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Key Performance Indicators to evaluate the performance of public sector entities involved in oil and gas exploration industry

Oil and gas industry

The oil and gas industry is broken down into three main segments: upstream, midstream, and downstream.

- **Upstream or exploration and production (E&P) companies** are responsible for exploration, drilling, and production of oil and natural gas. It includes activities such as locating oil and gas reserves, drilling wells, and extracting hydrocarbons from underground reservoirs.
- **Midstream companies** are responsible for transportation, storage, and initial processing of oil and gas. This includes pipelines, storage facilities, and the transportation of crude oil and natural gas from production sites to refineries or distribution centers.
- **Downstream companies** are responsible for the refining of crude oil into various petroleum products, such as gasoline, diesel, and petrochemicals. It also includes marketing, distribution, and retailing of these products to consumers.

These segments are interconnected and together make up the oil and gas industry supply chain.

Oil and gas exploration

The oil and gas exploration (upstream) sector is known for its high risks and significant investment requirements. The risks primarily arise from the uncertainties and challenges involved in discovering and extracting oil and natural gas reserves from the ground or beneath the seabed. Factors such as geological complexity, volatile commodity prices, and environmental concerns add to the sector's high-risk nature.

Given the complexities and risks, assessing the performance of public sector entities involved in exploration and related investments can be challenging. Understanding the relevant KPIs is essential for accurately assessing their performance.

We explain below the key terminologies and key performance indicators that will be useful for performance auditors when auditing oil and gas exploration investments of public sector entities.

The information provided in this document is intended for general information purposes only and users are advised to conduct own research and seek expert guidance when necessary.

Key Terms used in oil and gas exploration

The below are some of the key terms that a performance auditor should understand before conducting the audit of oil and gas exploration companies-

Terms	Explanation
E&P phases	Exploration – This is the initial phase where oil and gas companies search for potential oil and gas reserves. They use geological, geophysical and seismic surveys to identify subsurface structures that may contain hydrocarbons. Drilling exploratory wells (exploration wells) is a part of this phase to confirm presence of oil or gas. Appraisal – After a discovery is made during the exploration phase, the appraisal phase involves drilling additional wells (appraisal wells) to determine the size and quality of reservoir, as well as assessing the feasibility of extracting resources. Development – Once the oil and gas reserves are deemed economically viable after appraisal, the development stage begins with setting up of infrastructure such as production facilities, pipelines etc. Production – In this phase, oil and gas resources are extracted from the reservoir and includes activities such as drilling production wells, maintaining infrastructure and ongoing extraction.
Block	An oil and gas block, also known as exploration and production (E&P) block, is a specific area of land or seabed that is allocated by a government to oil and gas companies for the purpose of exploring, drilling and producing oil and gas resources. Oil and gas companies obtain rights to explore and extract hydrocarbon (oil and gas) within a designated block. These blocks are typically awarded through a competitive bidding process or direct government agreements.
IOC or International Oil Companies	IOCs are large multinational corporations involved in the exploration, production, refining and marketing of oil and gas on a global scale. Some well-known IOCs include giants like Chevron, Exxon Mobil, Shell, Total and BP.
NOC or National Oil Company	A company that is owned, completely or in the majority, by a national government. Countries use their state-owned oil company to represent the interests of their state. Examples of NOCs include QatarEnergy (Qatar), Saudi Aramco (Saudi Arabia) etc.
Joint Venture	A joint venture is a business arrangement in which two or more companies come together to jointly explore and develop oil and gas resources. This partnership allows them to share the risks, costs and expertise involved in exploration and production of oil and gas. The parties will agree on the terms and conditions of the arrangement through Joint Venture Agreements. For example, QatarEnergy (NOC) formed a joint venture with TotalEnergies (IOC) to develop and operate Qatar's Al Shaheen oil field.
Carry / Carried interest	Carry is a disproportionate funding arrangement in oil and gas projects whereby one party pays all or a portion of another party's costs with respect to a particular project for a set period of time or amount. Example, other investors in a joint venture agree to finance the share of costs of NOC.
Operator	Operator is the entity designated as being responsible for conducting the operations at a specific oil and gas field or a project. The operator is often the company that has technical expertise and experience necessary to explore and produce oil and gas. Typically, IOCs act as operator.
Due diligence	Due Diligence is process of conducting research and analysis to determine the feasibility of a prospective oil and gas investment. In the oil and gas industry, due diligence involves: technical analysis (analysis of available geological data and reserves), financial analysis (economics of the project), environmental analysis, and other legal analysis. Due diligence report includes recommendation or conclusions based on the findings of the study, outlining whether the investment/project should proceed or be rejected, renegotiated or project to be subjected to further study and analysis.
Common types of agreements with host governments for oil and gas exploration	The following are the most common arrangement between oil and gas companies and government for exploration and production of oil and gas: Concessions or licenses - Under concessions/licenses, the operators are granted exclusive rights to exploration and production of the concession area. Concessions usually have royalties and corporate income tax as their main components. However, other payments to the government may be applicable such as bonuses, rentals, special petroleum or windfall profit taxes, property taxes and export duties.

	Production Sharing Contracts (PSCs) - An agreement between an investor or group of investors (i.e., oil and gas companies and investors) and a host government under which the government grants the investor an exclusive right to develop the Hydrocarbons (i.e., control of the Field), and the investor/s commits to develop such Hydrocarbons at the investor's sole cost, expense and risk. Here, the investors finance and carry out all petroleum operations (through operator) and receive an amount of oil or gas for the recovery of their costs and a share of the profits. Sometimes production sharing contracts also require other payments to the host government such as royalties, corporate income tax, windfall profit taxes, etc. Risk Service Contracts - Under risk service contracts, the operators finance and carry out petroleum projects and receive a fee for this service which could be in cash or in kind. The fees typically permit the recovery of all or part of the operator's costs and some type of profit component.
Signature Bonus	Signature bonus is the onetime payment made to the host government or relevant authority upon signing the petroleum exploration and production contract.
Seismic (geophysical) investigations **[Seismic Data / 2D Seismic / 3D Seismic / 4D Seismic]**	Seismic surveys or investigations are geophysical exploration technique used in the oil and gas industry to identify potential hydrocarbon reserves beneath the earth's surface. Seismic profiles are acquired by transmitting sound waves from a source above or in the substratum. The sound waves travel through the rock layers which reflect them up to sensors on the sea bed or at the surface which enables an image of formations in the substratum to be formed. Seismic surveys provide valuable information about the location, size, shape and characteristics of subsurface geological formations.
Lead	A lead is a potential accumulation (petroleum trap) that is currently poorly defined and requires more data acquisition and/or evaluation to be classified as a Prospect.
Prospect	Prospect is an undrilled potential accumulation (petroleum trap) that is sufficiently well defined to represent a viable drilling target.
Drilling program	This is program/plan that contains specific information concerning wells and well paths relating to planned drilling and well activities
Well	**Well**: A hole drilled to find a petroleum deposit and/or produce petroleum. **Wildcat well**: An exploration well drilled to find out whether petroleum exists in an unexplored or minimally explored area. **Exploration well**: An exploration well drilled to prove a possible deposit of petroleum or obtain information to delimit a discovered deposit. **Appraisal well**: An exploration well drilled to determine the extent and size of a petroleum deposit that has already been discovered by an exploration well. **Production well**: Collective term for wells used to recover hydrocarbon. **Dry well (dry hole):** A well that has been drilled for the purpose of exploring oil and gas but did not encounter viable quantities of these resources.
Resources	Resources is a general term used to refer to all prospective oil and gas estimated or speculated to be present in a particular area. Resources can be further classified into four categories: Prospective Resources; Contingent Resources; Technically Recoverable Resources; and Economically Recoverable Resources.
Prospective Resources	Resource classification for quantities of petroleum that are estimated to be potentially recoverable from undiscovered accumulations identified on the basis of indirect evidence, but which have not yet been drilled.
Contingent Resources	Contingent resources are potentially recoverable hydrocarbon resources from known accumulations but are dependent on contingencies. Contingencies could include regulatory approvals, technical challenges, need for further studies etc. Contingent resources have higher certainty than prospective resources because they are based on specific data and knowledge of an accumulation.
Technically Recoverable Resources	Resources that are recoverable using the existing technology and industry practices, regardless of oil and gas prices or production costs.
Economically Recoverable Resources / commercially viable discoveries	Economically Recoverable Resources are those resources that can be profitably produced under current market conditions. Technically Recoverable Resources will typically not be produced if production is not commercially viable.
P90/P50(Pmean) /P10	These are references to how confident the entity who put together the resource are in their numbers. The "P" is a reference to the confidence interval: P90 (Lowest estimate) - The resource estimate has been set with 90% confidence. P50 (Best estimate) - The resource estimate has been set with 50% confidence. P10 (Highest estimate) - The resource estimate has been set with 10% confidence. For example, recoverable resources from exploration prospect A is estimated at different confidence levels as follows: 100 million barrels of oil equivalent (p90 or lowest estimate)

	150 million barrels of oil equivalent (p50 or Pmean) 200 million barrels of oil equivalent (p10 or highest estimate).
Reserves Categories	Reserves refer to oil / gas in a reservoir that has been confirmed to exist and is economically recoverable with current technology. The following classifications divide the reserve volumes based on their certainty: Proved — Those quantities of petroleum, which, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be commercially recoverable, from a given date forward, from known reservoirs and under defined economic conditions, operating methods, and government regulations. If deterministic methods are used, the term reasonable certainty is intended to express a high degree of confidence that the quantities will be recovered. If probabilistic methods are used, there should be at least a 90% probability that the quantities actually recovered will equal or exceed the estimate. Probable — Those additional reserves which analysis of geoscience and engineering data indicate are less likely to be recovered than Proved Reserves but more certain to be recovered than Possible Reserves. It is equally likely that actual remaining quantities recovered will be greater than or less than the sum of the estimated Proved plus Probable Reserves (2P or PP). In this context, when probabilistic methods are used, there should be at least a 50% probability that the actual quantities recovered will equal or exceed the 2P estimate. Possible — Those additional reserves which analysis of geoscience and engineering data suggest are less likely to be recoverable than Probable Reserves. The total quantities ultimately recovered from the project have a low probability to exceed the sum of Proved plus Probable plus Possible (3P or PPP) Reserves, which is equivalent to the high estimate scenario. In this context, when probabilistic methods are used, there should be at least a 10% probability that the actual quantities recovered will equal or exceed the 3P estimate. In summary – "1P reserves" - proven reserves (both proved developed reserves + proved undeveloped reserves). "2P reserves" - 1P (proven reserves) + probable reserves, hence "proved AND probable."[2] "3P reserves" - the sum of 2P (proven reserves + probable reserves) + possible reserves, all 3Ps "proven AND probable AND possible. For example, an oil and gas company reported its reserve data in their annual report as “reserve estimates of Block A is 3000mboe (1P), 4000mboe (2P) and 5000mboe(3P) as of yearend 202X”.
Development plan	A detailed plan that addresses each step in the development of an Oil or Gas field from initial discovery through production and abandonment. A development plan often includes a drilling plan, details of wells, roads, pipelines and other infrastructure necessary for the development.
Cash Call	A request an operator of joint venture sends to the shareholders (investors or partners or working Interest owners) participating in the oil and gas venture for the payment of their respective share of costs related to the operation.
Farm-In and Farm-out Agreements	Farm-in and farm-out agreements are common in oil and gas industry which involve the transfer of working interest in an oil and gas projects between different parties. In a Farm-in / Farmout agreements, one party (farmee or incoming party) acquires a portion of the working interest in an oil and gas project from another party (farmor or outgoing party). These agreements are mainly used to manage risks and share costs.

Key Performance Indicators (KPIs)

The below are some of the important KPIs that is commonly used to measure performance of an entity involved in oil and gas exploration. A performance auditor could use these KPIs in auditing the feasibility studies of exploration project(s) as well as in auditing completed exploration project(s). It is important to note that KPIs listed below is intended to provide basic understanding of potential performance metrics and it does not cover all the relevant KPIs.

KPI	Description	What is considered good performance
Exploration success rate	This KPI measures the percentage of exploratory wells that resulted in discoveries. The exploration success rate is calculated by dividing the number of successful discoveries (i.e., those with sufficient reserves to justify further development) by the total number of exploratory wells drilled. There is Technical Success Rate (TSR) and Commercial Success Rate (CSR). TSR or geological or technical success rate is defined as finding oil & gas accumulations. CSR or economic or commercial success rate is the proportion of wells that resulted in commercially viable oil and gas discoveries.	A high success rate indicates more efficient exploration
Chance of Success or COS	COS represents the estimated probability or chance that an exploration well or project will be successful in discovering commercially viable oil and gas reserves. COS is expressed as a percentage, representing the probability of success. COS is calculated through a combination of expert assessments and data analysis. The following are specific types of chance of success assessment - 1. Geological chance of success – This assesses the probability of finding hydrocarbon reservoir based on geological and geophysical data. 2. Commercial chance of success – This evaluates the likelihood of a drilling project being economically viable.	A high COS indicates greater probability of success.
Discovery or reserve size	The discovery of economically viable hydrocarbons (such as oil or natural gas) reserve is the primary measure of success in exploration. This is the estimate of volume of recoverable reserves. Oil and gas companies provide reserve quantities at different stages of a project, depending of the level of data and confidence in the estimate. The key stages at which reserve quantities are typically reported as follows- 1. Exploration phase: Reserve estimates are based on early geological assessments and seismic data.	Larger reserves are more profitable.

	2. Appraisal phase: The reserve estimates are based on data collected from drilling appraisal wells. 3. Development phase: Companies report developed reserves in this stage. 4. Production phase: The reserve estimates are based on reservoir behavior and additional production wells.	
Reserve or resource replacement ratio (RRR) **(mainly relevant at a corporate level)**	A metric used to evaluate the ability of an oil and gas company to replace its produced reserves with new discoveries. The RRR is computed using (I) the amount of reserves added during the year, divided by (II) the production of the company during the same year.	A ratio above 1 indicates healthy exploration program.
Internal Rate of Return (IRR)	IRR is a financial metric used to evaluate the potential profitability of oil and gas exploration project. IRR is a rate at which the NPV of future cashflows equals zero.	A higher IRR indicates a more attractive project.
Net Present Value (NPV)	NPV is the net present value of all future cash inflows and outflows of a project. The future cashflows are discounted at a suitable discount rate (typically weighted average cost of capital (WACC)) to bring the future cashflows to their present value.	A positive NPV indicates that the project is expected to generate return greater than its cost of capital. A higher NPV is better.
NPV10 or PV10	NPV10 uses a fixed discount rate of 10% to calculate the present value of future cashflows. NPV10 provides a standardized benchmark for comparing and evaluating different oil and gas projects.	A project with higher positive NPV is better.
NPV per boe (Net present value per barrel of oil equivalent)	Net Present Value divided by recoverable reserve. This metric provides insight into the profitability of the project on a per unit basis, allowing a more meaningful comparison between oil and gas exploration projects.	A Higher NPV per boe suggests that the project more economically attractive.
Risked NPV or risk adjusted NPV	Risked NPV is calculated by multiplying the NPV by the Chance of Success. This measure incorporates the uncertainties and risks associated with exploration.	A higher risked NPV is preferred.
Expected Monetary Value (EMV)	EMV is calculated by multiplying the probabilities with the financial outcome of each scenario. EMV = (chance of success * NPV in case of success) + (chance of failure * NPV in case failure). This measure incorporates the uncertainties and risks associated with exploration.	Higher EMV would indicate more favorable outcome.
Break-even price	This is the oil or gas price at which a project becomes economically viable. Break-even price =Fixed costs per unit + variable costs per unit.	Projects with lower break-even price is more attractive.
Exploration cost per barrel or Unit Finding Costs (UFC)	Finding cost per barrel = Total exploration and appraisal cost / recoverable reserve. Exploration costs typically include expenses relating to activities like seismic surveys, geological and geophysical studies, drilling exploratory wells, appraisal of reserves, etc. These costs are incurred to identify and prove the existence of new oil and gas reserves.	Lower cost per unit is desirable.
Unit Development Cost (UDC)	UDC = Development capex divided by recoverable reserve or total expected production.	Lower cost per unit is desirable.
Unit Operating Cost (UOC)	UOC = Total operating expenses of production divided by recoverable reserve or total expected production.	Lower cost per unit is desirable.
Unit Technical Cost (UTC)	UTC = (Total capital expenditure + Total operating expenditure) divided by recoverable reserve or total expected production OR	Lower cost per unit is desirable.

	UTC = (UFC+UDC+UOC) divided by recoverable reserve or total expected production	
Government take	Government Take represents share of the oil and gas revenue that the government collects through various fiscal mechanisms such as taxes, royalty, production sharing, bonuses and others from the oil and gas companies operating within their jurisdiction. Government take is often expressed as a percentage of the total revenue or cashflow from oil and gas production.	A low government take can make an oil and gas exploration project more appealing to exploration companies.
Dry well / Dry well costs	Dry well costs refer to the expenses incurred on drilling exploration wells that do not result in commercial discoveries.	High dry well costs can indicate a lower exploration success rate.
Exploration budget vs actuals	Comparison of exploration budget to the actual expenditures provides valuable insights into the financial performance and cost management of exploration activities.	Good practice is to adhere to the approved budget as closely as possible.
Exploration failure cost exposure	This is an estimation of the financial losses that could occur if an exploration project turns out to be unsuccessful due to a dry well or uneconomical discovery. This KPI helps companies quantify and manage the financial risk in exploration.	Failure cost exposure should be within the approved risk tolerance limit.
Maximum financial exposure	This KPI represents the highest financial commitment the exploration company would face if the project advances through all the phases from exploration to appraisal to then development. It is a measure of the most significant potential loss a company could face in a project due to various risk factors. This KPI helps oil and gas companies understand the magnitude of risks that they might face and allows them to take appropriate measures to mitigate or manage these risks.	Maximum exposure should be within the approved risk tolerance limits.

Measurement Units

The below are some of the most common measurement units used in oil and gas industry:

Abbreviation / Acronym	Full form	Description
bbl	Barrel of Oil	A unit of volume for oil. One barrel is approximately 42 US gallons or 159 liters.
bbl/d or bpd or bopd	Barrels of Oil per day	The number of barrels of oil produced in a single day.
Mbbl	Thousands of barrels of oil	Measurement of oil in thousand barrels.
Mmbbl	Millions of barrels of oil	Measurement of oil in million barrels.
Cf	Cubic Foot	Commonly used for measuring natural gas volume.
Mcf	Thousand Cubic Feet	
Mmcf	Million Cubic Feet	
Bcf	Billion Cubic Feet	
Tcf	Trillion cubic feet	
Btu	British Thermal Unit	The price of natural gas is expressed in currency units per energy content, which is expressed in terms of BTU. As an approximation, 1,000 cubic feet of natural gas yields about 1,000,000 BTU when burned. This conversion factor varies depending on the specific characteristics of the gas.

Boe	Barrel of Oil Equivalent	A metric used to convert volumes of different Hydrocarbons (e.g., Natural Gas and Crude Oil) into a single volumetric measure for comparison purposes. Common industry oil to gas conversion factors usually range between 1.0 barrel of oil equivalent (boe) = 5.6 thousand standard cubic feet of gas (mscf) to 1.0 boe = 6.0 mscf as per Society of Petroleum Engineers (SPE). This conversion factor is a general approximation and may vary depending on the specific characteristics of the gas.
Boe/d	Barrel of Oil Equivalent Per Day.	The number of barrel equivalent of oil produced in a single day