

HYDROCARBON EXPLORATION PHASE AND THE NIGERIAN PETROLEUM INDUSTRY ACT 2021

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ABSTRACT

The Petroleum Industry Act (PIA) 2021, recently enacted by the Nigerian National Assembly is an amalgam of several earlier laws and memoranda of understanding (MOU's), with important new updates. It embodies comprehensive management instruments for tighter governance of the industry. Now structured into the upstream, midstream, and downstream sectors, its governance would prove more prudent. This contribution intends to outline and discuss the upstream sector (exploration). The main research focus is the initial activities of the intending operator for which is the careful assessment of available geological information to support any major decisions such as fresh acreage acquisition, firm-in, or buy-out. Prior to acreage acquisition, the prospective operator examines the business climate by assessing the technical, socio-political, and fiscal factors as well as the potential upsides. Thus the design of the study encompasses the assessment of easily available geological information all the way to the more intricate subsurface data acquisition and the formulation of the field development plan as stipulated by the relevant provisions of PIA. Among the major findings of this study is that a successful exploration phase is firmly predicated on seismic acquisition with safety goal zero target and flawless drilling operations. An additional determinant of a successful exploration phase, which PIA has granted a maximum of six-year enterprise by an operator, is the strict application of a set of PIA provisions that may be termed nontechnical essentials, but which will guarantee a seamless exploration operation, namely community affairs, HSSE (Health, Safety, Security, and Environment), and the Nigerian Content. These are also governed by strict rules, some of them involving international protocols, as well as separate National Assembly enactments.

Keywords: value chain, business case, exploration and production, geological review, acreage acquisition, seismic surveys, lead identification, prospect evaluation, well proposal, wild cat, HSSE, community affairs, stakeholder matters, local content.

1. INTRODUCTION

In an effort to address the multiplicity of issues arising from the increasing complexity incidental on the operations of the petroleum industry, various earlier governments of the Federal Republic of Nigeria enacted laws for control and governance of specific aspects. In the process, ten different enactments had been in force till 16th of August 2021, the day the Petroleum Industry Act (PIA) of the Nigerian National Assembly was signed into law by the Nigerian Head of State. The Act repealed the following pieces of petroleum industry legislation:

- i) Petroleum Act 1969¹
- ii) Hydrocarbon Oil Refineries Act²
- iii) Petroleum Equalization Fund Act, 1975
- iv) Associated Gas Reinjection Act, 1979³
- v) Petroleum Equalization Fund (Management Board etc.) Act⁴
- vi) Nigerian National Petroleum Corporation Act⁵
- vii) Deep Offshore and Inland Basin Production Sharing Contract Act⁶
- viii) Nigerian National Petroleum Corporation Act⁷

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¹ Chapter 350 Laws of the Federation of Nigeria (LFN) 1990 and Chapter P10, Laws of the Federation of Nigeria 2004.

² No. 17 of 1965, CAP H5 LFN2004

³ CAP A25 Laws of the Federation (LFN) 2004, its amendments.

⁴ No. 9 of 1975, CAPP11 2004

⁵ (NNPC) 1977 No, 33 CAP N123 LFN

⁶ (DOIBPSCA), 1993 CAP D3, LFN 2004 and its amendments.

⁷ No. 94 of 1993, CAP N124 LFN2004

- ix) Petroleum Products Pricing Regulatory Agency Act, 2003
- x) Motor Spirits (Returns) Act⁸
- xi) Petroleum Profit Tax Act⁹

However, the provisions of certain laws remain in force until termination or expiration of the relevant oil prospecting licenses and mining leases including the Petroleum Profit Tax Act, Deep Offshore and Inland Basin PSC Act of 2004.

The law took at least two decades to formulate and had been a very intricate document for the National Assembly but was eventually passed despite controversies borne out of partisan sentiments. The rationale for passing the bill into law has been that it is hardly easy to panel-beat such a long and complicated draft into perfection. Besides, amendments can still be made in the future as the operational mechanisms, effectiveness, and the full implications of the various aspects begin to unfold and as the global petroleum industry scenario continue to evolve. The Act seeks to provide a framework for the legal, governance, regulatory and fiscal matters of the Nigerian Petroleum Industry as well as the development of Host Communities. It contains 5 chapters, 319 sections and 8 schedules. The objective of this paper is to relate the exploration phase to the provisions of the PIA.

In purely technical terms, the exploration phase of the industry comprises all the activities and studies necessary for finding a new hydrocarbon occurrence (Fig. 1). Although the technicalities applicable to this phase vary among operators, the procedures are all geared towards reducing risks and uncertainties to the barest minimum. In general, the processes include planning, acreage acquisition, regional geological review, play/lead and prospect definition (involving seismic acquisition, processing and interpretation), initial volumetrics, maturation and evaluation. Drilling a wild cat well finally yields the information with which to affirm the success of the exploration phase so far and heralds the next major stage, specifically appraisal. The PIA provisions for exploration are contained in Part II of Chapter 2 and provide for the upstream operations and the environment.

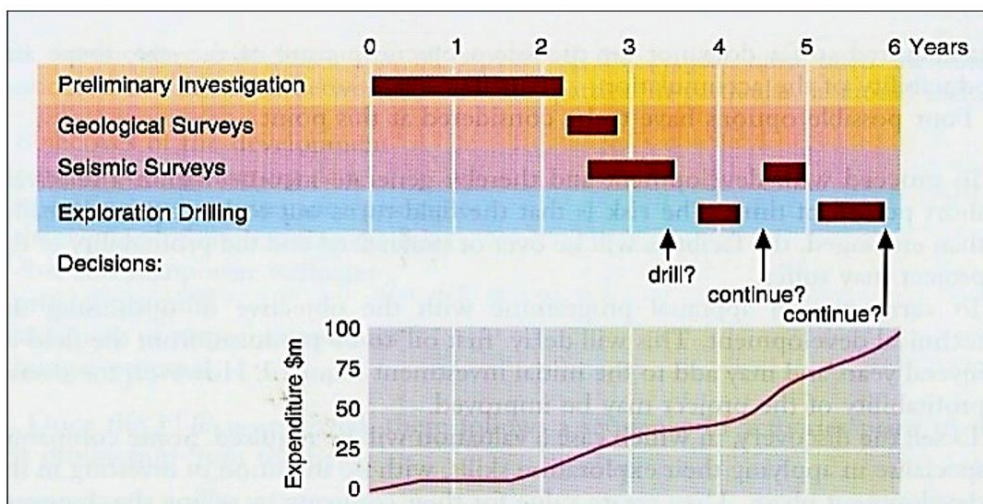


Fig. 1. Flow chart of a typical exploration programme.¹⁰

2. BASIN ENTRY STRATEGY AND BUSINESS CASE

⁸ CAP M20 LFN2004

⁹ Cap P13 LFN 2004, (PPA)

¹⁰ Jahn, F., Cook, M. and Graham, M., 2008. Hydrocarbon Exploration and Production, 2nd Edition. Elsevier Publishers, Amsterdam, 443p.

2.1 Concepts

In the petroleum industry value chain, the entry phase is exploration, the task of this paper. The major step is basin entry, itself preceded by identifying the areas or basins to invest in and follows the business opportunity realization management system (Figs. 2 and 3) established by the Shell Group of Companies (2004).

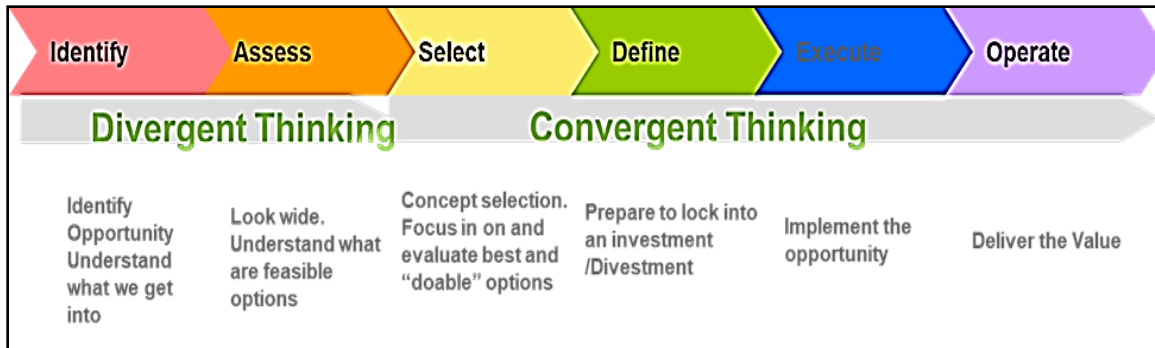


Fig. 2. The business opportunity realization management system (after the Shell Group of Companies, 2004)

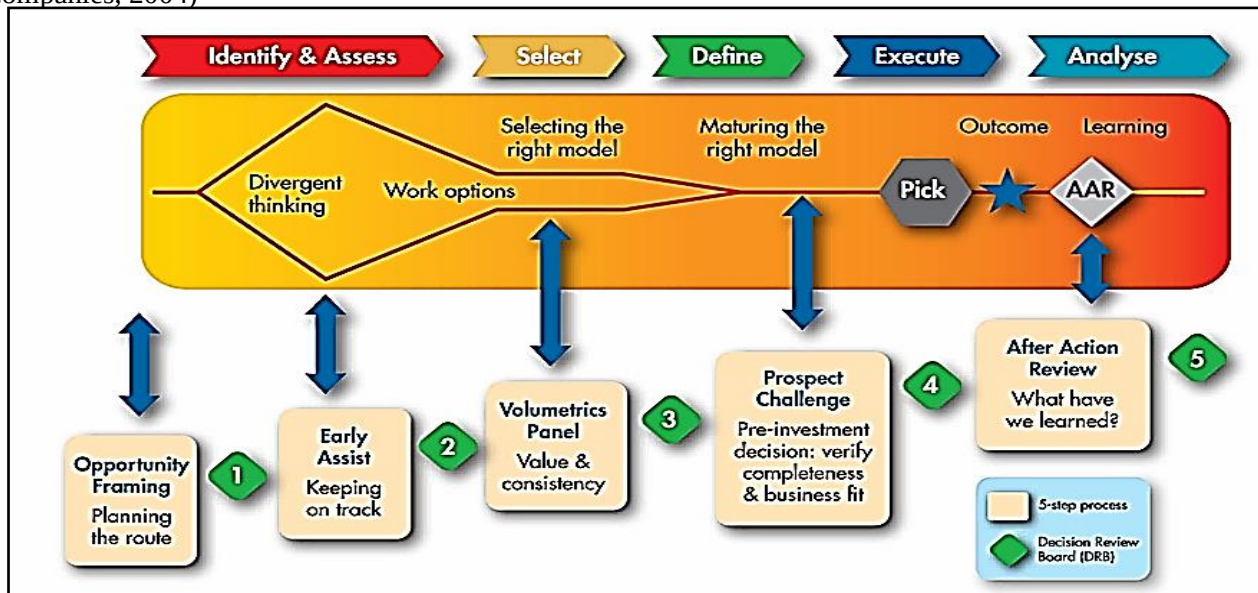


Fig. 3. The exploration opportunity realization management process; AAR = After Action Review (after Shell Group of Companies, 2005)

2.2 Basic Factors

Gaining access to a specific area of land, swamp or sea for hydrocarbon exploration and eventual exploitation is predicated on a series of factors including economic and financial, technical, political, social, reputational, environmental, potential upsides, and, most importantly, the extant fiscal regimes (which have been comprehensively set out in Chapter 4 of PIA). Of course, the technical consideration is critical and is directly linked to the economic consideration since profitability is the ultimate goal.

The assembly of information in the public domain or domiciled in the appropriate federal or state offices is where to start but will most probably continue with specific commissioned studies, or direct investigation by the intending operator. There is substantial investment in resources, especially time, involved in the gaining access phase. Part II of Chapter 2 of the PIA, which provides for the upstream operations and the environment, is elaborate on the administration of

acreage and vesting of data, based on the national grid system, in consultation with the Surveyor General of the Federation. The grid system has to be applied in administering licence and lease areas, relinquishments, bidding, well locations, petroleum conservation measures, and other regulatory acreage management procedures.

Technical: - In the hydrocarbon business the major technical consideration is the determination or quantification of the potential size of the prize. This entails the assessment of probable volumes and its integration with the prevailing market forces and the other factors that will be considered in the whole exploration, appraisal, and production process. Therefore, technical consideration is directly linked to the economic consideration since profitability is the lowest common factor. Operability of the business will also be a very significant factor if there are local issues which would potentially impact the price of the size.

Political and Fiscal: - In a given country of operation, the potential for nationalization has to be borne in mind. Having once happened in Nigeria, the chances of a repeat cannot be completely ruled out. Other considerations include current embargoes by some powerful countries which have the potential to restrict movement of goods and technology. This would render the execution of the project very difficult or even totally impossible. Another factor is the fiscal policies of the government. Would the history of changes in fiscal policies by succeeding governments indicate possible adverse impact on operations? Hydrocarbon business typically consists of long-term projects which stretch across several changes in government. Levels of taxation and flexibility of tax regimes and policies are all determinants of the attractiveness of the investment climate. Constraints on the repatriation of profits, personnel security, local costs, inflation, and exchange rate forecasts are key issues here. These are supposed to be taken care of by the PIA as follows (Fig. 4 and Table 1):

Potential Upsides

- Improved incentives for investments in deep offshore including lower tax and royalty rates
- Royalty across terrains will range from 5% to 15% in addition to royalty based on price up to a maximum of 10%
- Hydrocarbon tax rate 15% to 30% for onshore and shallow water areas and Companies Income Tax (CIT) rate of 30%
- No NHT rate for deep offshore operations
- The PIA replaces the Investment Tax Allowance (ITA) and Investment Tax Credit (ITC) with a production allowance per crude oil production
- Introduction of certain fiscal incentives as a way to prioritize midstream gas activities. Specifically, gas pipeline companies can benefit from a tax-free period of five years in addition to the current gas utilization incentives
- Reduced royalty rates for gas utilized in Nigeria
- Tax deductibility on environmental remediation and abandonment costs as clearly provided in the PIA
- Tax exemption on segregation of multiple stream businesses into single stream business

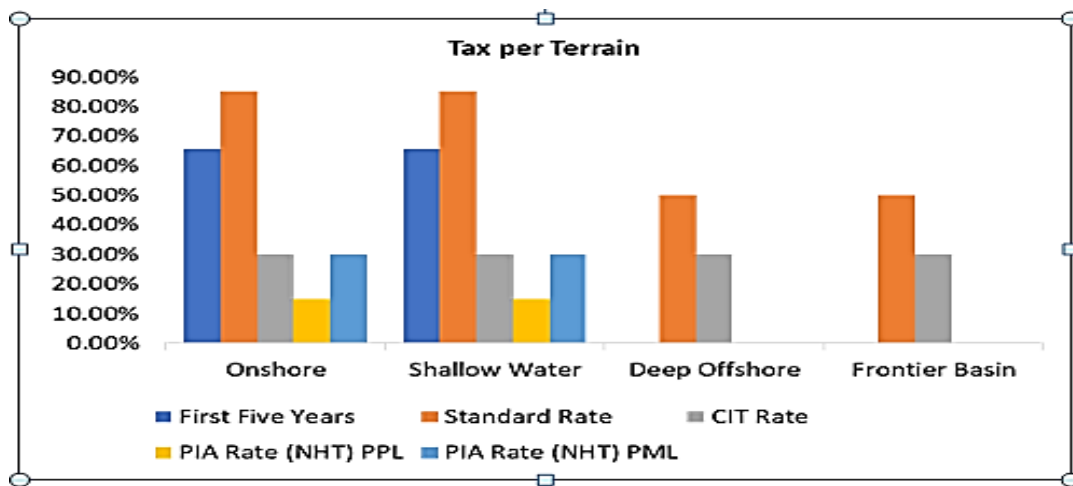


Fig. 4. Different tax rates against terrain; NHT = Net Hydrocarbon Tax; CIT = Companies Income Tax, PPL = Peer Production Licence (from Olumide Esa, Deloitte Nigeria, presentation at NAPE 39th Convention, 17th November 2021)

Table 1. Production rate and royalty rate across terrain in PIA (from Olumide Esa, Deloitte Nigeria presentation, NAPE 39th Convention, 17th November 2021)

Terrain	Production Level	Rate
Onshore	>10,000 bpd	15%
Shallow Water	>10,000 bpd	12.5%
Onshore/shallow Water	First 5% bpd	5%
	Next 5,000 bpd	7.5%

Social: - Aspects of the social factor include any threat of civil disorder, threat to life and properties, availability of skilled local labour and local training centers, the degree of effort required to set up offices (ease of doing business) and positively engage with locals, precautions needed to protect the environment from harm during operations, any specific local legislations, environmental regulations, and degree of local authority organization.

Reputational: Involved here are issues that come to the forefront especially for the international energy companies as regards branding quality and, therefore, stock price health. The ability to attract and retain top-rated staff is affected negatively if a company struggles with reputational issues. Compensation analysis, regulations and policies can adversely affect business considerations. Where there are laws that allow the judiciary to impose fines that can wipe the companies out of existence, inflow of businesses can be adversely affected. Leveraging on the economies of scale and other business interests such as knowledge of the laws and the economic and social conditions are very crucial.

2.3 Acreage Acquisition

The Commission is responsible for granting the exploration licence, which is initially for three, renewable for another three years. The licence is strictly for exploration and does not include any right to produce hydrocarbons. Thus, petroleum exploration licence allows to be carried out

geological, geophysical, geochemical, and other surveys, as well as any data interpretation and the drilling of shot holes, core holes and carrying out stratigraphic tests related to the exploration for crude oil and natural gas. Exploration wells and appraisal wells are not covered by petroleum exploration licence. Petroleum prospecting licence and petroleum mining lease allow for their drilling and grants the holder the right to carry away and dispose of hydrocarbon extracted during the drilling of exploration or appraisal well as a result of production tests.

Petroleum prospecting licence and petroleum mining lease can only be obtained based on a competitive bidding process and in compliance with licensing round guidelines issued by the Commission. Remarkably, as clearly stated in 71(10) of the Act, allowed free of any licensing are geological, geophysical, or geochemical surveys for scientific or educational purposes, with the proviso that the results of the surveys are not for sale or for any commercial purposes.

The PIA has come into force at a time in the history of petroleum in Nigeria when both exploration and production are proceeding *pari passu*. Thus, while onshore and shallow offshore areas of the Niger Delta Basin are gradually passing into brown field status, the deep/ultradeep offshore and the inland basins are still under exploration¹¹. Even the deeper horizons of the delta can fit into the frontier category,¹² and may possibly complicate acreage acquisition processes. Bids can be based on technical competence or financial commitment of the bidder.

In general, if a region is known to be an important petroleum province, the first license round can be highly competitive and costly. Farm – in and farm – out arrangements involve an acreage being operated by an invited company (farmee) rather than by the owner (farmor).

3.0 EXPLORATION TECHNICALITIES

3.1 Regional Geological Review

Prior to seeking and acquiring an acreage, the prospective operator carries out broad reviews of the geology of the area and focuses on the sedimentary basin of interest. The relevant information includes the mode of basin origin (which is directly or indirectly traceable to plate tectonics), the stratigraphic parameters (specifically the order of the lithic fill), as well as the structural characteristics, all in search for the existence of a hydrocarbon system. The landmass of Nigeria is entirely underlain by rocks of the Precambrian crystalline Basement Complex with about 50%

¹¹ Abubakar, M.B., Shirputda, J.T. and Aliyu, A.H., 2021. Basin Geometry, stratigraphy and petroleum prospectivity of part of the northern Benue Trough (Gongola subbasin), Nigeria. In Obaje, N.G., Bomai, A, Abubakar, M.B. and Nwajide, C.S., (Editors). *Aspects of the Petroleum Geology of Nigeria's Frontier Basins*. IBBUConsult Ltd, Minna, p. 24 – 44.; Obaje, N., Bomai, Bomai, A. Dabai, M., Ozoji, T. and Habu, S., 2021. New insights on the geology and potential petroleum systems of the Bida Basin and Sokoto sector of the Iullemmeden Basin. In Obaje, N.G., Bomai, A, Abubakar, M.B. and Nwajide, C.S., (Editors). *Aspects of the Petroleum Geology of Nigeria's Frontier Basins*. IBBUConsult Ltd, Minna, p. 121 – 143.

Ojo, O.J., Akande, S.O., Adepoju, S.A., Bamidele, T.E. and Awe, A., 2021. New geochemical, palynological and sedimentological data from Bida Basin: implications for paleogeography and hydrocarbon prospectivity. In Obaje, N.G., Bomai, A, Abubakar, M.B. and Nwajide, C.S., (Editors). *Aspects of the Petroleum Geology of Nigeria's Frontier Basins*. IBBUConsult Ltd, Minna, p. 144 – 177.; Raji, M., Johnson, L.M., Olobayo and Adedossun, T.A., 2021. Critical assessment of unconventional shale and gas potential the Nigerian frontier inland basins. In Obaje, N.G., Bomai, A, Abubakar, M.B. and Nwajide, C.S., (Editors). *Aspects of the Petroleum Geology of Nigeria's Frontier Basins*. IBBUConsult Ltd, Minna, p. 231 – 244. Yandoka, B.M.S., 2021. Petroleum generation characteristics of the Cretaceous source rocks of the Yola Sub-basin, northern Benue Trough, northeast Nigeria. In Obaje, N.G., Bomai, A, Abubakar, M.B. and Nwajide, C.S., (Editors). *Aspects of the Petroleum Geology of Nigeria's Frontier Basins*. IBBUConsult Ltd, Minna, p. 261 – 288.

¹² Ozumba, B.M., 2021. Deep play potentials of the Niger Delta Basin, Nigeria. In Obaje, N.G., Bomai, A, Abubakar, M.B. and Nwajide, C.S., (Editors). *Aspects of the Petroleum Geology of Nigeria's Frontier Basins*. IBBU Consult Ltd, Minna, p. 178 – 204.

of it exposed (i.e. outcropping) while the rest of the area is undercover of seven sedimentary basins (Fig. 5), only one of which (Bida) is exclusively owned by the country (Table 2).

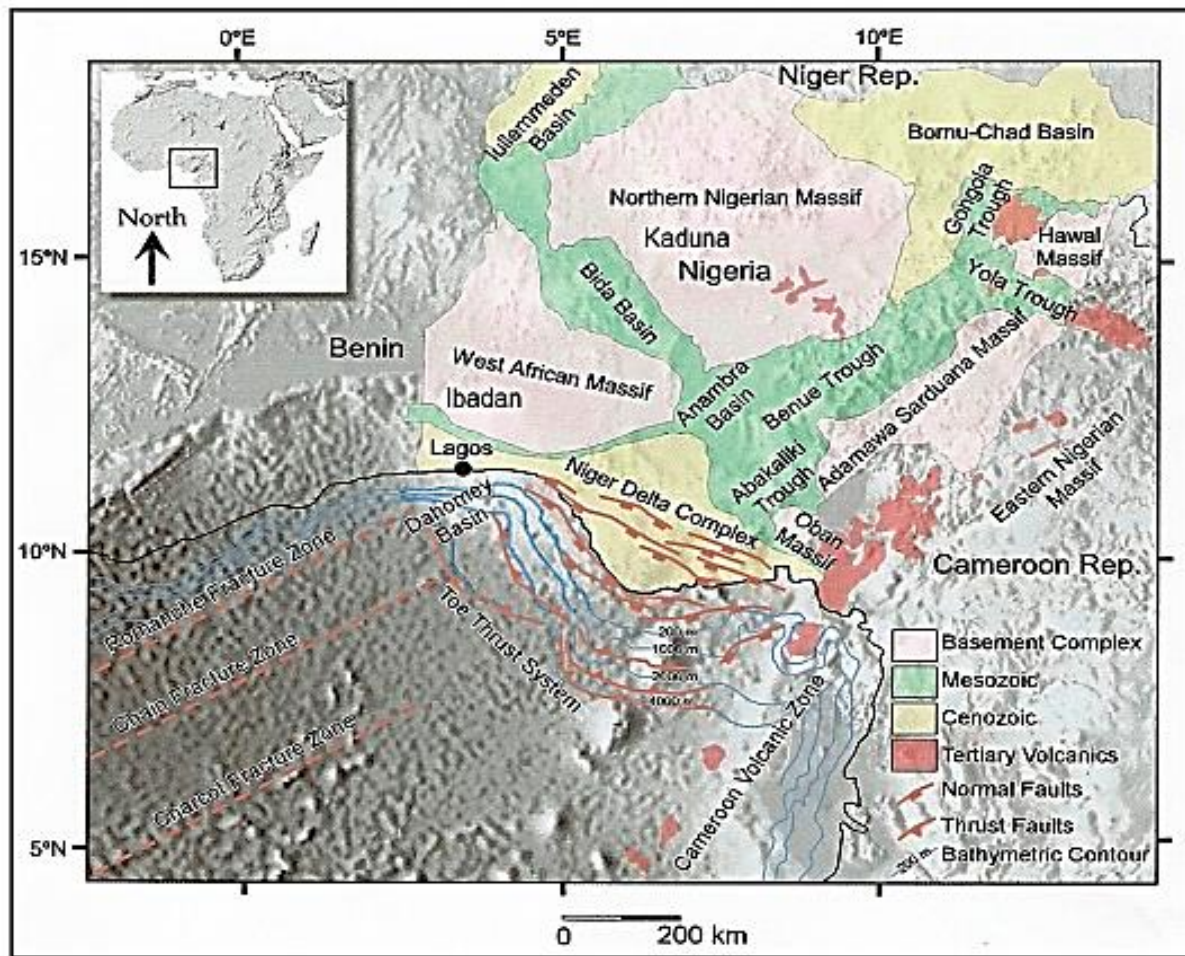


Fig. 5. Geological map of Nigeria showing areas of basement exposure, sedimentary basins, Cenozoic volcanism, as well as some local and regional tectonic lineaments; (from Corredor *et al.*, 2005)¹³

¹³ Corredor, F., Shaw, J.H. and Bilotti, F., 2005. Structural styles in the deep-water fold and thrust belts of the Niger Delta. *AAPG Bull.*, v. 89, p. 753 – 780.

Table 2. Classification and hydrocarbon status of Nigeria's seven sedimentary basins (after Nwajide, 2021)¹⁴

Basin Class	Basin Name	Tectonic Control	Co-Owners	Hydrocarbon Status
Rifts	Benue Trough	Rift + Strike-slip	Niger, Chad, Cameroon	Commercial discovery; exploration ongoing
	Dahomey	Transform Faulting	Ghana, Togo, Benin	Producing; exploration ongoing; Tar Sands
	Bida	Half graben + strike-slip	None	Speculative
Riders	Anambra	Thermal decay (detumescence)	Cameroon	Producing
	Niger Delta	Thermal decay (detumescence)	Cameroon, Sao Tome and Principe, Equatorial Guinea	Prolific Producer
Synclises	Chad	Sag basin edge	Niger, Cameroon, Chad	Exploration ongoing
	Iullemmeden	Sag basin edge	Niger, Mali, Burkina Faso	Speculative

3.2 Seismic Survey

Progressing from the regional geological review is the acquisition of subsurface data using seismic survey. If such data had been acquired through earlier work by another organisation, the data could be purchased. Acquiring 3D seismic data involves a lengthy contracting process, huge funds, a large number of staff, laborious logistic arrangements and very high safety and security risks. Successful stakeholder/community engagement is key. Also in the reckoning are environmental issues such as the disruption of the ecosystem and biodiversity incidental on felling of trees during line cutting, as well as the use of explosives. This aspect is not directly captured by PIA but may be made up for in the requirements of the mandatory environmental impact assessment which, though stipulated by PIA, has its own specific enactment.

There have been claims that the use of explosives for seismic acquisition caused cracking of house walls (Report on Nembe Creek Seismic Acquisition Investigation by Shell, 1998). Even though this has no scientific basis, it is the judiciary that has the last say.

¹⁴ Nwajide, C.S., 2021. An overview of Nigeria's frontier basins and their hydrocarbon resource potentials. In Obaje, N.G., Bomai, A, Abubakar, M.B. and Nwajide, C.S., (Editors). *Aspects of the Petroleum Geology of Nigeria's Frontier Basins*. IBBU Consult Ltd, Minna, p. 1 – 23.

The seismic method of exploration may not guarantee oil finding, but it is the method of choice in the Niger Delta petroleum province. It has to be considered that success in hydrocarbon exploration is the addition of materiality (size of discovery, stratigraphic disposition of the reserves, API gravity of the crude, and nearness to disposal facilities).

Next to seismic acquisition is seismic processing. All data acquired must not only be processed but reprocessed (e.g. Fig. 6) because of the rapidly changing technologies involved in 3D processing. Processing of seismic data takes time and funds because of the huge machine technological power required and the high level of expertise of the manpower involved. This is why most companies contract out seismic data processing and have to wait out the relatively long time required for negotiations, quality control and verification prior to acceptance of results. These are all preparatory to interpretation. To a large extent, the quality of seismic data determines the accuracy of the time-to- depth conversion to obviate drilling blindly. It is also a key data set in overpressure prediction, the chief drilling hazard.

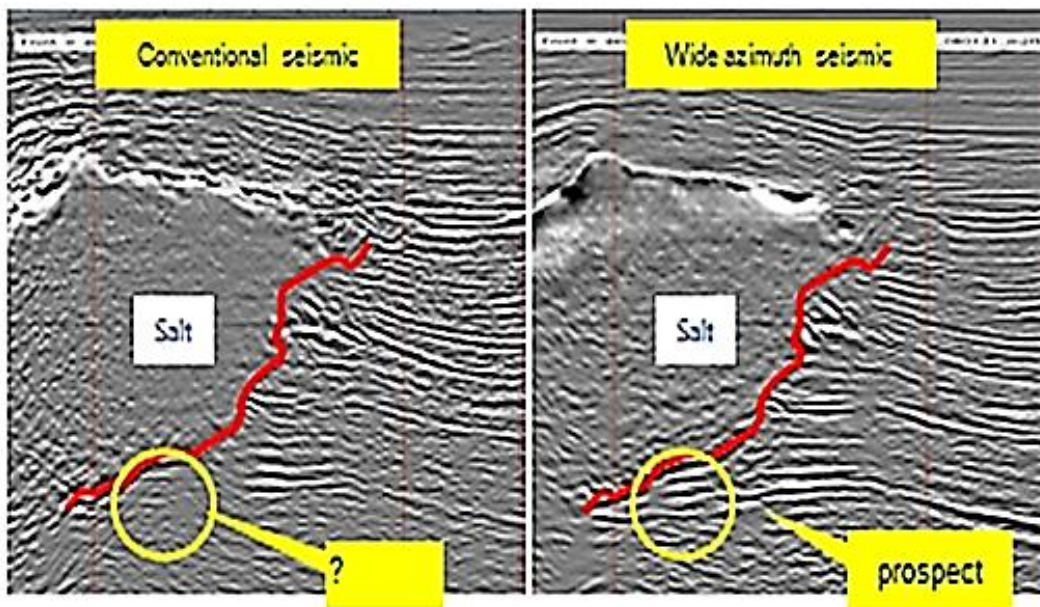


Fig. 6. The power of advances on wave equation – based imaging: anisotropic reverse time migration (Wide azimuth in Gulf of Mexico as against conventional seismic) clearly showing a prospective interval below salt (Phadke *et al.*, 1998)¹⁵

Other factors considered in the framework zone are the issues of serendipity and analogues. The former refers to the occurrence of a fortunate stroke, for instance, due to hydrocarbon presence in the same trend along which there is a chance occurrence of larger volumes not earlier predicted, or for which data interpretation could not easily be stretched to account for. An analogue, on the other hand, connotes an event similar or comparable to another occurrence either in general or in some specific detail. Analogues may be strata or sequences formed coevally or by processes resulting in similarity in rock characteristics. Analogues are usually very well known in studied areas where the results can be used in simulations or simply in correlations.

¹⁵ Phadke, S., Bhadwaj, D. and Yerneni, S., 1998. Wave equation-based migration and modelling algorithms on parallel computers. Proceedings of SSPG'98, p. 55 – 59, 5.

3.3 Lead Identification

Closely following the interpretation of the stratigraphic and structural framework from the processed or reprocessed seismic data is lead identification. This is the stage at which possible structural or stratigraphic features constituting possible traps are identified. Experience gained from analogous, as well as the preliminary estimation of volumes for such leads, facilitate the ranking and selection of the best of the identified features (Fig 7). The next series of activities is referred to as exploration evaluation and involves the definition of the Gross Environment of Deposition (GED) and Cross Risk Mapping (CRM). Hitherto, work has been on the entire basin. With the lead identified, the focus is the play and involves three processes: the play risks (mostly using analogues), mapping of the risk segments, and carrying out initial volumetric calculations.

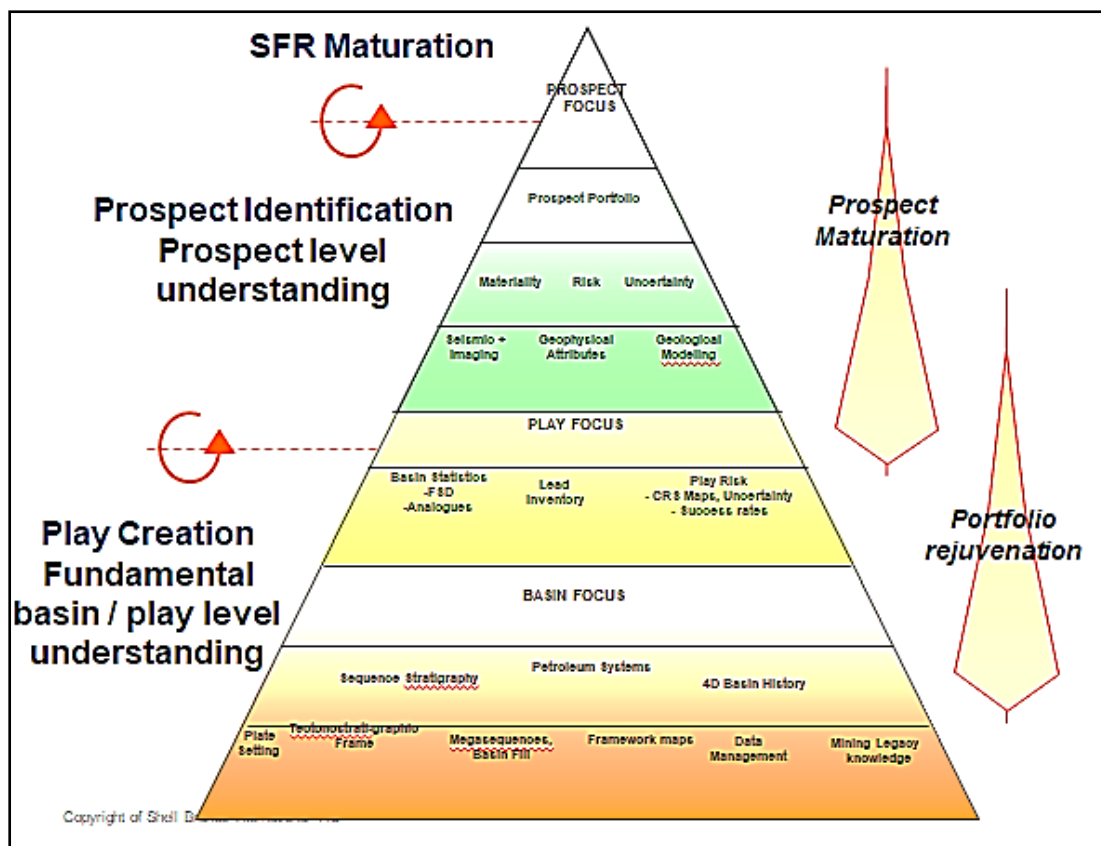


Fig. 7. Play - based exploration framework (after Shell Group of Companies, 2008)

3.4 Play, Lead and Prospect Definition (Evaluation)

The focus here is on materiality – size of prospect or material volume, as well as reservoir quality (in terms of porosity and permeability), hydrocarbon saturation, oil API, area of the prospect, and column height. The risks involved in petroleum exploration are mainly in the completeness of the petroleum system elements like presence or absence of charge, reservoir, seal, time of migration, and trap integrity issues. There are common uncertainties about pressure prediction, sudden overpressure or under pressure occurrence, error – proneness in depth conversion, fluid types and fluid contacts. The specialists and their roles in mitigating these uncertainties and risks and in preparing the well proposals are represented in Figure 8.

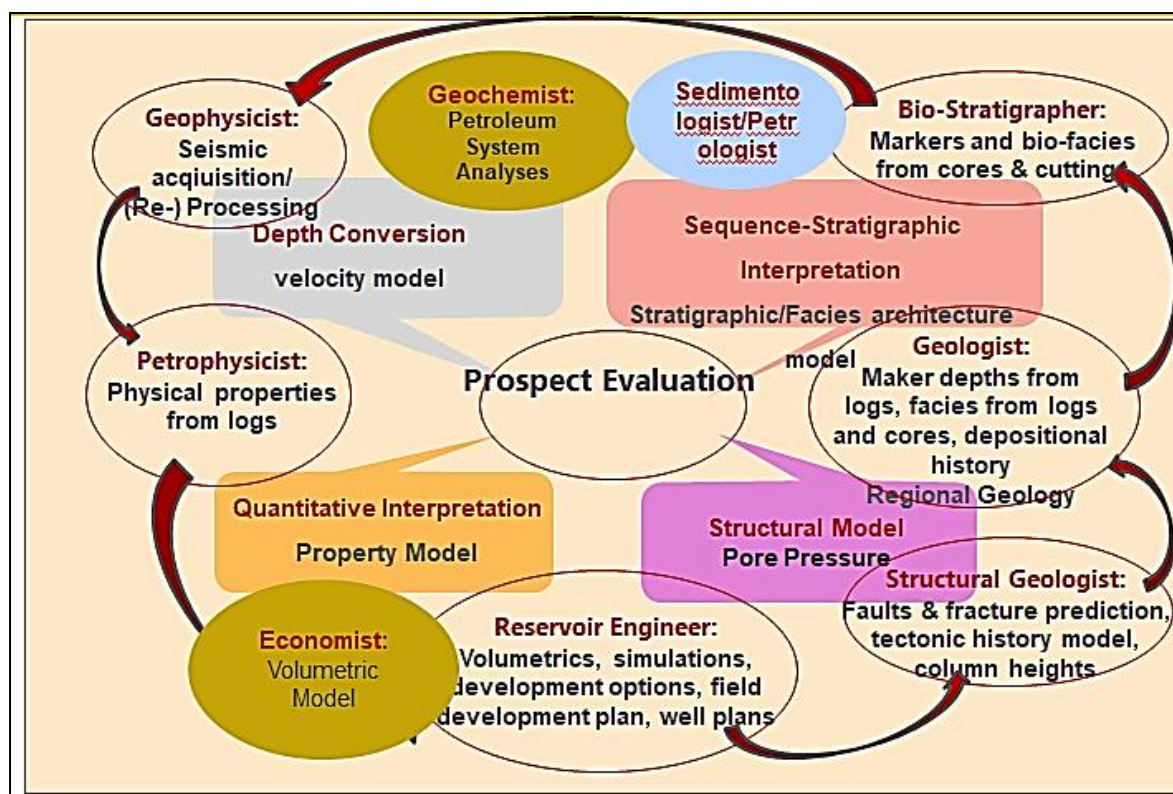


Fig. 8. Evaluation process and the key actors

Maturation of a prospect or evaluation is a reiterative process by a team of specialists. The iteration is meant to reduce errors and increase confidence in the company's ability to successfully prosecute the drilling process. Pressure prediction is a particularly critical action item and must be quality-controlled via higher authorities. If it goes wrong, the consequences are so steep as to constitute a threat to the life of the company (e.g. the Gulf of Mexico on the BP-operated Macondo Prospect blowout, 2010). The evaluation report is known as the well proposal and usually embodies a summary as shown in Table 3.

Table 3. An example of well proposal summary sheet

■ Well :	OGBENE-1X
■ Offtake Area and OML:	Coastal Swamp Depobelt, OML 36
■ Type of Location :	Swamp
■ Type of Hole :	Main hole is Vertical, Pilot hole is deviated.
■ Surface Co-ordinates:	X: 377112, Y: 67592 West Belt
■ Tolerance Area :	Circle of 50m radius centred on the surface and subsurface targets.
■ Proposed TD :	11,750 ftah (11700 fss), for the Main hole; 12,370 ftah (10910 fss), for the pilot hole.
■ Correlation Wells:	Opugbene-1 & Tebidaba-1
■ Potential Drilling Hazards:	Drilling through faults may lead to mud losses. Appropriate mud conditioning (LCM) needed. E5000 and E6000 reservoirs probably pressure depleted. No overpressures expected at TD
■ Timing :	Q3 2005

3.5 Operations Exploration

This is the entire set of activities that will culminate in the drilling of the exploration well and starts with elaborate planning towards fully achieving the objectives of the well proposal. Accessibility to the location would be dependent on the location type – onshore (land or swamp), shallow offshore, deep offshore, or frontier basin. In some cases, rivers have to be dredged, roads and bridges built or rebuilt so as to carry the drilling rig weight, and tidal regimes monitored and considered. Communities to be impacted directly or indirectly, temporarily or for much longer time, can be a major obstacle as regards permit to operate. The PIA provision of a grant of 3% of oil revenue to host communities is aimed at mitigating this obstacle. Rig moves can take days to weeks or even months, all accumulating costs. Drilling rigs (Figs. 9 - 11) cost a lot to lease and move to location.

Drilling rig contracts are usually long-time leases, commonly 2 to 5 years, which implies continuous engagement to avoid paying for idle rig time or premature termination. Therefore, the time requirement for a company to acquire, process and interpret seismic, and carry out regional geological evaluation leading up to drilling operations is vital. The PIA provision of three years, renewable for another three years, may, therefore, be considered adequate for location preparation and rig move.



Fig. 9. A land drilling rig



Fig. 10. A typical swamp master drilling rig

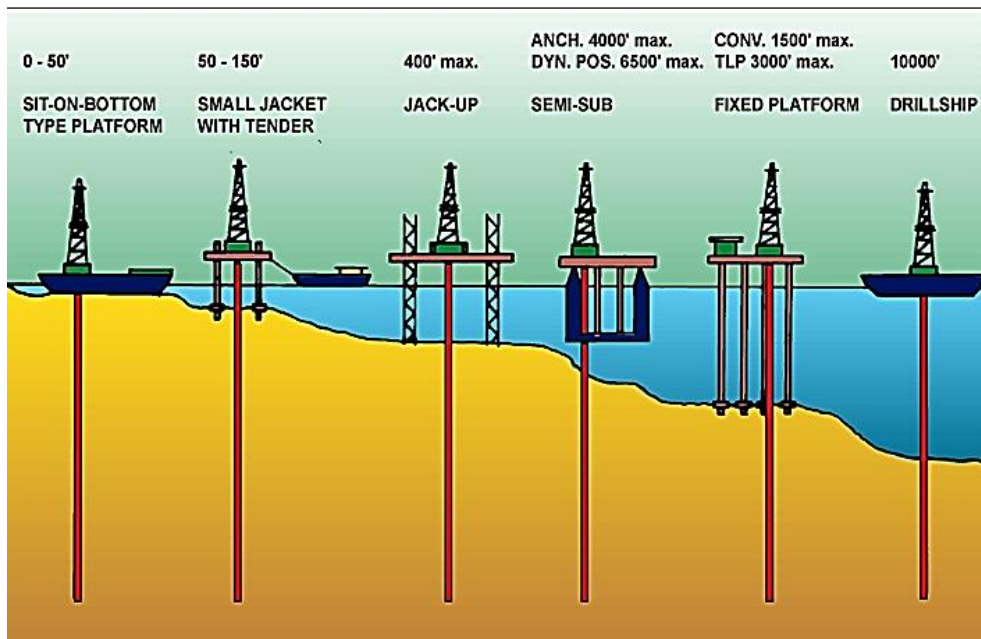


Fig. 11. Types of drilling rigs for shallow to deep offshore locations

4.0 NONTECHNICAL ESSENTIALS For the sustenance of operations in the field and laboratory, and workshop aspects of the petroleum industry, health, safety, environment, security, and community affairs are matters of major concern. The criticality of these items is understandable in view of the potentials for negative impact and danger to personnel, environment and equipment pervading the entire gamut of exploration, appraisal, production, and decommissioning. For each of these aspects the key is management commitment which in turn spurs positive response from employees and related stake holders (Fig. 12).

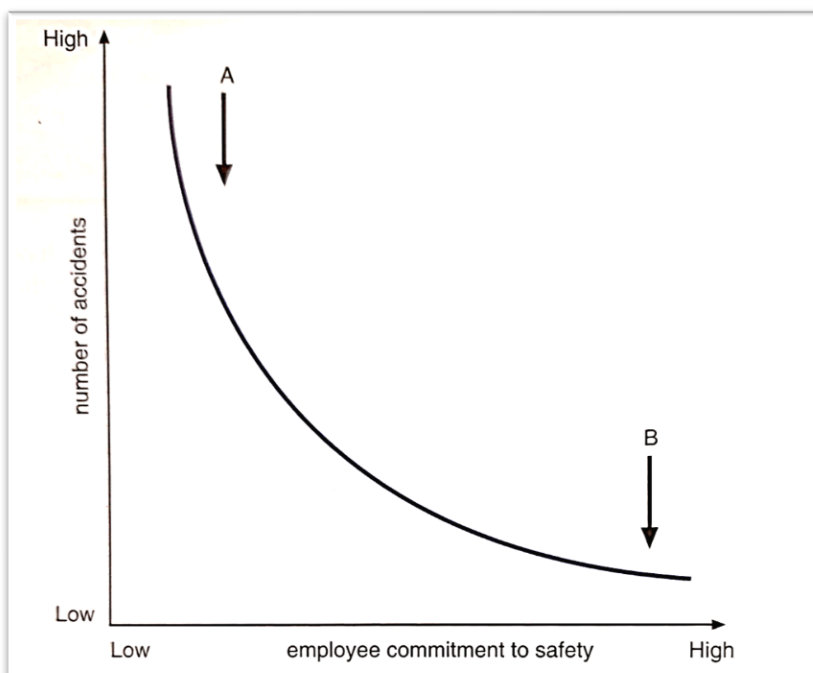


Fig. 12. Dependence of safety performance on employee commitment (after Jahn *et al.*, 2008)¹⁶

¹⁶ Jahn, F., Cook, M. and Graham, M., 2008. *Hydrocarbon Exploration and Production*, 2nd Edition. Elsevier Publishers, Amsterdam, 443p.

4.1 Health

For the health aspect, management commitment consists mainly in the provision of the infrastructure and facilities such as well-equipped and adequately staffed clinic capable of health care delivery in both home/office base and field locations, including emergency-related operational equipment. Personnel being the most important asset of any given organisation, their health status should be the *numero uno* in their welfare. Provision of all measures ensuring the minimization or complete elimination of health hazards in the work environment should be the norm, and of course dovetails into the safety aspects.

4.2 Safety

Safety is a major issue in even the simplest operation in the petroleum industry. Benchmarking safety performance is commonly done by recording the number of accidents or lost time incidents (LTI), *i.e.*, events leading to or resulting in worker absence for one or more days. Another measure of the level of safety is the recordable injury frequency (RIF) which is the number of injuries requiring medical treatment per 100 employees¹⁷. Of course, in any organisation set up for profit purposes, monetary cost is a significant measure.

Techniques for improving an industrial organisation's safety performance include writing clear work procedures and equipment standards since, as shown by results of accident investigations, failure to follow procedure is a major cause of LTIs and/or RIF. Other techniques for improving safety performance are staff training, safety audits, emergency safety drills, and carrying out hazard/risk analysis with regard to designs of plant and equipment.

For any upstream operator, paying less than very close attention to safety matters entails negative implications for reputation and even in fiscal terms. So, there is usually a strenuous effort to develop a safety culture that ensures that all company staff, contractors, and contractor staff subscribe and submit to, and operate within, the dictates of the said safety culture. The safety culture is the framework within which the safety management system (SMS) of any given operator resides. SMS is thus a form of quality management as well as a method of integrating operational practices. An operating company normally develops its own customized SMS fashioned as dictated by its local conditions, although with particular attention to the following areas, with emphasis on the integration of the various items into the operational procedures: -¹⁸

- Organisational structure
- Management personnel standards
- Safety assessment
- Design procedures
- Operational procedures, maintenance, modifications, and emergencies
- Management of safety by contractors in respect of their work
- The involvement of the workforce in safety
- Accident and incident reporting, investigation and follow-up
- Monitoring and auditing the operation of the system
- Systematic reappraisal of the system

¹⁷ Ibid at p 83

¹⁸ Ibid at p. 86

4.3 The Environment

Considerations regarding the environment have become a critical part of virtually every business, and majorly so for the petroleum industry. The criticality is such that many companies have to account for their performance as a part of an annual “sustainability report” which is independently audited and closely scrutinized by stakeholders. Individual companies commonly have their own environmental management system (EMS) but global standards have been established, specifically the ISO 14001. This system helps organisations identify environmental risks and impacts of their operation and how to manage them. The set of generic global standards embodied in the ISO 14001 is designed to support environmental protection and prevention of pollution in balance with socio-economic needs. Most petroleum industry upstream operators have adopted its framework, although with special attention to the sensitivities of the operational environment.

To ensure local sensitivities are identified and factored into the planning of operations, environmental impact assessment (EIA) is mandatory. An EIA has the principal objective of documenting, through field and other studies, the potential physical, biological, social and health effects of the planned activity (Fig. 13). The outcome of studies, usually to be carried out by an independent specialist organisation, will enable decisions as to whether the intended activity will be acceptable and if not, identify the way out. In the oil and gas industry in general, it is specifically performed for seismic operations, well drilling, facilities installation, production, and decommissioning. The results of studies are usually documented in an environmental impact statement (EIS) which discusses the beneficial and adverse impacts potentially arising from the activity.

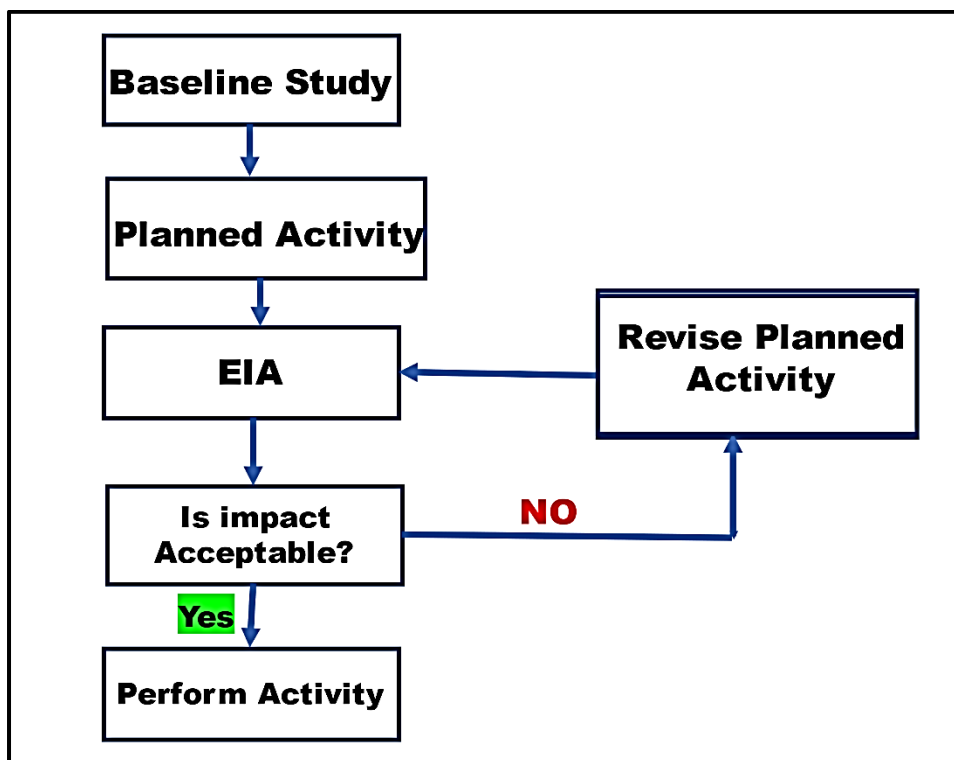


Fig. 13. Flow diagram and application of EIA

In the present context, section 102 of the Petroleum Industry Act obligates an operator with a petroleum exploration licence to submit to the Commission for approval, an environmental management plan which complies with relevant environmental acts, one of which is shown in Figure 14. It should be clear that the operator has the capacity to make good and generally manage negative impacts on the environment. This should be against the background of the broader policy thrust of the government as regards environmental protection and management practices. Additionally, the operator has to contribute to a fund set up by the Commission for the restitution of any environmental damage due to the operator's activities.

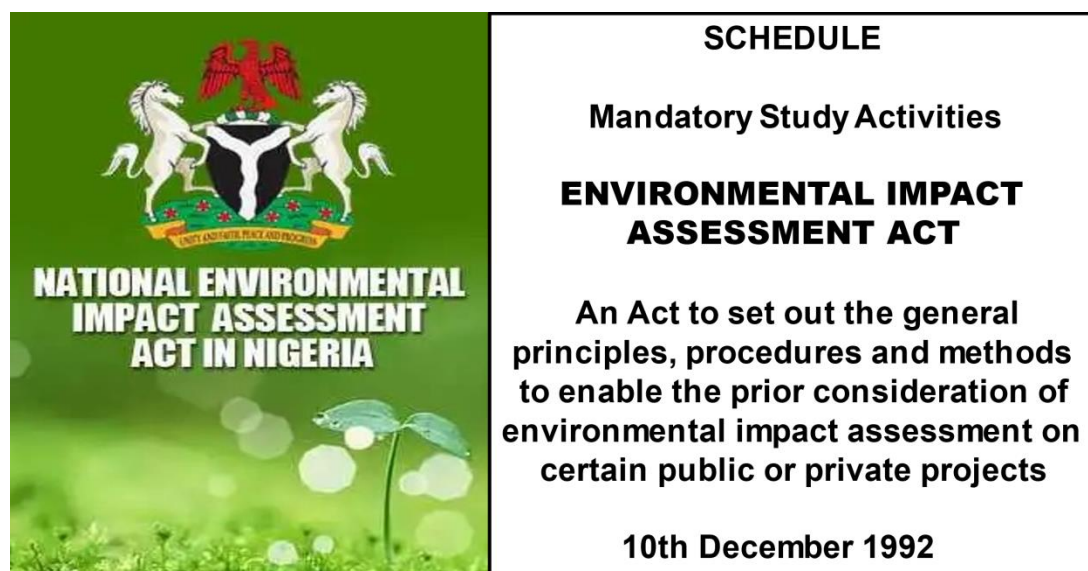


Fig. 14. The National Environmental Impact Assessment Act 1992 of the Federal Republic of Nigeria

The EIA process systematically examines the environmental consequences of an activity in advance (regarded as a “before project audit”). Its emphasis is on prevention, especially of negative impacts even with change in response to shifting environmental pressures. The key stages, as given by Jahn *et al.*¹⁹ include: -

- i) screening (determining projects to be subjected to EIA process)
- ii) scoping (issues to be included)
- iii) alternative (as considered by the proposer)
- iv) project description (clarification of rationale for project)
- v) preparation (for baseline studies, impact identification, prediction, evaluation, and mitigation)
- vi) public consultation and participation (to assure quality, comprehensiveness, and effectiveness of the EIA)
- vii) EIS presentation (communicating findings to public)
- viii) Review (appraisal by government and independent reviewers)
- ix) Decision making (consideration by the relevant authority of the EIS)
- x) Monitoring (mechanism to ensure that any conditions imposed on the project are being complied with, and to check the quality of the affected/impacted environment)

¹⁹ Ibid at p. 90),

- xi) Auditing (follows from monitoring); developed to test the scientific accuracy of impact predictions, and as a check on environmental management practices; vital feedback into the EIA process. (I suggest you remove these steps as it is becoming too detailed for envt)

A major environmental issue in exploration is waste management. Waste is generated in large quantities as contaminated drill cuttings, completion and workover fluids, chemical waste and radioactive scale, oil sludge, and spent catalysts. The required measure is to put systems in place (e.g., Fig. 15) to contain, transport, and dispose of them. Add oil spills due to equipment damage and destructive impact on the environment is clearly enormous, often resulting in litigations, hefty fines and reputation damage.

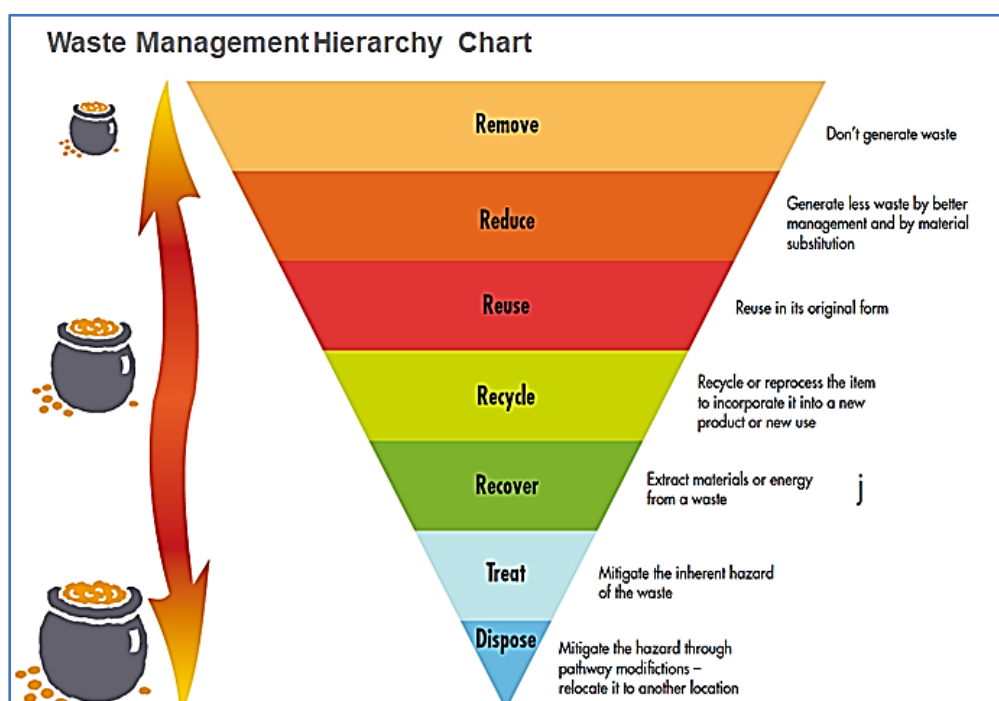


Fig. 15. SPDC waste management hierarchy chart

4.4 Security

Both locally and elsewhere, the petroleum industry is commonly beset with insecurity which we here define as exposure to danger or harm for personnel and equipment. Exposure to insecurity is, however, in degrees. It also depends on the geographical or environmental setting of the operations, such as land, swamp, or sea. If on land, the degree of habitation would determine exposure. If offshore, international, or locally engineered piracy would constitute the danger.

In the Nigerian petroleum industry setting, the incidence of insecurity has gradually increased to alarming levels and operations have had to be delayed, paused for long spells, or completely abandoned due to threats to life or even actual fatalities. Such situations have often arisen in connection with, or as a consequence of, community agitations for perceived or real unfairness or insensitivity on the side of the operators. Thus, security matters have become so intricately intertwined with community affairs which have become so important that PIA gave it a significant amount of space/attention.

A major consequence of heightened insecurity has been the reaction of the operators, especially in terms of budget on personnel costs. Operators have had to employ, train and equip their own

security personnel. Some major operators have had to connect to the national security system by way of supernumerary police in addition to having a detachment of fully armed police or the military proper. Even these measures have not fully guaranteed security, nor protected against security breaches by determined criminals or community – instigated protests. Many operators have eventually had to bow to pressures/threats by settling organized but nevertheless criminal groups in order to carry on with work.

4.5 Community Affairs

It would ordinarily be expected that, once an intending operator has gone through the not-so-easy process of acquiring an acreage and fulfilled all the financial and other obligations stipulated by the government agencies, operations would be plain-sailing. It is hardly ever the case. No sooner does an operator mobilise to any given location on land or swamp than a group of young men materializes at the site with a long list of inordinate, strange and outrageous demands. This attitude has heightened to such an extent that even simple geological field work can hardly be freely carried out. For many communities in the Niger Delta oil province, extortion from operators has become so routine that nothing really works until and unless the communities are “settled”, a usage for yielding to and actually fulfilling demands which may go as far as placing the members of a given community on the operator’s payroll, or employing workers exclusively from the community, qualified or not. Indeed, community matters have become such an encumbrance that PIA gave it a “larger than life” attention. It is even a part of the full title of the Act, viz: - *An Act to provide legal, governance, regulatory and fiscal framework for the Nigerian petroleum industry, the development of host communities; and for related matters.*

The PIA definition is that a host community is one situated in or appurtenant to the area of operation of settlor, and any other community as a settlor may determine under the Act. This highly expanded definition is perhaps advantageous to the extent that an operator’s footprint is extremely monetized and disruptive activities by communities are forestalled. Needless to say, a provision for permanent recompense for people adding no value to society appears too large-hearted to be commendable. The objectives of the provisions are clearly geared towards achieving sustainable development for each impacted community, providing social and economic benefits, enhancing peaceful and harmonious coexistence with operators. While these are well thought out objectives for well settled communities, a grey area may be identified as it is considered that, for the exploration of an acreage, which largely involves seismic surveying, operations may be transient. Such temporary activity should/ought to be provided for either separately and specifically, or in the definition of host community as contained in the act. A question in this regard is: - should a fully developed modern urban area such as a state capital city be regarded as a host community? Or is it to be taken that every given host community is a rural setting presumably with little or no modern amenities? There is the tendency for community members to become completely dependent “operators” to the exclusion of non-members of the given community by having a CAC-registered board of trustees for each impacted community.

Corporate Social Responsibility (CSR) is the giving back measure which most oil companies have voluntarily or compulsorily had to embark on in order to operate uninterruptedly. For most operators, the process involves engaging the given community leadership to identify the most rational, realistic, and beneficial projects. Experience shows that most of the communities are so distant from federal, state, and even local government attention that most amenities, such as

schools, access roads, and primary health facilities, taken for granted elsewhere, are lacking. Somewhat less basic are community halls, rural power supply, and paramount ruler's palace. No company, however rich, can supply all these and that necessitates the engagement of the communities to negotiate and properly order their priorities. There are success stories from operators who have achieved harmonious accommodation with their host communities and have surged ahead with uninterrupted operations.

4.6 Local Content

The Nigerian Oil and Gas Industry Content Act 2010 is the safeguard for the community involvement in the activities of an operator. The act seeks to provide for the development of the Nigerian content in the oil and gas industry, Nigerian content plan, supervision, coordination, monitoring, and implementation of the Nigerian content. The main thrust is to ensure that all operators and alliance partners shall maintain a bidding process for acquiring goods and services which shall give full and fair opportunity to Nigerian indigenous contractors and companies.

As provided by the Nigerian Oil and Gas Industry Content Development (NOGICD) Act 2010, bidding for license requires that an operator shall submit a Nigerian Content Plan to the Board demonstrating compliance with the Nigerian content requirements of the Act. This is to ensure that first consideration is given to services provided from within the country and to goods made in Nigeria. The plan should also stipulate that Nigerians shall be given first consideration for training and employment in the work programme for which the plan was submitted. Section 27 of the act provides for an operator to maintain an office in a community in which the operator has significant operations. Additionally, the Board shall ensure that Nigerians shall be given the first consideration for employment and training by any operator or project promoter who must maintain a reasonable number of personnel from areas it has significant operations.

Various capacities and capabilities have been attained since the enactment of the Nigerian Content Law. The achievements have been so well recognised in the African continent that such countries as the Republic of Congo, Kenya, Uganda, Gabon, and Angola have benefited in terms of mentorship and peer assistance on local content practice and implementation.

It is to be noted that the benefit of the NOGICD act has not been Nigerianisation of the oil and gas sector, but rather domiciliation and domestication of value-adding activities. On this basis, the key thrusts include the integration of the communities into the oil and gas value chain, the maximisation of the participation of Nigerians in the oil and gas business activities, and maximum utilisation of Nigerian resources in goods, services, and assets.

Several operators have had to document their achievements, performances, and commitment, and actual practice as regards local content. Such operators include Shell, Seplat, ExxonMobil, Addax, First E &P, NLNG, Saipem, NNPC, Total, and ENI. Much of the performance has been through CSR, use of contractors, community power supply, employment and training, and research and development (notably by First E & P).

5.0 SUMMARY

Through the dictates of the newly enacted PIA, the Nigerian petroleum industry has undergone some revolution that would hopefully make it of greater benefit to the nation. Being formally structured into upstream, midstream, and downstream sectors would enable improved governance. The upstream sector is where the entire enterprise commences and involves the critical value chain: - exploration, appraisal, development, production, and decommissioning or abandonment. This paper has presented the exploration phase and its primal relationship with PIA as well as adjunct enactments such as on the environment and the Nigerian content.

- * The exploration process is a very detailed methodological and skilled procedure that must be thoroughly followed in order to reduce both technical and nontechnical risks and uncertainties.
- * For a prospective entrepreneur, acreage acquisition is the basic physical reality. However, the common practice is to first examine the business climate painstakingly as indexed by the technical, socio-political, and fiscal factors as well as how the application of well worked out business opportunity realization management system would materialize in potential rewards.
- * Exploration commences with the careful study of the geology of the area of interest, specifically the sedimentary basin lithic fills, to check for the presence of the fundamental petroleum system elements (mature source rocks, generation, migration, structuration, and trapping). The results of such studies usually point to where to acquire acreage in the process of basin entry as specified by PIA (e.g. by bidding or farm-in).
- * Exploration technicalities proper, involve geophysical probes, in the Nigerian environment, almost invariably by way of rather expensive 3D seismic surveys. The processing and interpretation of the data allow for lead identification and evaluation on the basis of which a well proposal is drawn up.
- * Drilling a wild cat well is the culmination of the exploration phase and involves a complex series of negotiations relating to hiring and moving a drilling rig to a prepared site on land, swamp, or offshore (shallow or deep). The success of the wild cat well is the perfect augury for appraisal and development.

The foregoing exploratory activities entail several nontechnical but essential aspects stipulated by PIA or even earlier enactments. Of critical moment is community affairs for which PIA provisions are specific on impact amelioration and redress. Health, safety, and security of personnel are of paramount importance. Safeguards for the environment are enshrined both in PIA and the National Environmental Impact Assessment Act 1992, as well as the Montreal Protocol of 1987. Local content in all aspects of the industry is emphasized both by PIA and the Nigerian Oil and Gas Industry Content Development Act 2010. These governance statutes are considered adequate, although there is need to closely monitor the effects of the PIA in order to identify areas of weakness or imperfection and apply necessary amendments.

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