



Concept Note for Development of R&D Plan for Bonga South-west Aparo (BSWA) Field Development



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1. Introduction

This paper seeks to provide a guide to The Shell Nigeria Exploration and Production Company (SNEPCO) on the development and implementation of R&D plan for Bonga Southwest offshore Operations.

The concept is intended to drive the establishment of a R&D ecosystem that will support the offshore Oil well development, operations and maintenance phase of all assets, with a view to leveraging local technology to maintain optimal oil production level. The concept is based on the NCDMB R&D framework depicted below

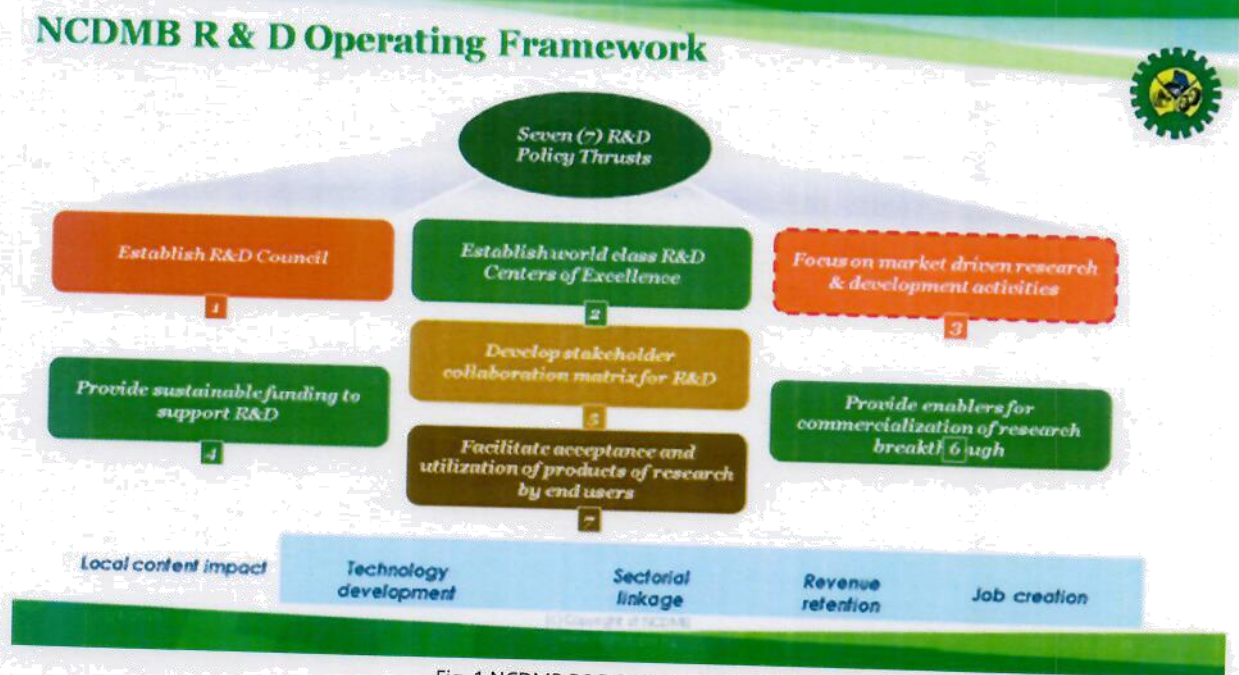


Fig. 1 NCDMB R&D Delivery Framework

2. Problem Statement

The first set of deep offshore production in Nigeria began in early 2000; Akpo (Total), Agbami field (Chevron JV), Erha field (Mobil JV), Bonga (Shell). With this breakthrough there has been increasing number of oil discoveries occurring deeper offshore of Nigeria. This trend indicates steady growth in demand for the technology to operate optimally in offshore environment.

Almost 20 years down the line, the offshore environment is still being dominated by foreign technology. This clearly indicates that very little of the multi-billion dollar



investments made by the NNPC and its JV partners is retained in the Nigerian economy. Based on the above reality, Nigerian Content Development and Monitoring Board is leveraging on the provisions of Sections 36-39 of the NOGICD Act 2010 to promote the development of a Research and Development (R&D) ecosystem in Nigeria, to support Deep offshore oil and gas projects and operations like the BSWA .

3. Scope of Offshore Field Operations

The scope of work associated with BSWA offshore field operations across the different phases of exploration, field development and operations includes data collection & processing, engineering design, transportation, fabrication of structures, construction of sub subsea systems, and manufacturing of equipment, spares, and accessories. Others include offshore installation and commissioning of FPSO, pipelines, flowlines and risers, transportation to site and installation of other project hardware delivered by various sub-packages such as EPC-1 (Floating Production Storage and Offloading), EPC-2 (Subsea Hardware), EPC-3 (Umbilicals) and EPC-4 (Single Point Mooring Buoy).

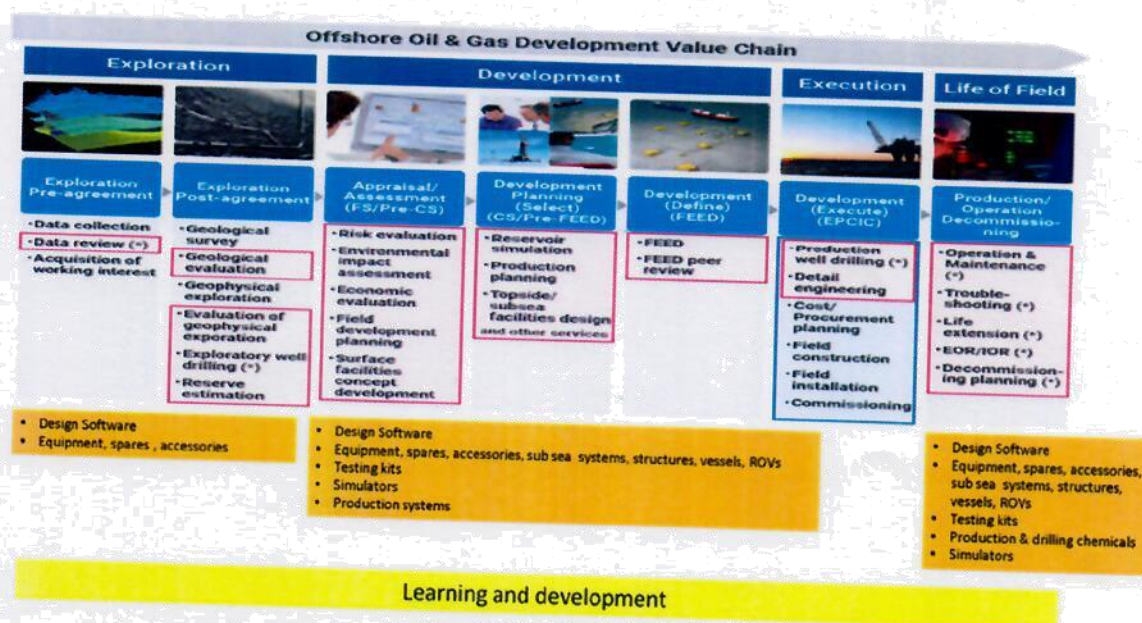


Fig. 2 Typical Scope of work associated with offshore field development



4. Pillars of the R&D Plan (Subsea Center of Excellence)

The pillars of the R&D plan shall be anchored around the themes of the NCDMB framework for R&D delivery and focused on development of R&D capabilities to support human, material and service requirements for deep water operations:

- 1.** R&D project – establishment of a multipurpose Subsea Research and Development Center to serve as technology solution center for Deepwater operations. The R&D Center shall have the following features:
 - a.** Infrastructure: The Center shall be built and equipped with state-of-the-art equipment for research and training delivery in any one of the Federal Universities or Polytechnics in Nigeria. These may include simulators, deep aquatic tanks, robotics center and any other ancillary equipment to further the study and understanding of hydrocarbon and subsea processes.
 - b.** Location: The Center may be located in any suitable Federal institution of higher learning offering Chemical Engineering, Petroleum Engineering, Mechanical engineering, Marine engineering or subsea engineering courses.
 - c.** Purpose: The primary purpose of the Center shall be for SNEPCO to carry out research and investigation aimed at supporting the human, material and service needs of Deepwater operations. The Center shall also be used by the SNEPCO for learning and development in technical courses relevant to Deepwater job functions.
 - d.** Scope: The Subsea Research and Development Center shall consist of 4 solution centers
 - I.** Materials development center– will focus on finding local raw material substitutes for production and drilling chemicals suitable for Deepwater environment, such as Complex reagents, Density improving agents, Silicone anti-foaming & anti-frothing agents, Corrosion inhibitors – bactericide agents, pH control agents, Grouting compounds and reagents for repair and insulation works. Others are Anti-turbulent additives, Pour point depressants, Foam-diatomite, diatomite and tripolith products, Pearlite products, Waterproofing (powder, mastic, sealant, fillings), Cables (submersible pump, control cable, heating cable)
 - II.** Maintenance solution center- focus on proactive maintenance techniques- work with the Offshore & subsea maintenance units to develop a proactive maintenance culture; and develop a local ecosystem that can assist in the development of homegrown maintenance techniques
 - III.** Product development center- the solution center for product development shall focus on adaptation technology for manufacturing equipment, systems, components and spare parts required for construction, operations, maintenance and repairs. Of interest should be Turbolators, Crude oil booster pumps, Flowing



well operation equipment, valves, mechanical seals, Electric induction heaters for bore holes, crossover adapters, bolts & nuts, gears, switches, Hydraulic bottom-hole engines, Units of submersible centrifugal pumps for oil extraction compressor station spares, insulation materials, HV/LV cables, Software, Equipment for wells dewaxing, instrumentation & control units, Autonomous Subsea Robots (AUVs), Autonomous Underwater Vehicles (AUVs), subsea pipeline inspection units etc.

- IV. Manpower training and development center - Developing a purpose built Subsea Research center affiliated to a university or polytechnic, offers opportunity to bridge the massive deficit in manpower capability for offshore operations. Center is proposed to host prototype subsea facilities and shall also be accredited to award globally recognized certifications. The proposed center can leverage on the model deployed by the Aberdeen-based National Subsea Research Institute (NSRI). This center is a collaboration between the Subsea UK, University of Aberdeen, Dundee University and the Robert Gordon University
2. Funding – SNEPCO shall fund the Center through annual budget provisions, revenue from training fees and other creative income generating offerings. The governance structure for the center shall be designed in a manner that will give the SNEPCO oversight on expenditure and ownership of research breakthroughs.
 3. Collaboration: NCDMB shall assist in the establishment of collaboration network between the Subsea Center of Excellence, academia, product developers and relevant government agencies responsible for R&D delivery. The collaboration network will ensure value realization for all investment made by the SNEPCO.
 4. Commercialization of research - It is expected that over time the Center may achieve some research breakthroughs that may have commercial benefits to SNEPCO, thereby creating income stream for the Center. We also estimate that start-ups will evolve from the research outcomes and these start-ups will join the pool of local supply chain delivering products and services to support deep offshore operations.
 5. Compliance with NOGICD Act- the ability of SNEPCO to develop and implement the R&D plan will bring its operations into compliance with provisions of the NOGICD Act.



5. Benefits of local R&D ecosystem supporting deep offshore Operations

1. Quick maintenance turnaround thereby minimizing offshore asset standby time and production losses
2. Drive down production cost
3. Improve drilling efficiency thereby optimizing reservoir performance & hydrocarbon recovery
4. Develop offshore technology that is beneficial to SNEPCO
5. Potential increase in Reserves: Replacement Ratio
6. Enhance Nigerian content index of SNEPCO
7. Develop pool of local entrepreneurs that will supply the raw materials, spare parts, equipment, subsea systems components for offshore operations
8. Create new businesses on the back of innovative research breakthroughs
9. Maintain healthy pipeline of local talents for the "life of the field"
10. Enhance SNEPCO- Academia interface



Fig.3 Subsea Jumper



Fig. 4 Remote Operated Vehicles

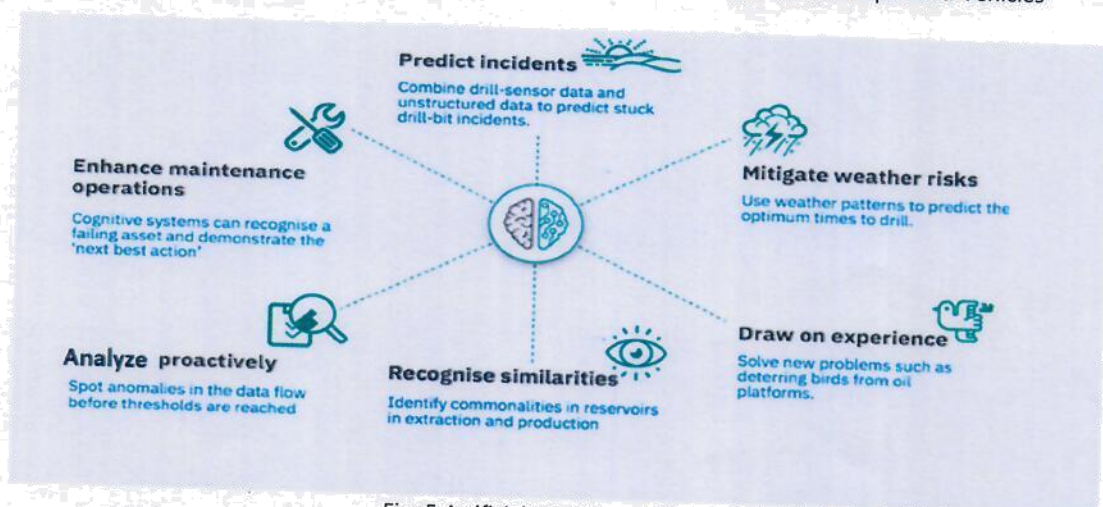


Fig. 5 Artificial Intelligence in Deepwater Operations



Fig. 6 Robotics in Deepwater Operations

6. Next steps

1. Hold meeting with Project promoters and SNEPCO to explain concept and seek alignment.
2. ES NCDMB sign off on the concept and transmit to Project Promoters for implementation.
3. SNEPCO to develop R&D plan along the concept.
4. Develop monitoring and reporting system to track progress and report accomplishments.

Approved for implementation

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