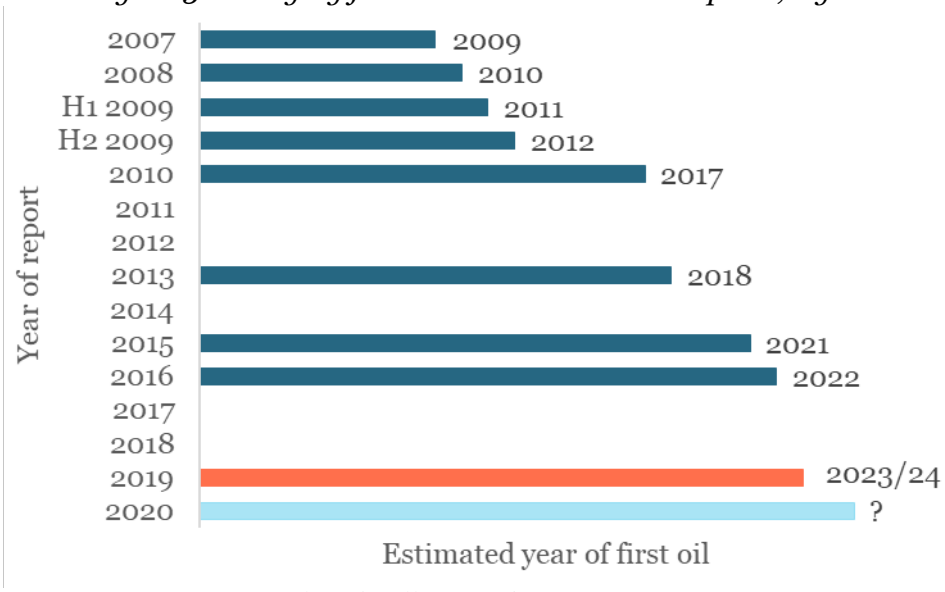
Our analysis of oil and gas asset data between 1960 and 2018 suggests that, on average across all projects worldwide, it took 7.5 years to get from discovery to production. In Sub-Saharan Africa, the

[15] There was significant price volatility from 2007 to 2009, but prices on average were very high by historical standards.

[16] The structure of the regulatory framework for the LNG project will depend on whether the blocks and the LNG plant are treated as separate entities. If, as expected, they are, PSAs will govern the blocks and a host government agreement will govern the LNG plant.

average timeline is longer: around 12 years. For only gas assets, the average time is 9 years globally versus 15 years in Africa.[17] Early predictions of first oil within as little as three years in Uganda were therefore clearly over-optimistic. However, delays have also resulted from a fall in the oil price, disputes about capital gains tax and how the oil should be split between a domestic refinery and exports, and the need to establish a cross-border route for an export pipeline. With the apparent resolution of these disputes and the signing of a 2017 intergovernmental agreement between Uganda and Tanzania for an export pipeline through Tanzania, an FID has been believed to be imminent for some time. However, negotiations of Ugandan and Tanzanian host government agreements for the pipeline are taking longer than expected (Abdallah, 2019). Another capital gains tax dispute also delayed Tullow's planned sale of its interest to its joint venture partners Total and CNOOC in 2019, with that only being agreed in early 2020 (Total, 2020).

Figure 3. Changing first oil estimates in IMF reports, Uganda



Source: Authors' collection from IMF country reports

Reasons for delay

There appear to be several reasons why Kenya, Mozambique, Senegal, Tanzania and Uganda have suffered delays.

Volatile oil and gas prices. The fall in prices at the end of the commodity boom has been frequently cited as a cause of delays. While prices are always subject to short-term fluctuations, this downturn was generally seen as the start of a period of prices being "lower for longer" (Arezki, 2016). There was particular pessimism about the long-term gas price due to expectations of excess supply and increasing convergence between the Asian, U.S. and European markets (see, for example: Standard Bank, 2014, p. iv). As a result, planned projects are likely to have been viewed as being less attractive, and perhaps even unviable—necessitating adjustments to the project design and/or the negotiation of a less burdensome regulatory framework, all of which take time. The lower prices prevailing at the time also meant companies had less capital available for new investments.

Delays in passing key legislation and regulations. Governments often choose to put in place

[17] This analysis was done using Rystad Energy's Ucube database that consists of over 25,000 oil and gas assets globally, but we calculated averages only for assets that have started production to date.

new legislation or to revise existing legislation post-discovery as the prospect of an oil and gas sector becomes a reality. Delays in this process have been cited in Tanzania and Kenya as a significant obstacle to project development (see, for example: Miriri, 2018). Tanzania started developing the core of its legal framework as early as 2006, when offshore exploration was starting to increase. However, the Petroleum Act was only passed in 2015. Since then, only some of the necessary regulations have been finalized. Kenya's Petroleum Bill took from 2013 to 2018 to pass. It is difficult to definitively establish common causes of these delays. However, it is likely to result in part from political deadlock, limited capacity, and insufficient prioritization of core parts of the legal framework. For example, alongside Tanzania's delayed Petroleum Bill 2015, there was also a revenue management bill. Limited capacity makes prioritization more critical. There also appear to be specific "sticking points" in some cases. For example, in Kenya, the arrangement for sharing revenues sub-nationally appears to have been a key obstacle.

Negotiating a better deal for the country. Kenya, Tanzania, Uganda and Mozambique all appear to have taken longer to get to FID partly as a result of their governments trying to get a better deal. This has included attempts to negotiate higher taxes, a larger supply of the resource to the domestic market, greater local content and supporting infrastructure that is more beneficial to the country. These efforts have been made more difficult by lower prices.

Slow development of negotiating and regulatory capacity. Before a country has made a significant discovery, it often does not make sense for the government to invest heavily in developing the capacity necessary to negotiate deals in the sector or intensively oversee company operations. After a discovery, a government will often try to develop strong negotiating and regulatory capacity as it proceeds. However, when this process moves slowly, it can mean that deals, approvals and other regulatory decisions are delayed. For example, the Tanzanian government has indicated that it has been cautious about concluding a deal until it is confident that it has sufficient capacity to avoid mistakes (Materu, 2019a).

Cross-border issues. Several countries have had to resolve ownership questions where oil and gas deposits straddle national boundaries or when maritime boundaries are disputed. For example, while Ghana's Jubilee project was developed on schedule, the Tweneboa-Enyenra-Ntomme (TEN) field reached first oil two years later than expected as a result of a maritime border dispute with Côte d'Ivoire.

Resources discovered in landlocked countries require cross-border agreements to facilitate export routes to market. Disagreement around the route and the contractual terms for the pipeline to transport Uganda's oil to the ocean for export is a key cause for delays in the development of both Ugandan and Kenyan oil. In 2015, Uganda agreed to route its oil through Kenya, with a pipeline also connecting Kenya's oil blocks to the ocean. However, in 2016, the Ugandan government agreed to route its oil through Tanzania instead due to reported security and financial considerations. The companies operating in Kenya then had to agree a separate pipeline to a Kenyan port. Negotiations on both pipelines continued at the time of writing.

Wider country developments. In Mozambique, macroeconomic mismanagement—including significant borrowing without the required parliamentary approval and subsequent difficulties in servicing the loans—highlighted governance weaknesses and increased the country's risk rating, making it a more difficult context for investors to operate. Governance and macroeconomic factors have also been found to hinder the timelines of mining projects going from discovery to production around the world (Khan, Nguyen, Ohnsorge, and Schodde, 2016).

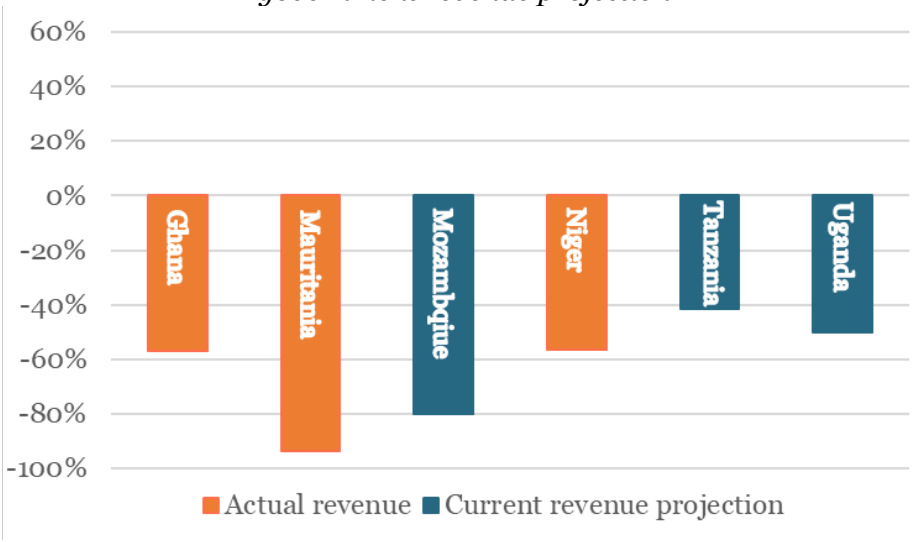
3.3 Government revenues generated

A third category of disappointment is government revenues. The three countries in our sample that have begun producing oil—Ghana, Mauritania and Niger—experienced clear successes in terms of timeline. However, public revenue collection has fallen significantly short of forecasts.

The principal reason for disappointing government revenues in Mauritania and Niger is a shortfall in production. Challenges associated with taxing production are also a factor, especially in the case of Ghana. The resource sector can be hard to tax effectively. First, the fiscal terms that set out how to share profits from newly-producing fields are generally agreed upon at the time of license allocation, before exploration commences (Daniel, Keen and McPherson, 2010). This means that in new producers, the tax terms are mostly set when a country was resource poor with perceived high exploration risk. At this stage, governments often have limited sector expertise and weak bargaining power. Second, some of the key tax instruments used to generate government revenues in the sector can be complex and hard to administer (Calder, 2014). This challenge is exacerbated by the risk of companies taking advantage of such weaknesses and shifting profits overseas (Beer and Loeprick, 2017).

Some analysis suggests that government revenues are also likely to disappoint for the other countries if and when they reach first oil or gas. Indeed, no countries in our sample have or are likely to generate government revenue greater than initially projected. As shown in Figure 4, for the countries in which we have government revenue data, actual government revenue or the most recent projection is an average 63 percent lower than was initially projected.

Figure 4. Difference between initial government revenue projection and actual or most recent government revenue projection



Source: Authors' collection. See details in text.

Mauritania was expected to generate more than $700 million a year by 2015, as projected by the IMF in its baseline scenario in 2006 (IMF, 2006, p. 21), as shown in Table 3. However, this projection was based on its Chinguetti field producing over 50,000 barrels a day over 20 years and additional production from other fields. In reality, unforeseen geological complexities meant Chinguetti production, which started in 2006, never met expectations. It then ceased production earlier than expected in 2017. Other fields are still yet to be developed. As a result, revenues have been significantly lower than projected despite a higher oil price and higher government revenue per barrel. Average annual government revenue of $67 million between 2010 and 2015 (based on

Extractive Industries Transparency Initiative (EITI) reports) was even lower than the IMF's low case scenario (Mauritania EITI, 2013-2017).

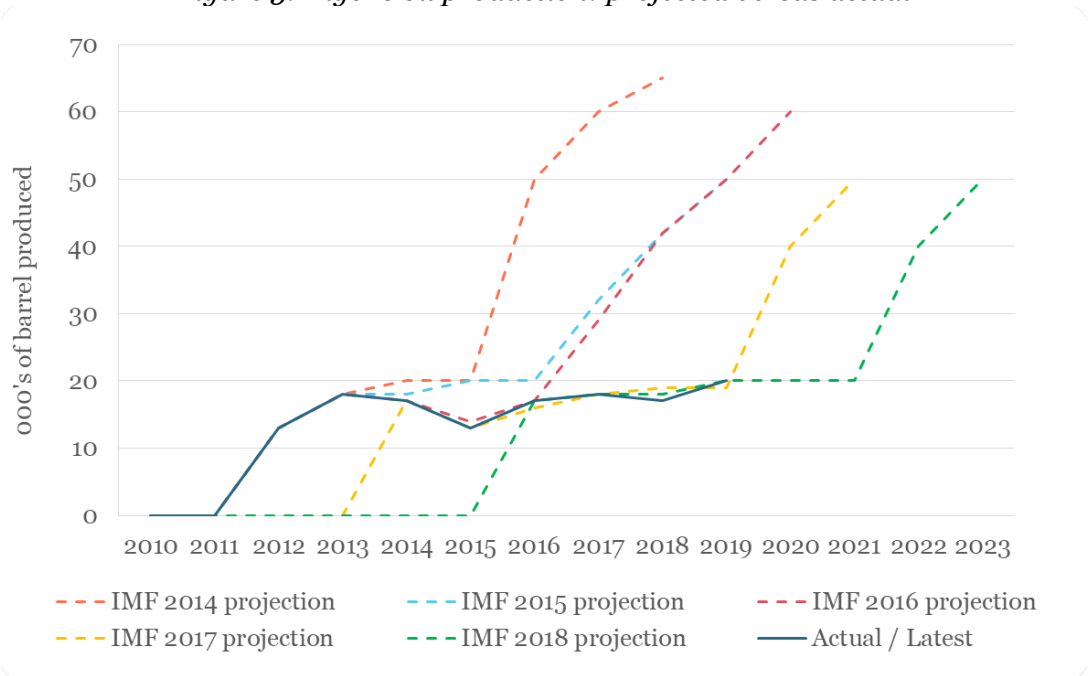
Table 3. Mauritania's oil revenues: projected versus actual

	IMF baseline forecast for 2010	IMF low case forecast for 2010	Actual for 2010	IMF baseline forecast for 2015	IMF low case forecast for 2015	Actual for 2015
Production (barrels/day)	143,562	104,110	8,000	98,904	59,178	5,082
$/barrel	37.8	28.3	80.2	42.2	31.7	50.6
Government revenues ($m)	550	253	38.5	723	166	40.1

Source: IMF (2006); MREITI (2013, 2017)

Niger has also seen production shortfalls impacting government revenues, with production constrained by the country's refining capacity and lack of an export pipeline. The Soraz refinery that was constructed as the Agadem oil field was developed has a capacity of 20,000 barrels a day. IMF government revenue projections have been based on oil production significantly exceeding this volume from 2015 onwards (see Figure 5). However, despite Niger's oil reserves allowing for this ramp up, plans for an export pipeline stalled. As a result, while the IMF forecast in 2011 that government revenues would be 1.6 percent of GDP by 2018 (IMF, 2011 p.40), they were 0.7 percent of GDP in practice (IMFa, 2019, p.47).[18] Construction of an export pipeline via Benin was expected to start mid-2020 but the pandemic may well delay that.

Figure 5. Niger's oil production: projected versus actual



Source: Authors' collection from IMF reports

[18] Pricing arrangements for purchases and sales by the partly state-owned refinery appear to have also reduced government revenues, though less than production shortfalls have.

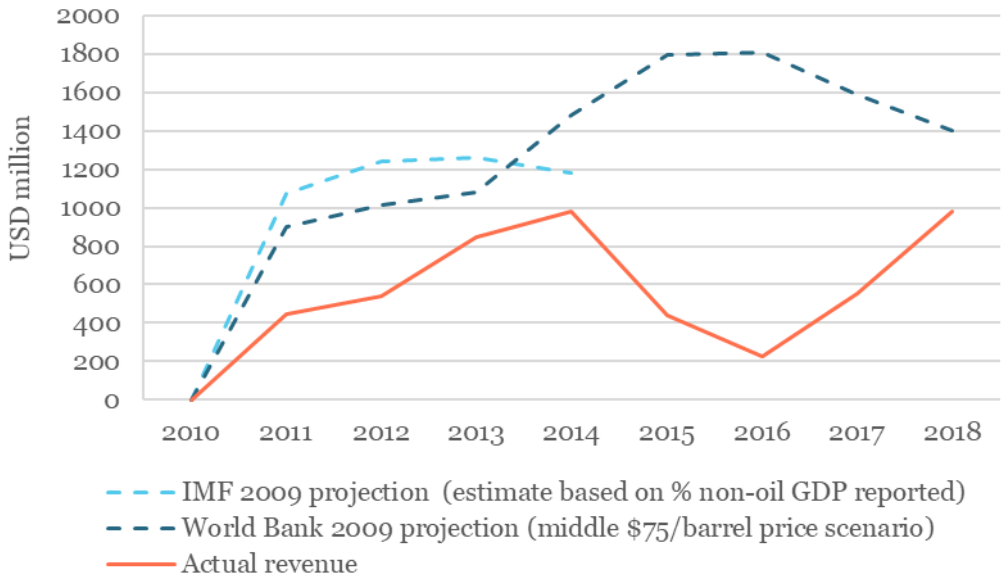
In Ghana, early projections by the IMF (2009, p. 28) and World Bank (2009, p. 21) suggested government revenues of at least $1 billion from 2011 onwards. However, as Figures 6 and 7 show, these projections proved overly optimistic. The World Bank estimated average government revenue of $1.4 billion a year in its central scenario between 2011 and 2018. Actual revenues were less than half that, approximately $0.6 billion for that same period (PIAC, 2019. p. 51).

This revenue shortfall was not caused by lower oil prices. From 2011 to 2014, the price averaged $108 per barrel, significantly higher than the IMF's forecast of $62.5 per barrel and the World Bank's main scenario assuming $75 per barrel. From 2015 to 2017, the actual Brent price was much lower, averaging $50 per barrel. However, the World Bank alternative scenario that assumed a constant price of $50 per barrel from 2011 (which therefore does not account for the earlier high prices enabling more rapid cost recovery in reality) still estimated revenues of more than $0.5 billion. In contrast, they were below $0.4 billion from 2015 to 2017.[19]

Jubilee has suffered from several operational problems, never producing to its 115 mbd design specification and experiencing significant delays with its gas infrastructure. These challenges are believed to be at least partly due to the pace at which it reached production (New Petroleum Producers Discussion Group, 2019). The slight shortfall in production volumes compared to projections was offset by production from the neighboring TEN field in 2017. Another key driver of lower revenues is costs being higher than anticipated, compounded by limited ring-fencing of cost deductions across projects. While the World Bank assumed total capital costs of $4 billion for the Jubilee project, our best estimate of actual costs is closer to $7 billion.[20] The World Bank also assumed lower operating costs compared to the reality. Moreover, with the same companies involved in the TEN project and weak ring-fencing provisions, at least some of its development costs—initially planned to be around $4.9 billion—are likely to have been deducted against Jubilee's taxable income. Initial projections of government revenues do not appear to have factored in this impact. The development of additional oil discoveries, such as the TEN project, means at least some of these revenues will be collected in the future. Though as a result of the sharp decline in oil prices in 2020, the government has slashed its oil revenue forecast to $0.6 bn, meaning revenue is no higher than in the early years despite the larger volumes (MOFEP, 2020).

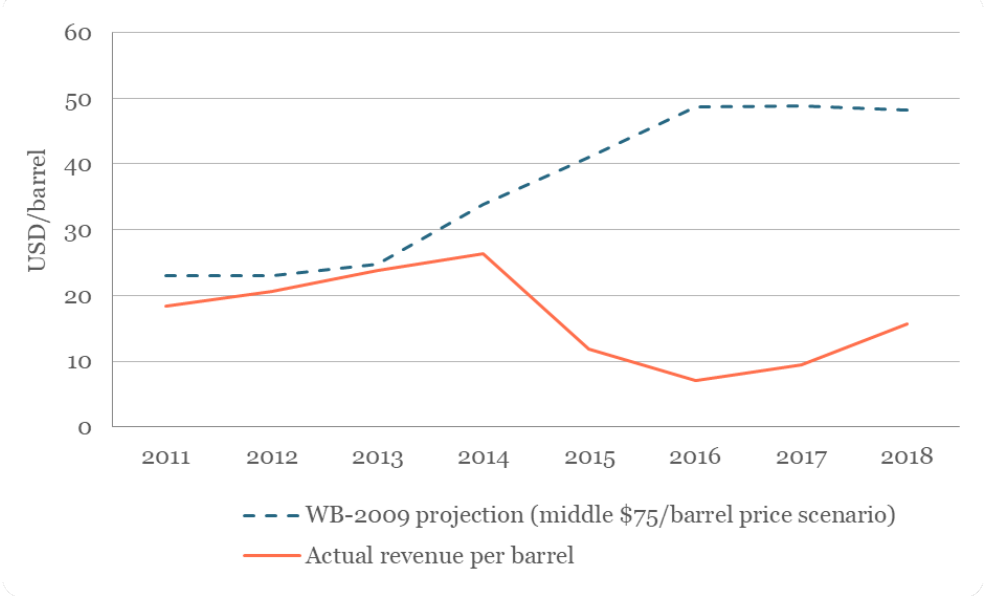
[19] The original IMF forecast stops in 2014, hence it is not directly comparable in this low price period.
[20] Our estimate is based on initial development costs of $4.8 billion, $1.1 billion additional investment in 2012, and additional maintenance of around $1 billion.

Figure 6. Ghana oil revenues: projected versus actual



Source: Authors' calculation based on IMF (2009), World Bank (2009) and PIAC (2019).

Figure 7. Ghana government oil revenues per barrel: projected versus actual



Source: Authors' calculation based on World Bank (2009) and PIAC (2019)

We do not know what government revenues will be in the countries yet to reach production, but several of them were also at risk of suffering disappointment based on pre-pandemic projections. For example, the first widely publicized estimate of Tanzania's revenues from the planned LNG project in 2014 suggested annual revenues of $3 billion to $6 billion at peak production were possible (IMF, 2014). However, from 2017 to 2019, independent analysts estimated peak revenues of $3.5 billion to $5 billion, with a greater likelihood of revenues at the lower end of this range (see, for example: Henstridge, 2018; Scurfield and Mihalyi, 2019). Similarly, in Mozambique, a 2012 World Bank-funded study suggested that annual government revenue could average over $6 billion for the

life of the project and could reach $5 billion by the eighth year of production (ICF International, 2012). In contrast, the government indicated in 2018 that it did not expect annual revenues to exceed $1 billion until at least the tenth year of production (Government of Mozambique, 2018).

Reasons for revenue disappointments

Government revenue projections are only as reliable as oil and gas price forecasts, which are notoriously hard to predict. However, there are several additional reasons why Ghana, Mauritania and Niger have suffered revenue disappointment, and Mozambique, Tanzania and Uganda could as well.

Over-optimism regarding ramp up and production levels. In Niger, refining and pipeline limitations have constrained production capacity, while in Mauritania, geological complications resulted in lower than projected production and ultimately curtailed production earlier than expected. In Ghana, a combination of subsurface and surface issues caused Jubilee production to disappoint. Initial revenue projections for Mozambique and Tanzania are also likely to be unrealistic given the planned projects are smaller and likely to expand less quickly than these projections assumed.

Prices and pricing arrangements. In Niger, the refinery was buying oil at a discounted price and then reselling oil to consumers at a discounted price, which squeezed taxable profits. Early IMF projections of large oil revenues for Uganda were revised down as it reduced price assumptions from 2014 onwards.

Underestimates of costs or cost deductions. In Ghana, costs for producing blocks proved higher than assumed in earlier projections. Subsequent discoveries also increased cost deductions and delayed government revenues as a result of weak ring-fencing of projects. These problems might be exacerbated by fiscal regime choices which favor profit-based taxes over production-based taxes.

Mistaken fiscal assumptions in models. IMF projections for Mozambique appear to assume fiscal terms that are likely to differ from reality. In 2013, it estimated corporate income tax would be paid in the first production year, which is unlikely even if production ramped up as quickly as it assumed. IMF projections for Tanzania also appear to be based on higher taxes than at least some of the current contracts contain. For example, in its 2014 projections, the IMF assumed state equity of 20 percent and a government profit share of up to 60 percent (IMF, 2014), while the only PSA for the LNG project in the public domain (for Block 2) allows for state equity of 10 percent and a government profit share of up to 50 percent (Natural Resource Governance Institute, 2020).

3.4 Impacts of disappointment

In Sections 3.1 to 3.3, we presented several factors that have led to slower sector growth and lower petroleum revenues than initially anticipated. In this section, we present some descriptive evidence that both the discovery of oil and gas and subsequent disappointments likely had an important impact on the development of these countries. However, given the peculiarities of each case and the wide-ranging areas it may impact, we do not provide a comprehensive review, nor do we aim to prove causality between sector developments and the various indicators discussed below.

We have identified three potential areas of impact in our review of the 12 countries. These are unrealized public expectations, suboptimal policy and institutional frameworks, and the derailment of public finances. The three areas are strongly interlinked. Following a discovery, expectations of future petroleum wealth might shape policy changes, which in turn may drive the management of public finances. However, changes in public finances may in turn further drive future expectations

and additional policy changes.

Unrealized expectations

The first impact is unrealized expectations. Given the complexity of the sector, public misunderstanding is common. This can lead to unrealistic expectations about the scale and timing of production and its benefits. Over-optimistic projections and statements by companies and International Financial Institutions (IFIs) are also likely to have caused and exacerbated inflated public expectations in many of the countries we analyzed. The role of government is less clear cut. In some cases, the government has attempted to temper those expectations and align them better with reality. In others, government and politicians have only inflated them further.

Earlier studies have documented this impact. Cust and Mensah (2020) find a jump in citizen expectations after oil finds in Africa, as measured by survey responses regarding their personal economic outlook using Afrobarometer public polling data. In Tanzania, a local research institute has been mapping citizen expectations around the gas sector. In 2015, only five years after the game-changing offshore discovery in 2010 and still some years from FID, 53 percent of citizens surveyed believed production was already taking place.[21] The survey also highlighted over-optimistic expectations of how transformative gas production could be: 40 percent believed that they or a family relation would be employed in the sector, equivalent to more than 4 million jobs if extrapolated (Twaweza, 2015).

Despite Liberia's very limited oil resources, its potential benefits have captured the imagination of citizens on multiple occasions, as discussed by Collier (2016). Confusion erupted in 2013 when African Petroleum reported a pre-drill estimate for its Bee Eater prospect (African Petroleum, 2013). But the 840 mbbl figure in estimated recoverable resources was mistakenly interpreted in the media, as if Liberia was starting to produce 840 barrels of oil a day (see, for example: All Africa, 2013). Another newspaper ran a headline "If last week's announcement by African Petroleum that there's a huge deposit of oil offshore Liberia is anything to go by, then there is no need for Liberians to live in abject poverty again."[22] A third article stated that Exxon will be starting oil production in 2017 (Oguh, 2015), despite the Mesurado well that it drilled the year before being dry. After drilling, the well was announced as a discovery and it was some time before it was acknowledged to be non-commercial.

In several countries, the government has attempted to counteract some of this unrealistic excitement. After the confusion around exploration results in Liberia, the National Oil Company of Liberia (NOCAL) issued multiple public statements to try and clarify the situation (see, for example: NOCAL, 2012).

In Senegal, there have been only minor slippages in the production timeline. However, the government and the IMF have been cautious not to integrate the boom expected from petroleum into their projections. For example, a bond prospectus issued by the government in 2018 states: "Until a reputable international firm sets a date and production targets, production and earnings from oil and gas will not be integrated into Senegal's macroeconomic framework. No assurance can be given as to when or whether the new oil and gas discoveries will be developed or the level of production they will represent" (Government of Senegal, 2018).[23]

[21] A limited amount of gas was being produced from onshore projects at this time, which could have been partly the reason for this mistake.
[22] The article ran in print by *Independent*, January 21, 2013 (source: presentation by David Santley, World Bank, 2013).
[23] Bond prospectus of the $1bn Eurobond issued by Senegal on 13 March 2018 due 2048.

However, in many countries, governments have often failed to challenge, caveat or highlight uncertainties inherent in over-optimistic projections by companies and IFIs; and have done little to temper inflated public expectations. In some countries, governments and politicians have actually exacerbated them.

Celebrating Ghana's giant oil discovery in 2007, President John Kufour said "Even without oil, we are doing so well… With oil as a shot in the arm, we're going to fly" (Kufuor, 2007, cited in BBC, 2007). A year later, before any government revenue projections had been published, the opposition's presidential candidate stated that "In five years, Ghana will earn US$15 billion" (Addo, 2008). Then, in 2010, President John Atta Mills promised that "The petroleum resources will take Ghana into an industrial revolution in the next 10 years," (Mills, 2010).

In Tanzania, when campaigning to be re-elected in 2010, President Jakaya Kikwete stated about the town near one of the large gas discoveries: "Mtwara will be the new Dubai" (Must and Rustad, 2018).

One explanation for the lack of government questioning of over-optimism by companies and IFIs may be limited capacity to interrogate it and develop countervailing analysis. However, some have pointed to political advantages to explain government encouragement of such over-optimism. (Bawumia and Halland, 2017). Similar political influences may have been at play in Tanzania (Dupuy and Katera, 2019).

Support for a government as a result of such promises is likely to dissipate when those promises are not fulfilled. Therefore, mismanaged expectations may be politically disadvantageous in the longer term. However, in the interim, these inflated expectations can have a tangible and damaging impact.

Suboptimal policy and institutional frameworks

The second impact of unrealistic projections is adoption of suboptimal policy and institutional frameworks. As we have discussed, the discovery events presented in Section 2 were followed by a surge in interest in further exploration as well as development of some potentially viable finds. These developments certainly warranted changes to the policy framework. However, our review found several cases where the changes implemented, often based on perceived 'good practice' for resource-rich countries, do not appear, in retrospect, to be well aligned with the new realities.

Establishment of new government institutions. In several countries, new government institutions have been established to focus on the sector. For example, Sierra Leone's Petroleum Directorate was established in 2011, shortly after the country's first discovery. Liberia's Petroleum Regulatory Authority (LPRA) was established in 2018. Similarly, Uganda's Petroleum Exploration, Development and Production Act 2013 provided for the establishment of a new regulatory authority, the Petroleum Authority of Uganda (PAU). [24]

Setting up such institutions ensures resources are focused exclusively on developing and/or regulating the sector. However, in countries with limited financial and human resources, establishing these specialized entities needs to be carefully timed. If premature, they can hamper the strengthening of regulatory capacity and impact other areas of sector governance by spreading scarce resources too thinly or necessitating prioritization of one objective over the other (Heller and Marcel, 2012). Considering that Sierra Leone and Liberia are yet to make a commercially viable discovery, these countries may have benefited from waiting longer before investing substantial public resources in the development of new institutions. Indeed, Liberia's 2012 National Petroleum Policy offered useful flexibility, only requiring the LPRA to be established "as soon as practicable and

[24] The same Act also established the Uganda National Oil Company.

no later than the commencement of commercial production." With plans to develop Uganda's discoveries in place by 2013, establishing PAU may have been timely. However, it should be cautious in expanding further—for example, from its current 86-person staff to the planned 239-person staff— and engage in a careful cost-benefit analysis, especially until an FID has been made (Government of Uganda, 2018).

A risk-taking commercial role for national oil companies. In 2011, Ghana established the Petroleum Commission to take over regulatory responsibilities from Ghana National Petroleum Corporation (GNPC) and to enable GNPC to have a clear commercial role. The government announced intentions for GNPC to develop its own risk-taking exploration and production activity in order to exert greater control over Ghana's petroleum reserves and become an independent operating company over time. Given that oil production had already commenced, GNPC's transition to a commercial role may have been timely. However, other national oil companies (NOCs), such as NOCAL, are beginning to assume an exclusively commercial role several years before an FID. Such a role can expose a country to the financial risks associated with exploration, and can make significant demands on a government's scarce financial and human resources, but, before an FID, generate little return.

Stricter fiscal and regulatory terms. Some governments have tightened terms after a discovery has highlighted a country's potential and reduced the risk of further exploration (Heller, Mebratu-Tsegaye, Mihalyi and Toledano, forthcoming). A better deal should be possible, but governments should be cautious of tightening terms too much. After the sequence of large discoveries in Tanzania in 2010 to 2012, the government attempted to take advantage of increased interest and introduced a new model PSA in 2013 with much stricter terms than previous versions. However, alongside falling prices, these stricter terms are believed to be at least partly the reason for the lack of interest in the 2013/2014 licensing round and that no new licenses being granted since then (Bofin and Pedersen, 2017).

Setting up of sovereign wealth funds. Countries such as Ghana, Mauritania, and São Tomé have set up SWFs for the deposit of petroleum revenues. For many countries, it is prudent to set aside a portion of petroleum wealth. These savings, and interest earned on them, can be used to benefit future generations. They can also help mitigate serious macroeconomic challenges like Dutch Disease or significant budget volatility.

However, given the size of government revenues actually generated in Ghana and Mauritania to date, such savings are unlikely to yield a greater return than investing in critical development projects or the interest payable on debt. Indeed, Ghana's savings have yielded a net annual return of around 1 percent since 2011, while, over the same period, the country has been paying more than 9 percent interest on some of its loans (Bauer and Mihalyi, 2018). Petroleum revenues in these countries have also been small relative to the size of the economy and government revenues. For example, in Mauritania, government revenues from the sector were an average 1.3 percent of GDP between 2010 and 2015 so the kinds of macroeconomic challenges that SWFs are designed to mitigate—most notably Dutch Disease—were not significant. São Tomé established an SWF in 2004, even before a commercial discovery had been made. Establishing an SWF early can preempt special interests from capturing any future revenues and can increase the likelihood that the government introduces strong transparency and accountability provisions. However, even small SWFs require the use of scarce human and financial resources (Bauer and Mihalyi, 2018).

Shifts in energy strategy. Expectations surrounding oil and gas have impacted more than just the management of the public finances. After a large gas discovery in Kenya in early 2015, the government cancelled an LNG import deal with Qatar stating that it planned for the discovered gas to be extracted and converted into power in nine to 15 months' time (Zyl, 2015). This gas has yet to

be sanctioned for production—presumably resulting in the government having to seek out a costlier alternative.

Derailment of public finances

The third area is the derailment of public finances. This area has already received considerable attention by scholars who have analyzed the impacts caused by giant oil and gas discoveries on various economic indicators. Arezki et al. (2017) find a decline in savings, and Cust & Mihalyi (2017) identify a growth disappointment, in the five years after discovery.

We do not aim to provide rigorous statistical evidence in this section, but would draw attention to only one indicator: debt sustainability. This is the result of the IMF/World Bank joint debt sustainability analysis across the 12 countries discussed in our study.

Table 4. Change in debt sustainability risk, according to IMF and World Bank[25]

Country	2011 Debt Sustainability Analysis	2020 Debt Sustainability Analysis
Ghana	Moderate	High
Guinea-Bissau	High	Moderate
Kenya	Low	Moderate
Liberia	Low	Moderate
Mauritania	Moderate	High
Mozambique	Low	In debt distress
Niger	Low	Moderate
São Tomé and Príncipe	High	In debt distress
Senegal	Low	Moderate
Sierra Leone	Moderate	High
Tanzania	Low	Low
Uganda	Low	Low

Source: Authors' collection from IMF and World Bank DSA reports

As Table 4 shows, the IMF and World Bank's assessment of debt sustainability worsened in 9 of the 12 countries, while it improved in only one case. Of course, there are regional and cyclical factors at play too, but various studies point towards resource sector disappointment being a major factor behind debt problems in Ghana (Bawumia and Halland, 2017), Mozambique (Hubert, 2019) and São Tomé (Frynas, Wood and Hinks, 2017). For example, both Ghana and São Tomé had taken on loans that were to be repaid in-kind using oil sector proceeds (Mihalyi, Adam and Hwang, 2020). With the

[25] These represent the latest assessment as of April 2020. All were conducted before the 2020 global pandemic and economic crisis.

global economic outlook significantly worsening as a result of the global pandemic, these countries are now at increased risk of a debt crisis. The resource revenues they were planning to use to repay their debt may be significantly smaller, arrive later or not at all.

4. Lessons learned and policy recommendations

We have reviewed the trajectory of petroleum sector development across 12 Sub-Saharan African countries that were once deemed to be on the verge of becoming resource rich. We have identified some success stories as well as several disappointments that these countries experienced.

Four countries never found large, commercially viable deposits. Five are still yet to start production, with three of these still yet to even secure the necessary investment. In the three countries where investment has happened, government revenues remain modest and have fallen short of projections.

We believe that governments, development partners, and other international organizations could do more to avoid these potential disappointments. We also think that they could do more to account for potential disappointments that cannot be avoided and therefore mitigate their impacts. We set out recommendations on both below.

4.1 Discoveries

Recommendations for governments

Select reputable, well-qualified companies. The use of less qualified and reputable companies makes discovery announcements less credible. As a result, governments should time their licensing rounds well, and hold them only after sufficient preparation to maximize interest. Strong pre-qualification criteria should be used to exclude companies that have no record of accomplishment in exploration or have a history of breaking laws.

Establish rules on company announcements. Governments should set rules on how companies should announce exploration results. These rules should ensure that announcements are clear, comprehensive and accurate. Norway is an example of good practice in this area (Norwegian Petroleum Directorate, 2018).

Assess company announcements. Regardless of whether a government establishes rules for company announcements, it should not rely on those assessments for its own forecasting. Governments should seek expert advice to inform policy making and make their own announcements. This may cause challenges for a government as it has a promotional and a regulatory role which may be in conflict. However, when unfounded optimism dominates policy making and communication, problems arise.

Avoid changing institutional frameworks and wider national planning processes prematurely. Even if a government takes the above steps to avoid potential disappointments resulting from premature or over-optimistic discovery announcements by companies, it cannot control other potential sources of disappointment. For example, unforeseen geological complexities. Governments should therefore be cautious in changing the institutional framework and investing large public resources to operationalize new institutions until the commercial viability of a discovery has been demonstrated or it has progressed towards a development plan. This cautious approach should also apply to wider national planning processes, such as a country's spending plans and energy strategy. However, even then, governments should develop different scenarios rather than one projection of how a project and therefore its impact on the sector, public finances and wider development may evolve.

Manage public expectations through balanced communication. Governments should ensure careful management of public expectations from an early stage. They should make their own announcements of discoveries, but should also announce dry wells. They should communicate any

delays to project timelines and reductions in government revenue projections. Governments should use several means of communication to ensure that they reach the majority of the population (for more discussion, see Marcel, 2016).

Role of development partners and other international organizations

Provide geological expertise. Development partners could provide governments with geological expertise following discoveries, to help assess and update information on geological prospects and complement existing legal and economic expertise.

Support public communication efforts. Development partners could provide public information on exploration success rates—by both region and basin and both technical and commercial success rate—to help manage public expectations.

4.2 Timelines

Recommendations for governments

Prioritize policies that are critical for reaching production, without sacrificing a good deal. Two key causes of timeline disappointments appear to be delays in passing key legislation and the time required to negotiate deals with companies. This does not mean that governments should rush policy making or agree to a bad deal to get to an FID and production. Indeed, the time taken by some governments to ensure a robust legal framework, particularly in areas such as subnational revenue sharing, and negotiate a good deal for the country is likely to be beneficial in the long term. However, governments should prioritize policies that are critical for getting to an FID and production, namely the regulatory framework (such as the role of an NOC, local content requirements and any restrictions on the use of the extracted oil and gas) and infrastructural arrangements (such as the route of cross-border pipelines). Better prioritization may free up capacity to ensure a good deal is more achievable and takes less time.

Exclusive focus on these priority areas may be politically difficult given the pressure on governments to demonstrate commitment to best practices such as sound management of petroleum revenues and a comprehensive transparency framework from an early stage. Therefore, a government could first announce and commit to a list of policies that it will adopt, but develop them in a pre-defined sequence rather than all at the same time. In doing so, it will be under less pressure to dedicate scarce financial and human resources to develop less urgent policies until necessary. Second, it could defer operationalization of any less urgent policies. For example, revenue management laws could specify how much revenue is to be shared across provinces or the amount of revenue that is to be saved, but delay the drafting of regulations on the specific sharing mechanism or permitted saving instruments until an FID has been reached or other legislative processes have been achieved.

Account for sector norms and potential delays. Even if a government prioritizes policies critical for reaching production, legislative processes and negotiations with companies could still take longer than expected. This may happen in part because some factors, such as price changes, are outside government control. Governments should therefore calibrate timeline projections against relevant analogue projects and regional benchmarks, which are then adjusted for country-specific factors, rather than rely on standalone projections. Other projects that have reached production and regional benchmarks are likely to better account for the time needed for legislative processes, negotiating a good deal, and any other steps required to reach production. The development of several scenarios is still critical though, particularly because the energy transition could change company behavior in unpredictable ways.

Role of development partners and other international organizations

Be cautious and develop scenarios when forecasting timelines. International organizations and public policy professionals should also be more cautious in forecasting timelines. They should have clearer and stricter rules on when to publish estimates of first oil or first gas after a discovery. Like governments, they should also base such projections on relevant analogue projects and regional benchmarks and conduct scenario analysis. They should discuss the policy implications of worse case scenarios materializing. A recent IMF guidance note cautions against incorporating discoveries in the baseline before most of the related investment has been made and a high likelihood of project implementation is affirmed (IMF, 2018). This more cautious approach was followed in Tanzania, for example, where offshore gas revenue projections were not incorporated into the baseline projections of the debt sustainability framework. However, gas finds at around the same period were incorporated into the baseline projections for Mozambique.

4.3 Government revenues

Recommendations for governments

Account for drivers of lower revenues. Government revenue projections, whether produced by governments or other actors, should better account for risks to revenues. They should reflect the risk of lower production levels and ramp up speed, lower prices and pricing arrangements, cost overruns and tax offsets against new finds, as well as more accurately capture the applicable fiscal terms. Governments should build up their capacity to develop their own projections (AfDB and OpenOil, 2017). But an intermediary step would be to request the models and assumptions used by others to produce revenue projections. The parameters they have considered could then be compared against a checklist to verify their robustness against changing circumstances and other risks to revenues. Publishing the models that are used to produce revenue projections would enable other organizations to support governments in this area.[26]

Prioritize policies critical for sound management of the public finances, rather than the use of petroleum revenues. More realistic government revenue projections should reduce the risk of excessive borrowing and spending after a discovery. However, instituting overall fiscal rules for the public finances that prevent excessive public borrowing and spending is also critical. Governments should prioritize establishing these overall fiscal rules before rules that are specific to petroleum revenues. However, as noted above, governments may find that an early commitment to the sound management of petroleum revenues is politically important. Therefore, governments could still look to develop the policies without dedicating financial and human resources to operationalizing them until necessary.

Avoid saving petroleum revenues prematurely. Governments should assess the benefits of requiring a proportion of petroleum revenues to be immediately saved. This approach may not be optimal for many countries, particularly given that government revenue projections may turn out to be overly optimistic. Instead, a requirement for saving could be made conditional on reaching a degree of resource dependence. Tanzania has taken this approach: its revenue management framework requires saving only if revenues reach 3 percent of GDP.

Role of development partners and other international organizations

Account for drivers of lower revenues. International organizations and public policy professionals should systematically evaluate revenue forecasts for potential biases. For example,

[26] As done by organizations such as OpenOil and the Natural Resource Governance Institute.

company cost projections should probably be inflated in line with average overruns. They should conduct scenario analysis and advise on the policy implications of a worst case scenario materializing.

Build separate programs for new producer countries. Development partners should have separate programs for resource-rich countries and new producers given their distinct needs. For example, macroeconomic support from the IMF and World Bank to new producers could initially focus more on designing a fiscal framework that is robust to both upside and downside scenarios and then provide support for its implementation and monitoring. They should also be more cautious in supporting the setup of new SWFs.[27] Similarly, when advising new producers, they should focus their efforts on establishing transparency practices (as per the new EITI standard) on licenses, contracts and beneficial ownership rather than petroleum revenue disclosure. An example of good practice in this area is the New Petroleum Producers Discussion Group (see Chatham House, 2019).

5. Conclusion

The disappointments experienced by Sub-Saharan African countries in the past decade are not unique to the region. For example, in 2014, a media headline in the Bahamas suggested a discovery of 17 billion barrels of oil was made in 1986 despite there being no commercially viable discovery in the country's waters to date (Bahamas Press, 2014). In 2013, the Lebanese government suggested oil and gas production was possible by 2017 or 2018, but, in reality, exploration has only recently commenced (Sassine, 2013). However, by taking the above steps, governments, with the support of development partners and other international organizations, can both reduce the likelihood of disappointment by mitigating certain risks and better account for the possibility of disappointment in their decision-making. This will be even more important given the uncertainties the petroleum sector is facing. The global Covid-19 epidemic has led to plummeting demand, while the collapse of the OPEC+ agreement brought a surge in supply. As a result, oil prices reached a record low in March 2020. In the longer term, the energy transition will pose a key challenge, which will likely further increase global market volatility and make investment strategies more unpredictable, while gradually closing the window of opportunity for countries to develop their petroleum sectors.

[27] The importance of setting up a sound macroeconomic framework is recognized in principal in documents, such as IMF (2012).

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Appendix

Table 5. Resources discovered by all countries in sub-Saharan Africa[28]

Country	Criteria 1: Share of resource wealth discovered in 2001-2018 is larger than 75%	Criteria 2: Potential size of annual resource windfall discovered in 2001-2018 as percentage of 2000 GDP is larger than 5% of GDP	1946-2000 discovered oil resource (mbbl)	2001-2018 discovered oil resource (mbbl)	1946-2000 discovered gas resource (tcf)	2001-2018 discovered gas resource (tcf)	1946-2000 oil and gas discovery value in 2000 $m	2001-2018 oil and gas discovery value in 2000 $m	Nominal GDP in 2000 in $m
Ghana	**97%**	**44%**	45	1751	0.2	3	2,998	101,723	11,467
Guinea-Bissau	**100%**	**8%**	0	10	-	0	-	590	364
Kenya	**99%**	**12%**	6	563	-	1.2	320	33,875	14,136
Liberia	**100%**	**22%**	0	71	-	0.1	-	3,926	874
Mauritania	**100%**	**76%**	0	309	0	1.1	39	74,363	4,919
Mozambique	**97%**	**480%**	14	1453	4.1	108.6	15,204	448,049	4,667
Niger	**90%**	**31%**	20	188	0	0.1	1,109	10,300	1,671
São Tomé and Príncipe	**100%**	**85%**	0	34	-	0.1	-	1,977	58
Senegal	**88%**	77%	246	763	0	0.9	13,032	91,707	5,965
Sierra Leone	**100%**	**42%**	0	145	-	0.1	-	7,941	941
Tanzania	**96%**	**46%**	0	275	1.5	27.5	5,221	115,058	12,423
Uganda	**100%**	**54%**	0	1172	-	0.8	-	64,053	5,978
Angola	33%	**195%**	16144	7228	7	21.6	870,065	435,098	11,166
Benin	9%	0%	30	4	0.2	0.2	2,098	199	2,576
Botswana	**100%**	0.1%	0	0	-	0	-	106	5,803
Cameroon	12%	**7%**	1726	184	4	5.2	104,482	13,992	9,802
Chad	43%	**97%**	780	585	0.2	0.2	41,414	30,644	1,572
Congo, Rep.	36%	**204%**	4088	2333	6.6	8.4	237,614	131,098	3,220
Côte d'Ivoire	66%	**15%**	208	581	1.6	2.1	16,598	32,845	10,717
Congo, Dem. Rep.	0%	0%	438	0	0.2	0.2	23,624	-	19,077
Equatorial Guinea	43%	**396%**	1789	1282	7.7	14.4	121,078	91,534	1,156
Ethiopia	2%	0%	18	2	3.3	3.3	12,713	214	8,235
Gabon	22%	**65%**	4682	1142	1.6	4.3	250,941	70,242	5,397

[28] Entries highlighted in bold indicate that the country meets the criterion. Countries that meet both criteria are in bold. They are our focus countries.

Madagascar	0%	0%	3	0	0.1	0.1	396	-	3,878
Namibia	0%	0%	5	0	1	1	3,946	-	3,911
Nigeria	12%	**29%**	48386	6880	118.9	127.4	2,956,334	390,489	67,824
Somalia	0%	0%	55	1	1.9	1.9	9,656	48	7,124
South Africa	8%	0.1%	239	0	4.3	5	27,900	2,549	136,453
South Sudan	60%	**24%**	1034	1538	-	0.3	54,145	81,494	17,186
Sudan	33%	2%	735	360	0.2	0.3	39,153	19,056	45,677

Source: Rystad Energy's Ucube database; authors' calculations

Table 6. Forecasts of first oil and gas timelines

Country	Discovery	Type of discovery	First discovery year	First announcement by	First announcement when	First announced first oil/gas year	Actual / Expected first oil/gas year
Ghana	Jubilee	Oil	2007	Kosmos	2008	2010	2010
Ghana	Jubilee	Gas	2007	Kosmos	2010	2013	2014
Ghana	TEN	Oil	2009	Tullow	2012	2014	2016
Ghana	TEN	Gas	2009	Tullow	2015	2017	2017
Kenya	Block BB	Oil	2012	Tullow	2014	2019	> 2022
Kenya	Block 13T	Oil	2012	Tullow	2014	2019	> 2022
Mauritania	Chinguetti	Oil	2001	Woodside	2004	2006	2006
Mozambique	Area 1	Gas	2010	Anadarko	2012	2018	2024
Mozambique	Area 4	Gas	2011	Eni	2011	2016	2022
Niger	Agadem	Oil	2005	IMF	2008	2012	2011
Senegal	SNE	Oil	2014	FAR	2016	2021	2023?
Senegal	SNE	Gas	2014	FAR	2016	2024	2024?
Senegal	GTA	Gas	2012	Kosmos	2017	2021	2022?
Tanzania	Block 1	Gas	2011	IMF	2012	2020	> 2028
Tanzania	Block 2	Gas	2012	IMF	2012	2020	> 2028
Tanzania	Block 4	Gas	2010	IMF	2012	2020	> 2028
Uganda	Block 1	Oil	2008	Tullow	2007	2009	> 2024
Uganda	Block 2	Oil	2006	Tullow	2007	2009	> 2024
Uganda	Block 3A	Oil	2006	Tullow	2007	2009	> 2024

Source: Authors collection from company, government and IMF reports and statements