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Short guide summarising the oil and gas industry lifecycle for a non-technical audience

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Contents

Abbreviations

IOC	International Oil Company
IPIECA	International Petroleum Industry Environmental Conservation Association
LNG	Liquefied Natural Gas
NOCs	National Oil Companies
PSA	Production Sharing Agreement
PSC	Production Sharing Contract
PPT	Petroleum Production Tax

This document provides a brief outline of the lifecycles of the oil and gas industry. It aims to explain to governments, communities, citizens and local companies how and to what extent they can expect to benefit from the oil and gas industry.

The guide has been informed by interviews with Shell, BG Group, BP plc, Tullow Oil and IPIECA. Due to time constraints we have not been able to include interviews with a wider set of actors and stakeholders.

1 Timelines and actors in the oil and gas industry lifecycle

1.1 The five phases of upstream oil and gas industry lifecycle

Oil and gas sector comprise three main activities - upstream (exploration and production), midstream (transportation and processing[1]) and downstream (distribution and sale to end users/consumers).

This paper presents a simplified generic life cycle focused on the involvement of an international oil company (IOC) in the upstream oil and gas industry.[2] In reality, industry operations can be far more complex[3] – this paper aims to set out the basic principles.

Five phases of the upstream life cycle are used as a framework to present processes in the upstream industry. Midstream and downstream activities are developed in the develop phase and occur concurrently with the produce phase. Annex 1 presents a basic representation of revenue flows during a basic oil or gas block/license life cycle, based on the timing suggestions from two sources: Dietsche et al (2013) and Tullow Oil's Life Cycle document. These timings are based on broad generalisations about the length of different processes, which in reality are dependent on a range of factors, outlined below. These average figures are only intended to be indicative.

There are five phases to the life cycle of upstream oil and gas industry:

Phase	Timing	Activities
1. Explore	1-5 years	Exploration for potentially viable oil/gas sources through geological surveys. Government seeks investment for own exploration or grants access for firms to explore, through direct negotiation or bidding processes. Concessions may be awarded to international companies to explore in a particular geographical area, with contracts governing the rights to any oil or gas discovered agreed. Duration of licenses and permits varies by country and by licence or block. International companies may explore alone or two or more companies may form joint ventures to explore together with one company being appointed the operator. Often no potentially viable oil/gas sources are discovered and operations are terminated. Where potentially viable oil/gas sources are identified, further exploration will occur. Companies will develop work plans for the next phase. Investment will be made in the technical and commercial components of exploration and also in social and environment impact assessments.
2. Appraisal	4-10 years	Sites identified as potentially containing viable oil/gas sources are examined in more detail. Infrastructure may be developed to access sites. Site drilling is planned and exploratory wells are drilled to seek to discover and map oil/gas reserves. Depending on the location of the field, companies will engage with communities as their operations increasingly impact on the local environment and economy.

1 In the case of LNG, processing may happen at the production site: as such it happens prior to transportation, and means that the mid-stream phase also affects communities from which oil/gas is being extracted.
2 In recent years, there has been increased interest in processing oil products locally in developing countries because of the potential benefits from processing crude oil to the wider economy (job creation and skills enhancement in manufacturing and services industries). This is more the case for oil than gas, which is more complex and expensive to process and transport. This note does not cover midstream processes.
3 For example, it would be quite normal that several fields/blocks are being explored and exploited at the same time. Thus, on the side of government the impacts of various licence/block lifecycles would be cumulative, for example with respect to the macro-economy and revenue collection.

		If no commercially viable oil/gas is identified, operations will be terminated. Where oil/gas reserves are deemed commercially viable, exploration companies will prepare to develop the site.
3. Develop	4-10 years	Government contracts and permits may be revised/renewed and the site is prepared for production. Limited infrastructure and site development will already be in place as part of the exploratory and initial drilling phase, but during the field development phase activity will dramatically increase and first oil/gas will be produced towards the end of this phase.
4. Produce	20-50 years	Oil/gas reserves are being extracted and transported for processing and distribution. There is uncertainty in any field about the amount of oil/gas, so it can be difficult to predict the volume of production which will fluctuate across this phase, with the rate of extraction typically rising to a peak and tapering off towards the end of the field's commercial lifetime (Collier, 2012).
5. Close	2-10 years	Once it is no longer cost-effective to extract remaining reserves, the site is decommissioned and the operating companies are typically responsible for returning the site to as close to original state as possible. This phase can take decades if environmental monitoring is required.

It is important to note that in the majority of instances activity is unsuccessful at the explore and appraisal phase – no potentially viable oil/gas sources are found, or when exploration wells are drilled no oil/gas is discovered or the reserves are not sufficient to justify the size of investment required to extract them. The majority of projects will therefore not reach stages 3,4 or 5 of the life cycle described above.

Distinguishing oil and gas lifecycles

Conventional oil production refers to the extraction of petroleum consisting of crude oil. Gas occurs in two forms, *associated gas* – a by-product of oil production, extracted via oil fields, and *non-associated gas*, which is extracted separately to oil i.e. where no oil is found (BG, 2010). Conventional oil and gas life cycles are broadly similar, but there are differences. In terms of production peaks – oil fields tend to peak early in the production phase and have a longer decline whereas gas production tends to produce more steadily with regular fluctuations throughout the production phase. Oil may also be easier to process, transport and sell. Gas is more expensive to transport, difficult to store and commands a lower price per unit of energy than oil. Although the development of the process of liquefied natural gas (LNG)[4] has helped address this problem and made it viable to develop gas fields for export over longer distances than is normally possible by pipeline, the cost of significant upfront capital investment (BG, 2010) means that extraction can only be justified by much larger reserves of gas, compared to those required for oil and associated gas. LNG also has a distinct lifecycle because processing occurs prior to transportation, so the midstream phase happens at the same site as the upstream phase. An LNG 'project' can involve various upstream segments (several licences/blocks held by several international oil companies, either individually or as consortium partners) that are tied into one midstream segment and the upstream segment would typically involve several international oil and gas companies.

Due to the comparative complexity of *non-conventional oil and gas* extraction processes, lifecycles for non-conventional resources (such as shale oil and gas) are likely to take longer at the appraisal and develop phases.

4 Converting natural gas to liquid for ease of transportation and storage

1.2 Actors

The table below sets out the four main categories of actors and the broad nature of their involvement in the oil and gas life cycle.

Actor		Role
State	National government	Manages legal and fiscal infrastructure, collects and disburses state revenues from oil/gas industry activities; regulates the industry (or delegates regulatory authority to a separate agency or body)
	Local government	Manages local legal and fiscal infrastructure, potentially collects and also distributes (to local area) revenues from oil/gas
	National Oil Companies (NOCs)	Organisations completely or majority owned by national government. NOCs may pay revenues, taxes and royalties to government, they may also be charged with political and social responsibilities. They are often also the government agency responsible for managing the award of oil/gas contracts and collecting royalties and fees. As such, they can operate on both sides – as part of a joint venture consortium (particularly in the develop and produce phases of the life cycle) and as an agency of government throughout the life cycle, hence the inclusion of NOCs under the state category. NOCs typically act as the government component of PSCs/PSAs (Production Sharing Contracts/Agreements)
Oil industry	Contractor	IOC or NOC in contractual relationship with government to engage in oil/gas exploration
	Operator	The manager of the project – the company responsible for undertaking oil/gas production (often as part of a joint venture/consortium of companies, where it will operate on behalf of the other joint venture companies
	National Oil Companies (NOCs)	NOCs engage in exploration and production, independently and through contractor joint venture consortiums. Some NOCs invest in other countries
	International Oil companies (IOCs)	International companies of different size: super majors (very large companies which invest and deliver globally at all stages of upstream, midstream and downstream processes); smaller IOCs; oil exploration companies (focus on high risk exploration, 'farm out' part of their equity for drilling and project development[5])
	Oil and Gas industry associations	Membership companies and bodies which represent companies engaged in the oil and gas industry.
Supply chain	International companies	Companies involved in the supply chain, directly and indirectly. Providing both goods and services. This includes engineering, procurement and construction companies (EPCs) as well as those providing indirect services and inputs. They may also operate oil and production facilities on behalf of the Contractor companies
	Local companies	Companies involved in the supply chain, directly and indirectly. Providing both goods and services. This includes engineering, procurement and construction companies (EPCs) as well as those providing indirect services and inputs. They may also operate oil and production facilities on behalf of the Contractor companies
Community	Local community	People living in the area which is directly affected by the oil/gas exploration, or for offshore production in the access point for offshore fields including local government
	Local/national CSOs & service providers	Formal organisations representing local communities, delivering goods and services, engaged with IOC social investment programmes
	International NGOs, watchdogs & development agencies	Organisations engaged in monitoring extractive industry activities, improving their development impact and partnering with extractive industry actors, particularly on social investment and local content

Sources: Al-Fattah (20130: Dietsche et al (2013)

[5] This means selling all or some of their shares in a consortium, usually to a bigger company better able to finance and manage the development of a project (Dietsche et al, 2013).

1.3 Factors influencing the timing of oil and gas exploration and production

As can be seen in Annex 1, the timing of different phases of the life cycle varies significantly. Whether a phase takes one year or twenty depends on three factors, some of which can be influenced directly or indirectly by the actors identified above (Dietsche et al, 2013; Deutsche Bank, 2010; stakeholder interviews).

Physical and technical factors: key factors in determining the speed and cost of the process are where the potential or discovered oil or gas is located and the estimated quantities and ease of its extraction. Factors affecting this include the depth and geological location, whether or not it is onshore or offshore, and if offshore, deep water is more complex than shallow water. Also, the availability of hard infrastructure – access and transport (typically roads), water and electricity, most of which will need to be developed and provided by the IOC if it is not present at the start of exploration. Most of these factors cannot be directly influenced by the actors involved.

Social and political factors: three factors which influence investment decisions and speed with which activities progress – (i) government capacity and behaviour (ii) community response and (iii) company activity and engagement.

The government is responsible for designing and implementing the regulatory environment. If the regulatory environment is not stable and predictable or conducive to exploration or production it can delay activity or deter investment. Given the potential economic, social and environmental impacts of exploration and production, several government departments and agencies need to engage in parts of the process. The degree of coordination between layers of government (e.g. national and local) and across government departments (e.g. different Ministries responsible for natural resources, environment, labour and budget) is also important in determining how quickly government can establish a conducive regulatory regime, as is accountability, transparency and civil service capacity.

Community behaviour can influence initial investment and subsequent exploration and production decisions. For example, where communities are unhappy with outcomes of land agreements, infrastructure development or economic opportunities resulting from exploration and production, they may lobby government or engage in direct action which affects or halts activity in the oil/gas field. Community responses to exploration and production are influenced by specific regulatory and governance factors (e.g. government accountability and revenue transparency), legal factors (e.g. land ownership), and corporate engagement in the communities within which they operate. The socio-economic situation of communities may be a factor determining the likelihood of land and revenue agreements satisfying community expectations, for example, and the ability of an oil/gas company to contribute to the supply chain/local content during the life cycle.

Business coordination factors: Large international oil companies may not be the in-country operators of oil fields. IOCs may share responsibility through joint venture structures, where the IOC or the government – depending on agreed rights to reserves – allocates access to develop and produce reserves. Within joint venture operations, different companies have different proportional stakes and operators may have overall responsibility for technical and wider socio-economic impact of operations. This may impact both their ability to engage with communities, and the visibility of their community engagement activities. The degree of government involvement in production (and speed of government decision-making) and the nature of engagement by NOCs may also affect the speed with which contracts are negotiated and how easily technical and political obstacles through the lifecycle can be overcome.

2 How and when revenues from the oil and gas industry flow to host governments

Oil and gas companies (typically IOCs, but can also be NOCs) invest large amounts of capital upfront to search for, develop and produce, oil and gas. They obtain a return on this investment by selling the oil or gas, once discovered, developed and produced. This cost recovery process is taken into account by government during production, often by creating a revenue structure which allows the firm to recover these costs over a certain period. Governments typically do not contribute directly to the costs of exploration and extraction, but benefit either from receiving a share of production under a Production Sharing Contract/Agreement (PSC/PSA) and/or receiving royalties on oil and gas produced and/or from taxes on the profits from the sale of oil and gas. Governments also receive some income prior to production (through e.g. licence fees, VAT, Payroll taxes, customs duties, sales tax, personal income tax etc), meaning that there is a revenue flow to Government from the oil and gas companies before oil/gas is extracted – albeit a minimal one in contrast with the production phase – throughout the life cycle.

In oil and gas, unlike mining, under PSCs/PSAs there is typically a cost recovery ceiling - a limit to the amount of the substantial upfront costs an oil or gas company can recover in each year of production. This means that the contractor has to recover the upfront costs of exploration and development across the full production period, rather than being able to recover all in the first few years, making the upfront investment more risky for the IOC. Since cost recovery is evenly spread across the production period government revenues quickly increase at the start of production, once the government receives its share of production and/or taxes and royalties from sale of oil and gas. This can start even from the first oil production which can happen before the 'develop' phase is completed, although direct revenues from production are typically delivered in the first or second year of production (Dietsche, 2013).

2.1 Fiscal revenues throughout life cycle

The following forms of government revenue are common in the oil and gas industry:

- Bonuses: one-off payments e.g. on signing a PSCs/PSA (Production Sharing Contract/Agreement)
- Fees for licences and permits: these may include licenses to explore, to extend an exploration phase, to drill, to develop
- State share of oil/gas production: from first oil throughout production phase.
- Royalty payments: e.g. derived from fixed price per unit sold
- Petroleum production tax (PPT): analogous to royalty payment
- Income tax: throughout the life cycle, IOCs may be taxed on income including corporate income tax, local income tax and personal income tax on senior expatriate personnel
- Customs duties, VAT, payroll taxes: taxes on inputs and imports, likely to be particularly significant during the 'develop' phase
- Property tax and stamp duty: land-related taxation, some of which will be one-off at the explore and develop phases
- Tax on repatriated profits: this might include branch profits tax, dividend tax on non-resident shareholders

Annex 1 shows how the volume of revenue flows fluctuates across the life cycle. The vast majority of revenue for government is generated during the production phase. During this phase, global oil prices affect the value of oil, but the impact of oil prices on

government revenue varies depending on the legal and fiscal arrangements for a given project, which includes the terms of PSAs/PSCs.

2.2 Factors affecting revenue flows

Legal and Fiscal regimes

There are two main types of legal regimes which typically apply to the oil and gas sectors: (i) concession systems and (ii) contractual systems, usually PSCs/PSA (Production Sharing Contract/Agreement). Under a concessional system, the concession-holding company is granted full control over the extraction process. It also receives legal title to all resources produced whilst the government receives monetary return through a range of fiscal instruments including income tax, and often royalties and special resources tax. In the contractual system, host governments retain full control and legal title to resources until they have been produced, when they are shared between the government and the contractors; contractors recover their upfront costs from their share of production. Technically it is possible to achieve the same fiscal outcomes and levels of control with either legal system (BG, 2010). The core differences rest with the legal approach and associated roles that central government and the NOC may play (BG, 2010). A third type of legal regime is a Technical Service Agreement (TSA) in which the contractor is a fee by the government to development and produce oil and gas. The contractor never owns the resources, although the government may choose to pay the fee in kind by giving the contractor and equivalent value of oil and gas.

PSCs are the most commonly used regime in developing countries[6] (although concession regimes and PSCs are also used in parallel). PSCs are negotiated with host governments, usually represented by the NOC.

There are broadly two ways in which fiscal regimes operate – progressive taxation, where government taxes profit so revenue is linked to global oil prices and regressive taxation, where revenue is generated according the volume of production. In regressive taxation government share of benefit per unit decreases in proportion to the oil company's share during high oil price periods. Concession regimes can be regressive, if the government increases taxation rates during high prices when government wants to link revenue to soaring global prices, often for political reasons – due to rent seeking behaviour, but also possibly to allay community concerns if IOCs are seen to be making proportionately high profits (Deutsche Bank, 2010).

It should be noted that IOCs may also be offered incentives in the form of tax exemptions. These might include low statutory tax rates, preferential tax rates, tax holidays, extra deductions for certain expenses and loss carry forwards (te Velde, 2013). These incentives are usually designed to encourage investment perhaps where the exploration risk is very high and the country wants to encourage exploration, or in a mature area where fields are getting smaller and harder to develop economically, or to enable an old field with declining production to continue producing for a longer period. This may change the predicted revenues from oil and gas companies.

Production disruption

As the majority of revenue is generated during the production phase, disruption to production, as well as oil price fluctuation, can heavily affect revenues. As detailed above in section 1.3, a range of factors can lead to disruption to production through physical and technical difficulties, socio-political contexts – for example, social unrest and security problems – or as a result of regulatory changes by government or alterations to joint venture agreements by NOCs and other partner companies.

6 Europe and North America only use concessions

One source of community frustration can be lack of local understanding of the fiscal processes, the timing for revenue to be collected and redistributed, and impact from such redistribution. This can be addressed in part by a combination of provision of clearer information from NOCs, IOCs and government and by capacity building for communities to enable understanding of complex processes and structures.

2.3 Non-revenue benefits to host governments and communities

The most significant direct benefit a host country receives from the presence of oil and gas companies tends to be revenue. Oil and gas exploration and production also has macro-level impacts on balance of payments and export earnings. In terms of micro and meso-level impact from firms, there are also a range of other potential benefits to host countries and local communities. Annex 2 outlines the nature and impact of three categories of non-revenue benefit across the lifecycle:

Job creation and local content (supply chain)

Three levels of job creation occur in the oil and gas life cycle: direct skilled and less skilled jobs, indirect jobs, and induced jobs – jobs created as a result of wages and salaries spent by those employed in direct and indirect jobs. Annex 2 shows the phasing of these jobs during the life cycle. In many of the IOCs' operating countries in the developing world there are minimal opportunities for local people to access even unskilled and semi-skilled work in indirect services. As such, companies sometimes support local companies to enter the supply chain – through capacity building to provide competitive local goods, services and skills. Other corporate initiatives include building capacity of local firms to participate in the supply chain, for example through providing education and skills development.

Infrastructure development

Oil fields need to be accessible (i.e. with transport links – roads, sea, helicopters for most inaccessible locations) and need to have access to basic services such as water and electricity. Where these don't exist at an exploration site, companies may invest in developing them. Infrastructure investment by companies will meet two objectives – the business case for the company's operations and compliance with local regulation and infrastructure investment requirements specific to the site. For both objectives, outcomes are likely to be of greater community benefit where they are of mutual benefit to the company and the government. Companies and government can co-ordinate their interests and priorities in developing infrastructure and planning investment. The more this occurs, the higher the likely long-term benefit to communities.

Infrastructure investments by oil and gas companies have the objective of ensuring access to oil/gas fields and services throughout the lifecycle of the project, including ensuring access to the site after closure until company obligations to the site (e.g. for environmental impact) are concluded. Specific investment is predominantly dependent on project context. Regulation and engagement with government and local communities will also influence company infrastructure investment decisions.

Social investment

Many IOCs explicitly develop programmes of community engagement and investment in the areas in which they are operating. Social baseline and impact assessments may be conducted in response to regulatory requirements, and/or to facilitate companies' assessment of social risk, to identify priorities for social investment and to monitor impact (which may be a formalised requirement at the company level). Where this is part of the core business plan, it is often more effective for both the company and the

community (IPIECA, 2008). Social investment can relate to infrastructure and local content development, local charitable donations and non-business operations related spending. To be most effective, social investment should begin early in the lifecycle and be an integral part of business planning and development, designed to address the impacts of oil and gas company presence (IPIECA, 2008). Social investment typically includes programmes to deliver education and skills development and environment, health and safety services, with the intention of benefitting the local community.

References

Al-Fattah, S. M. (2013) The Role of National and International Oil Companies in the Petroleum Industry, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2299878&download=yes

Collier, P (2012) Managing Ghana's Oil Discovery, January, 2012, Centre for the Study of African Economies, Department of Economics, Oxford University

Deutsche Bank (2010) Oil & Gas for Beginners: A guide to the oil & gas industry

Evelyn Dietsche, Samantha Dodd, Dan Haglund, Mark Henstridge, Maja Jakobsen, Esméralda Sindou and Caroline Slaven (2013) Extractive industries, development and the role of donors, PEAKS Topic Guide

Ernst and Young (2012a) Applying IFRS in Oil & Gas Revised proposal for revenue from contracts with customers, Implications for the oil & gas sector, March 2012
Ernst and Young (2012b) Capital project life cycle management for oil and gas

David L. Goldwyn (ed) (2008) DRILLING DOWN: The Civil Society Guide to Extractive Industry Revenues and the EITI, Revenue Watch Institute.

Deloitte (2013) The Deloitte Guide to Oil and Gas in East Africa: where potential lies
Ernst and Young (2012) Capital project life cycle management for oil and gas

IPIECA (2008) Creating Successful, Sustainable Social Investment

KMPG (2013) Oil and Gas in Africa: Africa's reserves, potential and prospects
Tullow Oil (XXX) THE OIL LIFE CYCLE

Royal Dutch Shell (2013) Annual Report 2013

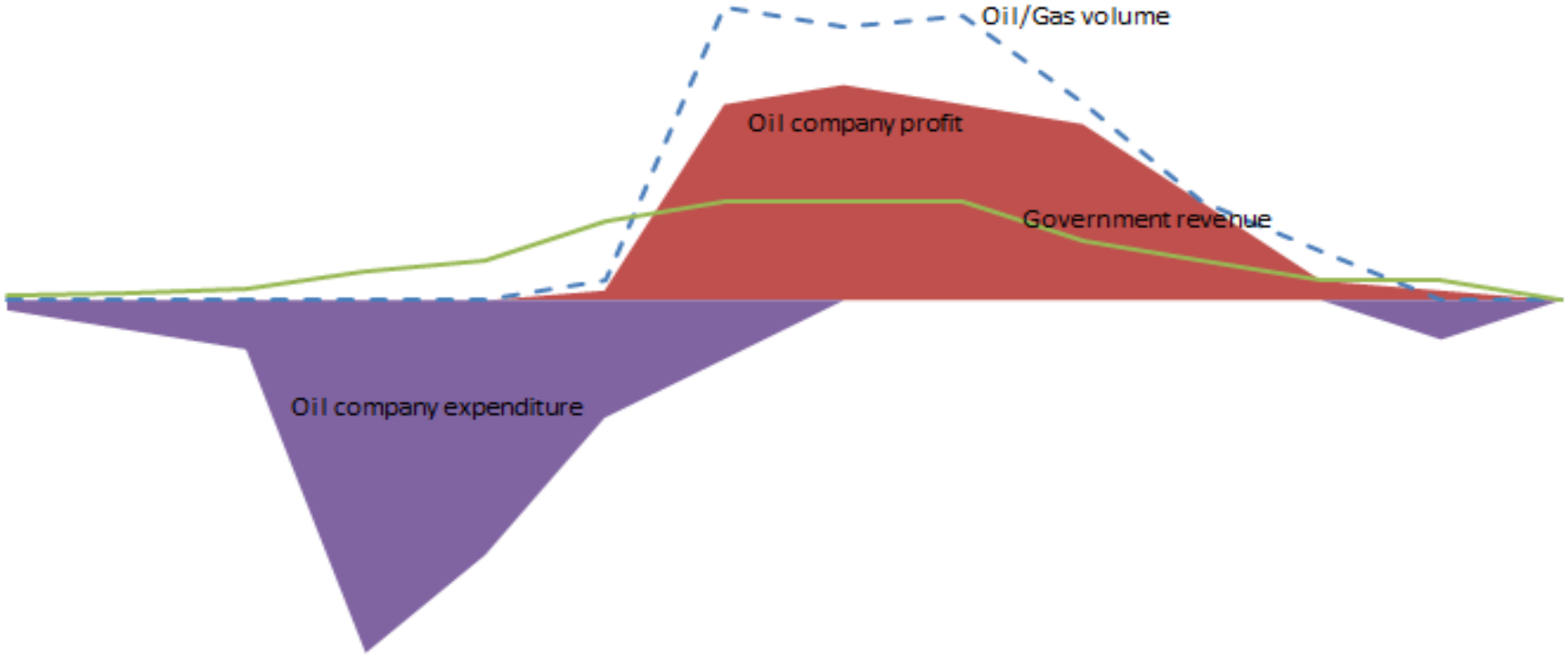
Tullow Oil (2012) Annual Report

Te Velde, D.W. (2013) Tax, investment and industrial policy in Taxation and Developing Countries, Training Notes, Economic And Private Sector Professional Evidence And Applied Knowledge Services

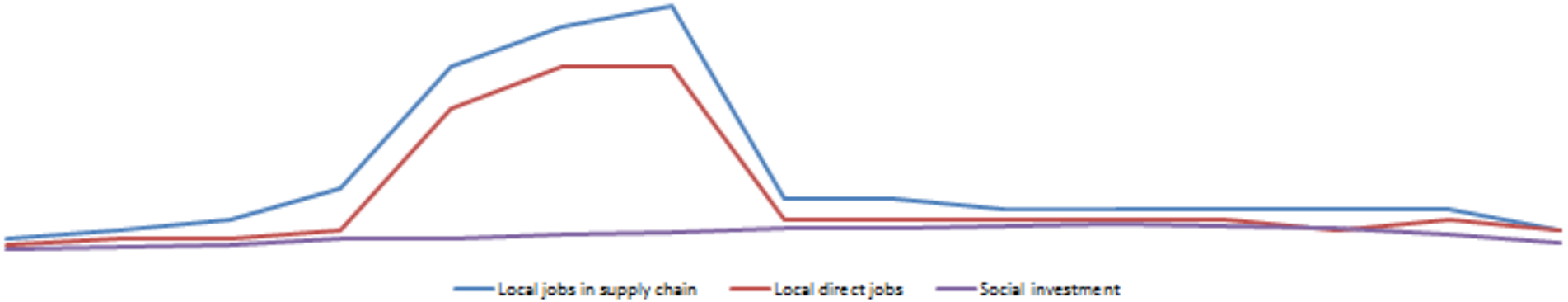
UNCTAD (2007) World Investment Report: Transnational Corporations, Extractive Industries and Development

Annex 1 - Revenue Life Cycle

ACTIVITY YEARS	**Explore** 1-5 years	**Appraisal** 4-10 years	**Develop** 4-10 years	**Produce** 20-50 years	**Close** 2-10 years
Oil/Gas Volume Government Revenue Company profit/expenditure	Zero – no flows Small – licenses, bonuses, customs duties, VAT and income tax High expenditure, no profit	Zero – no flows Small – similar to explore phase High expenditure, no profit	First oil/gas drilled Increase in capital expenditure increases revenue flows Once first oil/gas drilled, may start to recover costs	Production online – likely to peak early for oil, more gradually for gas, and decline towards end of production phase Major revenue period, although will fluctuate and likely to increase over initial period and peter out towards end. PPT and share of oil profits are the major source, plus income tax and other revenue sources Cost recovery across production phase, profits generated	Zero – no flows Small - licenses, permits, customs duties, VAT and income tax Limited profits, high closure costs



Annex 2 – Non-revenue domestic benefits lifecycle



ACTIVITY YEARS	**Explore** 1-5 years	**Appraisal** 4-10 years	**Develop** 4-10 years	**Produce** 20-50 years	**Close** 2-10 years
Local Jobs in Supply Chain	Minimal – generated by machinery imports and small technical staff team	Small increase, dependent on timing and existing and developed skills/capacity	Peak in construction jobs – highest employment-generating phase of life cycle	Higher capacity but limited opportunity in supply chain	Small potential peak in high activity periods of closure
Local Direct Jobs	Small number of highly skilled jobs. Limited benefit to local community.	Small number of highly skilled jobs. Limited opportunities for local companies and local technical skills – where available.	Small number of highly skilled jobs, large number of semi- and low skilled jobs	Small number of highly skilled jobs. Limited opportunities for local companies and local technical skills – where available.	Small number of highly skilled jobs. Limited opportunities for local companies and local technical skills – where available.
Social Investment	Initial community engagement and context analysis	Investment scaled up as likelihood of commercially viable operation increases	Influx management, risk mitigation - infrastructure, business development	Activities peak – likely to include income generation, sustainable social services	Scaling down, developing legacy and handing over