



Workshop Working Paper
The petroleum value chain

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Abbreviations

This paper is independently written and does not constitute the policy or reflect the views of The World Bank.

1 - Introduction

The primary hydrocarbon resources are crude oil and natural gas, which are located deep within the earth's crust. The oil- and gas value chain encompasses a range of activities to extract and transform the resources into useable, valued end-products. The rent generated by the host country (HC) in the process is often very large and if managed well, can contribute substantially to the development of its population.

A 2013 McKinsey study, however, concludes that almost 80 percent of countries whose economies historically have been driven by resources have per capita income levels below the global average. Moreover, the vast majority of resource-driven economies also fall short on human development indicators. Many of these countries lack strong governments at the national-, regional-, and local level. The way in which revenues are distributed may limit development and increase conflict within a country, in particular when resources are misappropriated. Growth of the petroleum sector can also have negative consequences for other sectors, as inflows of foreign investment can strengthen local currencies and make other sectors less competitive (the "Dutch disease"). In brief, experience indicates that if a country is to succeed in sharing the wealth of discovery of petroleum resources, inevitably a complex, long term process with multiple, major challenges to be surmounted, has to be expected.

In this essay the petroleum value chain is explained and the factors that most contribute to value creation appraised, including the role of the petroleum industry and the government and its agencies, and how these influence the value creation process, with focus on the upstream sector and social value.

This essay is the first of a series; many important subjects shall therefore merely be introduced to put these in context, whilst elaboration follows in a subsequent, dedicated essay.

2 - Overview of the petroleum value chain

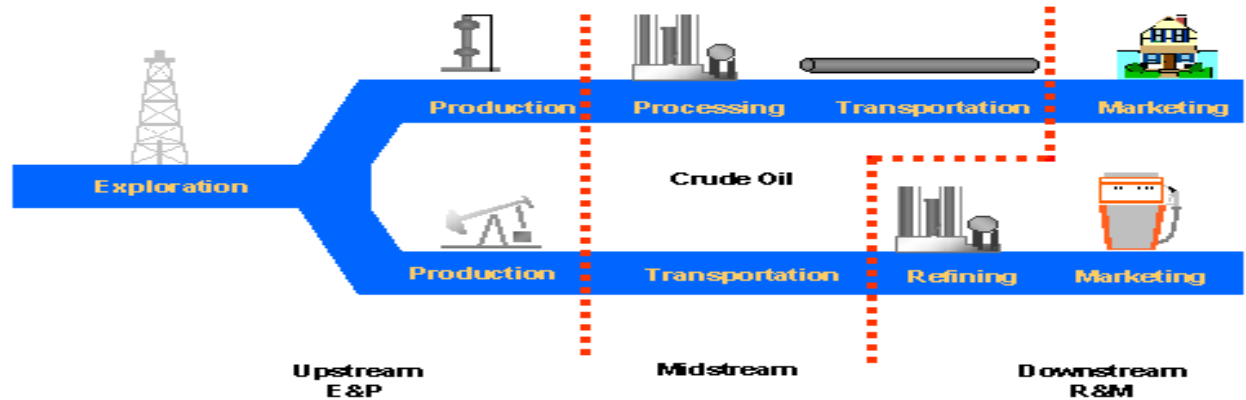
Crude oil's physical appearance varies from a light, almost colorless liquid to a heavy viscous black sludge. Oil can be classified along several dimensions, of which density and sulphur content are two of the most important. The quality of a crude oil is reflected in its price relative to other crude oils.

Natural gas can be found either in combination with, or in solution in crude oil, then referred to as associated gas, or in separate accumulations as non-associated gas. The composition of gas produced at the wellhead varies widely, but in most cases it contains pure natural gas, also known as methane, which is colorless and odorless, natural gas liquids (NGLs) such as ethane, butane, propane, and natural gasoline, as well as a number of impurities, including carbon dioxide and water. Dependent on the NGL content, gas is described as either wet or dry. Since gas has to be moved by pipeline or by committed LNG vessels, before a project can be developed, first a dedicated market has to be developed, making the launch of a gas project much more complicated than of an oil project. Thus in the past a lot of gas had been found accidentally, when the real exploration target was oil. This has led to a large amount of stranded gas: gas that has little or no commercial value because it has no identifiable market to go. Only over the past two decades search efforts for gas have been stepped up considerably.

The petroleum value chain starts with activities referred to as exploration and production (E&P) or the "upstream" sector. The sector referred to as "midstream" encompasses transportation of produced petroleum between production and processing facilities. In the

“downstream” sector crude oil refining, or in the gas value chain, regasification of liquefied natural gas (LNG), turn the extracted hydrocarbons into usable products for distribution to wholesale-, retail-, and/or industrial clients.

The petroleum value chain



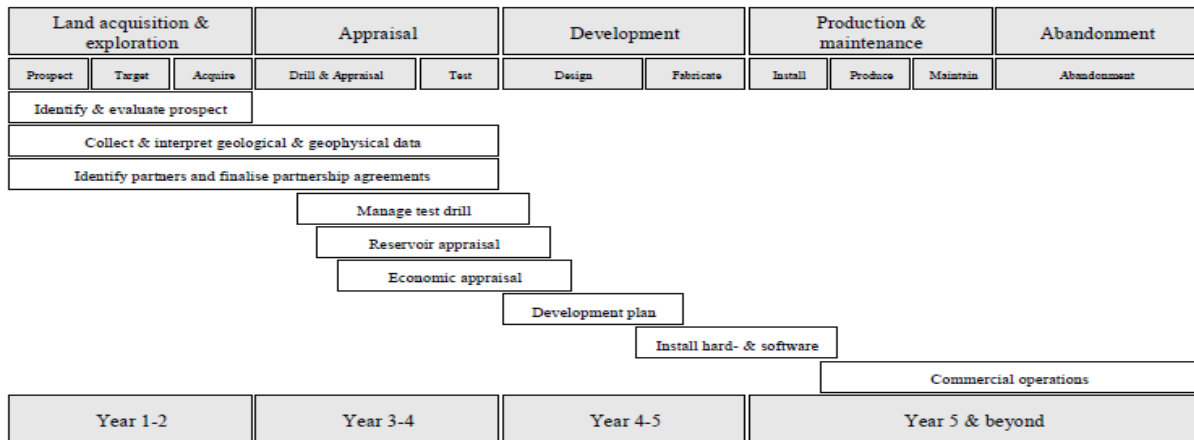
2.1 - The upstream sector

Identification of suitable areas to conduct exploration for oil and/or gas sets off the petroleum value chain. The identification is usually done using means such as aerial and satellite photography, as well as magnetic surveys. If identification activities are promising, exploration rights have to be secured by application and negotiation with the competent national authorities. Detailed information of a smaller area is then obtained through seismic surveys, which are considerably more expensive. Through complex computer analysis, the data are interpreted to create an image of geological structures below the earth’ surface which can contain deposits of hydrocarbons. If a suitable structure is identified, the only way to find out if hydrocarbons are indeed present is by drilling an exploration well. Exploratory drilling is therefore the next step, using drilling rigs suitable for the environment concerned: land, shallow water or deep water. There is considerable ancillary equipment, products and services associated with drilling, and many petroleum companies typically contract an outside services company for these tasks. On average only one in five exploration wells is successful. The costs for drilling such wells vary between several million to 150 million US dollars if it is an offshore deep sea well and even reached 7 billion US dollars in case of Shell’s Arctic exploration well, which recently had to be written off. Since no costs can be recovered if the well is not successful, this represents a substantial contribution to an important characteristic of the sector: its high-risk profile.

If the exploration well has demonstrated hydrocarbons in sufficient quantities, the process continues with the drilling of one or several appraisal wells to better assess the size and quality of the reservoir and thus the commerciality of the discovery. If still successful, the appraisal phase is followed by the development phase: drilling for full-scale production, and the building of infrastructure to connect the wells to local processing facilities or evacuation routes. Onshore infrastructure tends to be less complex and much cheaper than offshore infrastructure.

As illustrated with the schedule below, even on a standard upstream project it is not unusual to take up to five years to get from the initial exploration stages to full-scale commercial operation. For projects with challenging access, geology, or major infrastructure requirements the time horizons involved can be much longer still. These long lead times in project development and the fact that sudden changes in well-flow management can damage underlying reservoirs, result in structural rigidities in petroleum supply; given existing oil price swings this can have a negative effect on project economics.

Typical development schedule for an E&P project



The speed at which the pressure in the reservoir forces the petroleum upwards is known as the flow rate: it depends on the properties of the reservoir rock, the reservoir pressure, and in the case of crude oil on the viscosity – in short, the reservoir characteristics. Primary recovery with existing natural pressure typically recovers much less than 50% of the oil and 75% of the gas. In the face of inevitable natural production decline rates, various methods can be used to boost flow rates and overall hydrocarbons in-place which can be recovered commercially. Secondary recovery methods include the injection of water or gas into the reservoir, or the installation of surface-mounted or submersible pumps. Tertiary recovery methods, or enhanced oil recovery (EOR), involves the use of sophisticated techniques that alter the original properties of the oil. The decision as to whether and which secondary or EOR methods are appropriate for a certain reservoir often involve trade-offs between commercial (significantly increased production costs, but accelerated and possibly overall greater output) and geological considerations (too aggressive production can damage the reservoir and lead to lower overall recovery factors); decisions of major importance, both for the operator and HC.

Depending on the size of the reservoir production until decommissioning of the field can last anywhere between 10 and 50 years or sometimes even longer.

The oilfield activities include a number of auxiliary services in the E&P process, such as geological and geophysical surveys, drilling, equipment supply, and engineering projects; these form a major part of the overall oil and gas industry. A common aspect in the petroleum sector is a heavy reliance on skilled personnel. For the upstream sector this is typically a combination of staff from the IOC and its service contractors, since much of the project activities are contracted out to services contractors. The IOC as the operator is responsible for the overall project result vis-à-vis the HC and therefore bears a major share of the project risk. The IOC role is primarily one of project management and funding, whereas the specialized service contractors implement much of the project work, possibly up to 80% of the project costs.

In summary, the upstream sector may be characterized as follows: major investments have to be made early on in the project. It is a high risk/high reward activity; joint ventures therefore are a common feature. If any, compensation takes place over a long term and is related to production of discovered hydrocarbons. Compensation includes recovery of the investment and a relatively high rate of return on investment, justifying the substantial investment risk undertaken, collectively underscoring the significance of fiscal stability and economic predictability for a foreign investor.

2.2 – The midstream sector

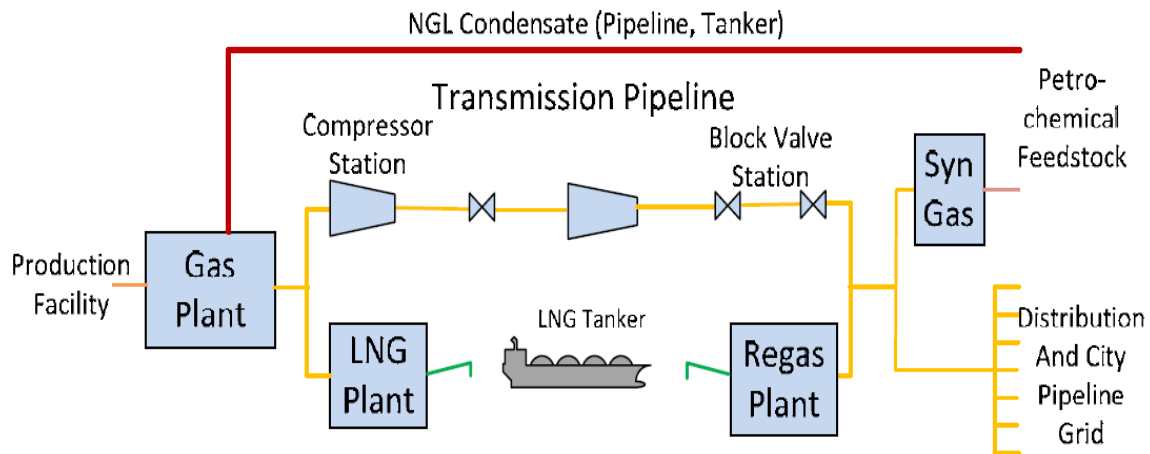
The parts of the value chain referred to as “midstream ” concerns transportation and encompass the infrastructure, such as pipelines and access to roads, rail, ports and storage. It is critical at various stages in the value chain and provides the links between production and processing facilities as well as between processing and final customer.

2.3 – The downstream sector

Refining and marketing is referred to as the “downstream” oil sector. Oil refining turns the extracted crude oil into usable products. Its composition determines the mix of products that can be obtained by refining and the ease of refining. Different products are more or less valuable at any one time, depending on the overall supply and demand. Refineries will try to produce the most valuable products if they are able to do so, but the overall supply of refineries of different complexities will limit the overall capacity to supply certain products. Crude oils which yield a large proportion of more valuable products and which can be treated by a large number of the world’s refineries, therefore command a premium over crude oils which produce a larger proportion of lower value products or which can be processed by only a limited number of refineries.

Following the refining process, the processed products are marketed and distributed to wholesale-, retail-, or industrial clients. Certain oil and gas products are the principal input for the petrochemicals industry. This explains the close historical and geographical links between the two.

Natural gas has a somewhat different division of sectors. In the upstream sector, gas and liquids are separated upon production. In the midstream sector the products are transported and/or LNG liquefied and regasified; in the downstream sector, the products are distributed to the consumers as demonstrated in the figure below.



3 – Measuring value creation

The economic value generated in the petroleum value chain can be extracted from the income statements published by oil- and gas companies and mainly consist of: (i) realized oil- and natural gas sales prices, (ii) costs of operations, (iii) taxation and (iv) company profit margins.

The realized oil- and gas sales prices are a primary driver of company profits and taxes payable and thus value creation. Since prices are determined at the international petroleum market, these are beyond the governments’ influence on value creation (except may be of Saudi Arabia).

The costs of petroleum operations are very substantial. Several implications follow:

(i) Efficient cost management by the operating companies, including the competitive tendering for oilfield services, are critical for overall value creation. Any relative inefficiency of these companies represents a direct loss of value creation.

(ii) In order to support national economic development, supply of goods and services as inputs to the petroleum sector (backward linkages), should be encouraged. Such policy may, however, be at odds with the efficiency referred to in the previous paragraph and/or truly competitive tendering.

(iii) Cost differences between operating companies exist as a consequence of different levels of technical efficiency and these may translate into losses of social welfare.

(iv) The large upfront capital costs and long lead times for E&P projects often call for strong partnerships.

In the worldwide upstream oil and gas sector, total government take - the government share of available cash flow from a petroleum project- varies from about 40 percent to well over 90 percent, making it one of the most heavily taxed sectors. Thus, tax revenue is often the single most important contributor to national social welfare. A primary function of a fiscal regime is its use as an instrument to capture a share of the overall rent. It may also be used to guide private-sector investment decisions and to provide incentives for efficient operations. In order to be able to take full advantage of the rent as resource, it is essential that a competent revenue collection and -management system is in place. Tax issues and fiscal systems shall be addressed in more detail below.

The risk profile and capital structure are characteristic differences between upstream- and the other activities in the value chain. In addition to normal project risks, E&P-business carries geological risks: wells may be dry or costs to extract petroleum from a particular reservoir may be prohibitive relative to volumes that could be produced. Indeed, there is a significant chance that investments made will yield no return at all; to compensate for such risks, returns on successful upstream investment are therefore comparatively high. Due to its risk profile, upstream exploration is normally funded by equity capital, that is [money](#) invested by the company's shareholders, which, in contrast to [debt capital](#), is not repaid to the [investors](#) in the normal [course of business](#).

Mid- and downstream projects are generally far less risk prone than the upstream projects, primarily because these assets are typically not constructed unless there is an upstream find that would support the investment. Furthermore, debt can be attracted to such projects, which reduces end use costs; both factors lead to considerably lower, "utility type" returns on investment. Tariffs are therefore often regulated in these sectors, which has an important effect on both, sector regulations and -institutional framework, as shall be discussed below.

Activities undertaken in different sub-sectors along the value chain by one company or group of companies, is referred to as vertical integration. This typically occurs in E&P and downstream and can have many advantages for value creation, such as securing sources of supply or off-take markets, profit margin elimination of intermediaries, or facilitation of logistical operations such as storage, and most important, the spreading of value creation risks along the value chain.

In the downstream oil sector, most industrialized countries levy significant additional consumption taxes - value added taxes, or VAT- on top of the taxes on crude oil. For instance, of the final price of the main refined products in the EU in 2013, on average 10 percent was accounted for refining cost and company profits, 28 percent for crude oil costs and 62 percent was due to taxes.

Benefits are normally measured in terms of economic value; this is a measure of benefit provided by a good or service and normally expressed in money. Social value refers to benefits provided by goods or services to a society collectively, and in addition to the economic dimension, encompasses social- and environmental dimensions. Impact measurement of social value is therefore complex and often not without ambiguity as for example is evidenced in the section concerning local content policies.

4 – Contribution to value creation

The elements most affecting the value creation for a national petroleum sector have been divided in: (i) circumstantial factors, (ii) petroleum sector specific policies and (iii) cross sector policies.

Circumstantial factors are essentially beyond the control of the HC. The other two categories on the other hand are fully under control of the government and determine the setting of the national petroleum sector. Policies provide the basis for the investors and participating company's ability and willingness to contribute to the value creation process. For ease of reference the policies have been subdivided in policies unique to the petroleum sector and cross sector policies. The first category usually falls within the exclusive jurisdiction of the minister responsible for the petroleum sector. The second category, cross sector policies, may be highly relevant for the petroleum sector, but usually resort under the jurisdiction of another ministry than the ministry of petroleum, or is a shared responsibility. An example is taxation and revenue management; highly relevant for the petroleum sector, but primarily under the jurisdiction of the revenue authorities. In this chapter we shall discuss circumstantial factors; petroleum sector policies and cross sector policies, shall be discussed in chapters 5 and 6, respectively.

Some contextual variables can materially affect value creation in the petroleum value chain. At best, however, the government may be able to optimize the conditions as presented, since these are generated externally and therefore beyond the control of the government. The most important of the external conditions include:

- the quality and quantity of the resources and their geological properties, the technical complexity and cost structure of production;
- the geographic location of the country and the resources position within the country, as well as the geographic conditions, such as the presence of a sea or rivers which determine ease of access for domestic- and export markets;
- the condition of the world economy, oil prices and their volatility.

5 – Sector specific policies

In particular sector specific policies determine the setting of the national petroleum sector. In this chapter, the following principal policy decisions are discussed: (i) depletion; (ii) award and administration; (iii) licensing and petroleum agreements; (iv) legislative- and regulatory framework; (v) institutional framework; (vi) industry participation;(vii) international matters.

5.1 Depletion policy

Governments must decide whether to explore for and/or produce petroleum, at what pace, and which company should undertake such activities. Maximization of social value creation should be achieved by choice of the optimal production pattern over time.

Depletion management can refer to individual petroleum reservoirs, to connected areas of production, or to the aggregate national level. It can be directly imposed by the government, guided by using instruments such as the licensing system and taxation, or

developed through the choices of individual project operators, sometimes beyond the scope of public involvement. Establishing an appropriate depletion policy may involve the following factors:

- *“Good oilfield practice”*: Deviations from good oil-field practice may permanently damage the reservoir;
- *Politics*: Nation states may have entered international commitments on productive capacity and output that limit discretionary decision making (OPEC);
- *State budget*: Better knowledge of the size of petroleum reserves provides an input for the design of sustainable macroeconomic policies and for improving intergenerational equity through the choice of current consumption rates;
- *Public pressure on spending*: Increased public income may result in political pressure to spend the money, irrespective of the availability of suitable reinvestment opportunities;
- *Domestic economy*: Suitable reinvestment opportunities for monetary income from petroleum operations might encourage accelerated production schedules. On the other hand, a lack of suitable re-investment opportunities, fears of hyper-inflation, adverse changes in foreign exchange rates (“Dutch disease”), or a lack of potential production linkages to the rest of the domestic economy may discourage aggressive depletion policies;
- *Institutional framework/ governance*: a strong institutional framework and competent governance is of major importance and shall be the subject of subsequent sections;
- *Resource curse*: Related to both the domestic economy and the institutional framework exists the apparent failure of many states to translate wealth of natural resources into sustainable economic development;
- *Price expectations*: Changes in the prices of oil and gas affect the value of uncovered resources;
- *Cost expectations*: Progress of technology lowering production costs may be worthwhile to wait for in cases where costs of extraction are high;
- *(Cross border-)Unitization*: is a process to be followed for joint development of a common petroleum reservoir, which extends across the boundary line of adjacent blocks, state- or national territories. The Government should prevent wasteful competitive drilling by rights holders and ensure that in the interests of economy, efficiency and conservation of the resource, the common deposit is developed as a single unit on a non-competitive basis by the entitled rights holders if the field is in its own territory. If the reservoir extends into a neighboring state, or - country, it should negotiate in good faith an acceptable arrangement allowing unitized development by the resource holders on both sides of the border. If the borderline is in dispute, a joint develop zone may be agreed, pending determination of the border location.

5.2 Award and administration

The resources in the subsoil in all countries around the world are either nationally owned, or the nation retains a veto on their use (except for the United States of America). Governments grant petroleum exploration-, development-, and production rights in particular areas or blocks by means of concessions or contracts, depending on their legal system.

A high degree of technical- and financial capability is required to carry out exploration-, development-, and production activities and licensing regulations normally define minimum capabilities that companies must demonstrate to be granted these rights.

Governments usually award hydrocarbon exploration- and production rights to qualified investors following competitive licensing rounds. Bidding procedures differ among countries. Some use rigid systems with only a few biddable parameters that affect the sharing of benefits between the country and the investors. Some award hydrocarbon rights on the basis of a work program; in other countries, many terms are negotiable. such as spending a minimum amount of money on exploration, shooting seismic, drilling wells, developing infrastructure, training and capacity building, or using local contractors.

Licensing rounds are more likely to increase competition among oil companies to the benefit of the host government. However, since projects in risky or newly opened areas often attract a lower number of potential investors, direct one-to-one negotiations between government and potential investors may -initially prove more cost-effective.

The proper and competent license-, or contract administration and management on behalf of the Government is a key function to ensure optimal exploitation of the resources for the nation. Implementation of the sector regulations for individual cases requires specific ministerial decisions to be taken, such as the granting of authorizations, be it licenses or contracts, or the approval of a work program or a sales contract. Administration includes the maintenance of an updated and reliable geological information infrastructure, including regional assessment of oil- and gas resources; this is important for providing a better understanding of the country's petroleum potential and helping define sector policies, facilitating bidding processes and managing the access to resources. Furthermore, a public register should be established, which together with a consistent procedural system can increase transparency in the allocation of mineral rights, and facilitate the management of competing land use, including in protected areas.

The Ministry of Petroleum would normally house the petroleum data bank for the collection and conservation of geological, geophysical, and petrophysical data as well as a hydrocarbon license management unit; although in some cases, the NOC is entrusted with the management of the petroleum data bank.

5.3 Petroleum license and -agreement terms.

Petroleum licenses or -agreements are a key element for technical- and commercial decisions by the petroleum companies, such as where and how much to invest, and whether or not there are incentives for cost-efficiency. The state can thus use its licensing system to shape industry structure. For example, it can decide on the frequency and area coverage of any licensing, set up economic incentives for participation, or impose conditions such as mandatory involvement of the state.

Three generic systems exist; the vast majority of arrangements existing around the world belong to the first two categories, concessions and production sharing contracts, which can fiscally be made equivalent:

(i) *The tax/royalty or concession system.* This historical system was the only arrangement available until the late 1960s. It still finds ample application and may be considered the most liberal system. The licensee obtains a license from the government for a fixed period of time, is responsible for all investments, and owns all E&P equipment for this period. Upon expiry of the concession, the installation mostly passes to the state, but the investor is typically liable for abandonment. The investor takes full title to reserves and production at the well head, net of any physical royalties. In addition to physical or cash royalties, taxation typically

includes the general corporate tax as well as a specific petroleum tax.

(ii) *Production-Sharing Contract (PSC)*. There exist a multitude of PSCs around the world, with many differences between them. The common features include: title to the production and reserves in the ground remains with the state or its NOC, who is often the partner in a PSC. The contractor funds the entire development, subject to approval of the development plans and puts its own capital at risk. Ownership of the installations often immediately passes to the state. The contractor is then reimbursed through a specified part of the production called "cost oil". The remainder of the production, the "profit oil" is shared between the contractor and the state. Usually corporate profit tax rates apply to the profit oil captured by the contractor. PSCs sometimes also involve an additional upfront royalty payment in cash or in kind.

(iii) *Service contract*. The contractor is usually paid a cash fee for providing the service of producing petroleum on behalf of the host nation: a fixed fee per barrel produced, either as a percentage of costs, or a variable fee as a percentage of gross revenues. The contractor provides all capital associated with exploration and development, but has no title to reserves or production. The sales revenue is used to reimburse the contractor's costs and to pay its fee, which is often taxable. This type of contract is not favoured by IOC's because it doesn't grant hydrocarbon title to the contractor who therefore is not allowed to account for these as its reserves.

5.4 Legal- and regulatory framework.

A robust and transparent legal- and regulatory framework is fundamental for a sustainable petroleum sector and usually has a hierarchal structure. The top of the hierarchy consists of the constitution, which addresses fundamental issues such as the organizational structure of the nation, ownership of petroleum resources and revenue allocation.

The layer below the constitution consists of the petroleum legislation, ratified by parliament, and provides for the fundamental provisions regarding petroleum matters. A well-defined petroleum law usually includes the following elements: definition of the role of the state; security of title; freedom to operate on a commercial basis; access to resources; comprehensive environmental protection requirements; and a framework for fiscal terms.

The primary sector legislation is followed by subsidiary legislation, usually referred to as regulations and normally issued by a the minister in charge of the petroleum sector. Regulations are generally of a technical, more specific and detailed nature and could for instance include a model petroleum agreement setting out applicable standardized terms for production sharing contracts.

In accordance with the sector law and regulations, specific ministerial decisions may be issued, mostly applying to individual cases such as the granting of an authorization, be it a license or contract, or the approval of a work program or a transfer of assets transaction

5.5 Institutional framework

A clear and comprehensive institutional framework helps enforcement of the legal- and regulatory framework and thus contributes to an efficient national petroleum management system. Institutional roles are to a large extent a reflection of the policies to be implemented; some fundamental differences exist between the upstream- and mid-/downstream sectors.

Sector specific *upstream roles* include:

- (i) The design of sector specific policies, their integration in wider national- and the international context, as well as stewardship of an adequate

- institutional framework;
- (ii) The design and implementation of sector legislation, -regulations and -licenses/contracts;
- (iii) Conducting public tenders for the award of petroleum licenses and negotiation of petroleum agreements;
- (iv) License/contract management and administration;
- (v) Participation, whether as an operator or as a government representative in commercial ventures; and
- (vi) Enforcement of license/contract compliance, including commercial, technical, and generally also health-, safety-, and environmental aspects of petroleum agreements and applicable laws.

The sector specific roles are often divided in some fashion between the relevant ministry, or possibly a statutory authority reporting to the ministry, and the state-owned oil company. In Norway, for example, the Ministry of Petroleum and Energy handles petroleum licensing, whereas the National Petroleum Directorate, which reports to the Ministry, is responsible for contract compliance for petroleum exploration and production. Other governmental ministries are responsible for health, safety, environmental, and oil spill preparedness. Petro handles the "direct financial interest" in oil- and gas fields.

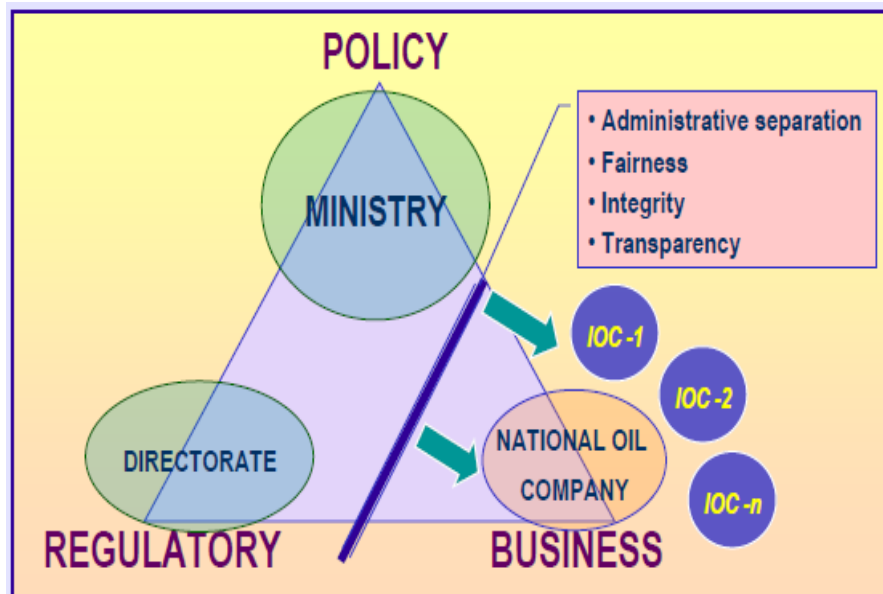
In the Netherlands, the State Supervision of Mines is an executive agency of the Ministry of Economic Affairs, and is tasked with upstream petroleum oversight responsibility, including health, safety, and environmental oversight. The Ministry of Economic Affairs itself, however, is responsible for petroleum licensing, -administration and - management. Similarly, in Mozambique, the Ministry of Mineral Resources is tasked with granting concessions, but responsibility for ensuring that petroleum operations are conducted in accordance with applicable laws and contractual commitments is delegated to the National Petroleum Institute. Other countries have independent upstream regulatory entities, rather than agencies reporting to the relevant petroleum ministry.

Regardless of whether upstream roles are assigned entirely to the relevant ministry, to a separate statutory authority, to the NOC, or to a combination of the three, the guiding principle should be that the assignment of responsibilities must be clear and without unnecessary overlap; this explicitly applies, both to the policies as well as their implementation in practice. All stakeholders should have a clear understanding of who is responsible for performing the various roles in the petroleum sector, including commercial responsibilities.

Another key condition for efficiency and effectiveness is that the entities concerned have the authority and resources available, commensurate with their responsibilities; the latter should include the technical capacity and market knowledge to be able to assess the geological potential of the areas for which a contract or license is offered and to adequately mitigate country- and project risks that may arise with the award of such a contract or license.

The state's role and - authority to regulate and administer the sector should clearly be distinguished from its investors' role to explore-, develop-, produce-, and sell the resource. Current best practice is mostly referred to as "the Norwegian institution governance model", as shown in the figure below.

The Norwegian institutional governance model



Petroleum operations generally require close technical- and environmental monitoring. A strong petroleum operations inspectorate as referred to above in the Norwegian and Dutch models is essential, particularly in case of a complex or maturing petroleum sector setting. Tasks may include: (i) enforcing sector regulations regarding exploration and exploitation, safety, health and environmental in coordination with other government authorities, (ii) advising the ministry of petroleum on the suitability of regulations and individual operating companies; (iii) facilitating the resolution of conflicts and/or possible environmental or social impacts; and (iv) ensuring that abandonment plans are properly implemented.

Mid- and downstream. As indicated above, return on investment in the mid- and downstream sectors is lower than in the upstream sector and tariffs are therefore normally regulated. Key mid- and downstream roles include: (i) regulation of tariffs for midstream assets such as pipelines and LNG facilities; (ii) ensuring efficient use of midstream transportation- and downstream distribution capacity; (iii) pipeline- and LNG safety; (iv) environmental oversight; and (v) state participation in mid- and downstream infrastructure.

It is important to ensure that regulator and operator functions of public entities are clearly separated, as per best practices in the world. Where regulation of tariffs is involved, such as in the mid- and downstream context, independence of the entity regulating those tariffs is essential in order to prevent undue political influence on market mechanisms.

Tanzania's independent Energy and Water Utilities Regulatory Authority, for example, has authority to regulate rates and charges, but its authority over the petroleum sector is limited to transportation and distribution. Pipeline projects are frequently developed as public-private partnerships throughout the world.

5.6 Industry participation

The companies participating in the sector include national oil companies (NOCs) and international oil companies (IOCs). The latter can add to the value creation process by providing foreign direct investments and technical- and management expertise.

Key factors for value creation by companies participating in the sector and thus selection criteria for their participation include:

- Cost efficiency of operations, overhead spending and investments;

- Technical excellence, which may support higher reserve replacement and field recovery rates, fewer fuel losses, and higher-value product yield for refining;
- The company's strategic choices, such as asset selection, targeting of domestic versus export markets, track record of compliance with laws, appliance of corporate social responsibility (CSR) policies etc...
- Relations with the company's base country, including trade-, taxation-, or bilateral investment treaties.

The policy options with respect to the level of competition and participation in the petroleum sector range from a pure monopoly held by the NOC without any outside participation, to a perfectly competitive market without any entry regulation or direct state intervention; in between are many possible combinations. No country has implemented either of the extreme options.

There are two principal arguments for the establishment of an NOC. First, there is an economic argument: domestic production may be a profitable undertaking, not only by generating tax income, but also by state participation in such production. Participation may also be required in the event IOC's would not be interested in exploitation, whilst the HC deems such activity nonetheless in the public interest. Secondly, a government may feel it needs to stay close to the petroleum activities to: (i) share in the decision making process, particularly development planning and investments; (ii) gain experience with the technical-, administrative- and commercial aspects of the operations; (iii) supervise the implementation of non-technical and -fiscal provisions, such as employment- and training of nationals and the use in the operations of locally supplied goods and services; and (iv) safeguard the national interest from total foreign domination.

Where an NOC exists, defining its roles in the petroleum law can help avoid conflicts of interest.

5.7 International matters

A legal regime for petroleum within a government's jurisdiction necessitates attention to quite a few aspects of international law. The nation may become a party to: (i) global or regional treaties, e.g. the 1982 Convention on the Law of the Sea, regulating offshore petroleum operations; various conventions for the protection of the environment and - the prevention of pollution; or (ii) bilateral, inter-state agreements/treaties concerning the joint exploitation of an oil- or gas field straddling their boundary (unitization); (iii) bilateral agreements for the reciprocal protection of investments; or the avoidance of double taxation with IOC's base country; (iv) regional multilateral treaties for economic cooperation, such as the Common Market for Eastern and Southern Africa (COMESA), or a mutual disaster support treaty.

6 – Cross sector policies

Sector specific policies are instrumental for establishing a national petroleum sector as an integral part of the wider national policy framework. Other policies which are not exclusively governed by the ministry responsible for petroleum matters may also directly affect the petroleum sector organization and governance, and co-determine the petroleum sector's attractiveness for investment. The most important cross sector policy matters are: (i) taxation and revenue management; (ii) social- and environmental concerns; (iii) local content; and (iv) governance.

6.1 Taxation and revenue collection

Petroleum projects are subject to a wide range of fiscal instruments. These include taxes that apply to all other sectors of the economy, as well as taxes that are specific to the petroleum industry. Non-tax forms of rent collection (such as royalties, surface fees, bonuses, and production sharing) are also often used. Moreover, the government, sub-divisions thereof and/or public regulatory bodies have powers to impose other levies onto industry participants, such as health-, safety- and environmental expenditures. When a NOC exists, the government should receive dividends and other forms of payment as a shareholder of the company. Government income may therefore consist of several revenue streams, to be collected in cash or in kind.

Wide differences exist in fiscal patterns across countries due to their difference in bargaining power when negotiating fiscal terms with IOC's. Since certain risks tend to influence the bargaining position, and consequently the fiscal terms, a country's bargaining power is derived from its particular circumstances. The most strict fiscal regimes tend to be in countries, which offer very attractive geological prospects, combined with political- and macroeconomic stability. The fiscal terms applicable in a given country must at least take into account the following key variables: (i) physical environment; (ii) geological prospectivity; (iii) existing infrastructure; (iv) economic- and political stability; and (v) other specific risks, such as security.

An important consideration when determining appropriate levels of government take is the potential trade-off between short-term state rent capture and longer-term value creation. If the fiscal regime is distortive, for example because it creates a disincentive to cost savings or encourages excess investment, then net welfare losses will result.

Given the nature of investment in oil and gas extraction—long term, large-scale and up-front - a particular concern for investors is to guard themselves against unforeseen changes to the financial premises of the project. The assurance of fiscal stability is an important investment incentive, carrying the cost of reduced flexibility for the government to increase tax on a given project in future.

The ability of a government to efficiently collect taxes, royalties, duties, and other revenues depends in part on the choice of fiscal regime and fiscal instruments, and in part on the administrative and audit capacity of the relevant institutions. The choice of fiscal regime is critical to achieving contract stability and fair rewards.

Internationally accepted accounting and reporting standards have been developed to deal with key financial accounting and - reporting issues unique to the petroleum industry. It is common practice for producing countries to refer to such standards in petroleum legislation, -contracts, and -licenses. Special accounting procedures are also generally annexed to the relevant contract or license. Ideally, accounting procedures are standardized and apply to all projects in a country. Standardization simplifies contract administration and revenue assessment and reduces the possibility of misinterpretation.

Normally, the sale of crude oil or oil products is regulated by transparent procedures—in which there are no conflicts of interest—specified in the petroleum legislation and in the relevant contract or license. In the interest of consistency, the same procedures should apply to the national oil company or the government entity responsible for selling crude oil, oil products, or both on behalf of the state. To ensure compliance, it is essential to collect and verify data on the volumes produced, consumed, and exported, and on the prices actually realized by the seller. Fiscal authorities also need to ensure that inter-company transactions are priced in accordance with market conditions for similar goods and services including financing, and do not become a vehicle for transferring taxable income from one affiliate to

another.

Transparency is improved and reconciliation of accounts is facilitated when all payments to the state made by petroleum companies, including any NOC, and the proceeds of taxes collected in kind are traceable and directed to a treasury account, preferably one opened at the central bank. In consideration of the potential impact on the treasury, clear policies are necessary to determine the extent of and modalities for financing the NOC's operations and for determining the amount of after tax net cash flow to be retained by the company and the amount that will be distributed to the government as shareholder.

6.2 Environmental- and social matters

The major environmental impact of any oil exploration is from an oil spill. Whilst the chance of a major oil spill may be low, the impact can be very large. Soil contamination from minor leakages and moderate oil spills also has been an issue. Furthermore, any land based development will affect the direct site through habitat destruction. It is therefore important to have good regulation in place to reduce risks but also contingency plans in case of oil spills.

The social impact in the development and production stages of the project in particular, can affect communities close to the operations. The development phase involves construction and employment tends to involve influx of workers. This can lead to a number of negative social issues including divisions in the community between the incomers and locals and can also lead to inflation, particularly of house prices and rents, increases in crime, health issues and social disruption.

The most successful examples of environmental and social impact mitigation and monitoring involve early consultation and participatory monitoring practices at the local community level. It is good practice to ensure that a consultation process with local communities takes place at the very early stages of a project. This helps minimize environmental- and social impacts and ensure that the communities receive adequate compensation and benefits based on the project's impact on their livelihood. Communities' understanding of, and support for, the project would in turn reduce conflicts and increase operational security.

Environmental- and social matters should cover the entire petroleum project life cycle. In accordance with good practice, the separation of roles among the ministry of environment or environmental agency, the environmental unit of the sector ministry and the state-owned company needs to be clearly demarcated to avoid institutional conflicts and poor environmental monitoring. The environment ministry (or agency) usually retains full ownership of the clearance/permitting process. However, many countries have adopted the "one-stop-shop" approach, in which investors' point of contact for all matters related to the implementation of petroleum contracts or licenses is the sector ministry, which in turn secures the clearance for the relevant environmental authority. This arrangement can be effective in simplifying compliance monitoring and reducing investors' cost of doing business.

6.3 Local content

The petroleum sector can serve as catalyst for national economic development through local content policies. This concept was first introduced in the early 1970s in the North Sea countries. Local content policies' identity is reflected in the most common tools that have been used since that time: creating NOCs; training and employment of nationals by IOCs; technology transfer from IOCs, use of local goods and service providers, and the establishment of joint ventures between international and local companies.

Local content development can take place along the entire oil and gas value chain and can

stimulate development of industries in the first place with supply inputs for the sector, or “backward linkages”; examples range from catering for the oil field services and local transportation services to fabrication of oil field installations. A second option is development of industries that process the products which have been produced and are available prior to export, the “forward linkages”; examples include oil refining, power generation and fertilizer production. Local content development can significantly contribute to the gradual diversification of an economy.

Sustainable development of local content needs regulation, but can ultimately only rely on the establishment of indigenous industries that can compete in the regional/international market. Countries with a frail and narrow industrial base should therefore provide for the preferential treatment of domestic companies as local content policy. Such preferential treatment, however, should be of a temporary nature only, so that these companies have incentives to become competitive; if not, the local services- and supply industry consumes oil wealth rather than adding value to it. In order to become internationally competitive, local companies need access to technology and financial resources. This can realistically only be obtained through active cooperation with international companies and financing institutions such as IFC. Therefore, IOCs are key stakeholders in the process of increasing the local content.

The Government has a direct impact on local content by virtue of establishing policies and the legal- and institutional framework and thus plays a central role. Determining the right level of government intervention is complicated because local content is a complex issue caused by the multi partite nature: (i) government institutions involved responsible for different sectors (e.g. oil- and gas, industry, education, finance/taxation, commerce); (ii) usually on different organizational levels (central-, state-, and community level); (iii) participating local companies and their sector organizations; (iv) training- and education institutes; (v) the IOCs as contract parties and project managers; and (vi) the international service companies as the project execution companies. A role of eminent importance for the government is therefore conceive a policy, issue laws and -regulations, align its agencies and other participants, award contracts with planned local content objectives and ensure coordinated actions. These activities should take place in an enabling environment for market-based activities for both, local as well as international companies.

A policy supporting sustainable local industrial development needs a long term perspective, does not come cheap and has risks associated, such as cost increases, project delays, HSE-challenges and corruption and may also have negative consequences for other sectors. Such costs may be considered a necessary trade-off between short-term efficiency and long-term economic development. Establishing a strong and efficient petroleum sector legal- and institutional framework is certainly the more efficient way to create economic value in the petroleum sector; however, as a contribution to social value creation, local content development may prove much more effective.

6.4 Governance

The following good governance principles were identified by the Chatham House Institute as universally applicable: (i) clarity of goals, roles and responsibilities; (ii) enablement to carry out the role assigned; (iii) accountability of decision-making and performance; (iv) transparency of information; and (v) sustainable development for future generations. This essay reflects these principles throughout; a few rules of practical importance are added in this section.

Building and enhancing the technical capacity of the government agencies entrusted with sector regulation, -monitoring, and oversight is necessary for the effective implementation of

the government's policies. Petroleum licenses and -contracts usually contain provisions related to training of locally recruited personnel, knowledge transfer, and sometimes secondment of government officials.

A problem common to government entities in many developing countries is how to retain qualified civil servants, given the limitations imposed by public compensation and human resource management policies. To overcome these limitations, some countries have created independent government agencies, modeled on the private sector, with different pay scales and human resources policies. Others provide special incentives to highly qualified civil servants. The difficulty many government entities face in retaining qualified staff underscores the importance of continuous training and capacity building as a tool for mitigating the effect of high turnover.

Accounting rules and -procedures for petroleum operations and regular audits that meet international standards are critical to assess production- and export volumes, -prices, and capital- and operating costs, as well as to monitor compliance with procurement procedures, local content obligations, and social compensation requirements. Whereas crude oil prices are normally set by the international market, in the case of natural gas regulation for the domestic market, price regulation is often necessary to protect end-users and prevent anti-competitive behavior.

It is essential that a public- or private company's provision of services or benefits to the government or its agencies is accounted for in the state's accounts. Regular audits and reconciliation of the treasury's - and companies' accounts will further strengthen transparency and public confidence.

Good practice calls for the government to publish revenues generated by petroleum activities from time to time. For this purpose, the Extractive Industries Transparency Initiative (EITI) is particularly relevant. It calls for companies to disclose all their payments to governments and for the governments to disclose corresponding receipts. A report issued by an independent administrator comprises the reconciliation of company and government disclosures, including the explanation of discrepancies. The EITI is a tripartite process that involves the government, extractive companies, and civil society organizations.

7 - Conclusion

In the foregoing analysis it was established that, compared with the mid- and downstream sectors, the upstream sector creates most value within the petroleum value chain; since the upstream sector is also most heavily taxed, in aggregate it generates the largest share of value for the HC and therefore attained most attention in this essay.

Essential characteristics of the upstream sector include the fact that major investments have to be made early on in the project, that the projects have a high risk/high reward nature, that compensation often stretches over a relatively long period and is dependent on production- and sales of the hydrocarbons concerned. These characteristics underpin the importance for the investor of economic predictability and political- and fiscal stability are therefore an issue of major concern.

Two aspects were identified as having fundamental influence on value creation: circumstantial factors and policies, whether sector specific, or cross-sector. Whereas circumstantial conditions are beyond the control of the government, it is presumably in full control of in-country policy formulation. To attract project investments by IOC's, among the multiple opportunities these have worldwide, a HC has to cultivate the conditions it can offer as an investment opportunity to IOC's, relative to competing petroleum producing nations. Improving the country's petroleum sector investment climate is the most efficient method to

achieve this; at the same time it improves the possibility of attracting technically efficient operators, which is another issue of major importance for the HC.

In addition to realistic- and competitive license- or contract terms, an advantageous investment climate is harnessed by clear policies, a comprehensive- and transparent- regulatory- and institutional framework, executed by a competent and properly resourced organisation, which is guided by principles of good governance. A direct correlation exists between the quality of these policies, their implementation and thus the perceived risk exposure by the investor on the one hand, and the HC's share of value creation, on the other hand.

To protect against risks for loss of value creation in the petroleum sector the HC may potentially suffer, establishment of an agency to ensure regulatory compliance is highly recommended. The advantages of the presence of an NOC was discussed, which include maximizing the government's share of the resource rent, availability of an additional instrument for training and for monitoring IOC operations, as well as IOC contribution to the petroleum sector's catalyst function for economic development through local content policies.

The brief overview and analysis of the petroleum value chain in this essay demonstrates that interactions between the sources of value creation are complex and dependent on the specific context for each country. Whilst "off the shelf" solutions for successful value creation are not available, experience from around the world can fortunately provide abundant examples of successful strategies and also strategies which did not end up well, each instructive in its own way.

Abbreviations:

COMESA – Common Market for Eastern and Southern Africa

CSR – Corporate Social Responsibility

Downstream – refining- and marketing activities

EITI – Extractive Industries Transparency Initiative

EOR – Enhanced Oil Recovery

E&P – Exploration and Production, or upstream

EU – European Union

HC – Host Country

IFC – International Finance Corporation

IOC – International Oil Company

LPG – Liquid Petroleum Gas

Midstream – transportation- and trading activities

NGLs – Natural Gas Liquids

NOC – National Oil Company

OPEC – Organization of Petroleum Exporting Countries

PSA – Production Sharing Agreement

PSC – Production Sharing Contract

Upstream – exploration- and production activities

VAT – Value Added Tax

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