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## **Benchmark Minimum Research Standards**

**NCDMB/BMRS**

**Approved By:** Monitoring & Evaluation Directorate, NCDMB

## **1.0 Introduction**

A major function of the Monitoring and Evaluation Directorate of the Nigerian Content Development and Monitoring Board is quality assurance through monitoring Nigerian Content Compliance by operators. This function requires the Board to set minimum standards and performance targets for research and development in the Nigeria Oil and gas industry in line with the Nigerian Oil and Gas Industry Content Development Act (2010). In this light, the Monitoring and Evaluation Directorate has presently developed its first set of Benchmark Minimum Research Standards for Operators/ Research Centres. The document was developed to serve as a major reference instrument for the establishment and review of research projects in the Nigerian Oil and Gas Industry.

## **2.0 Definitions**

### **2.1 Benchmark Minimum Research Standards**

The Benchmark declarations contained herein, describe the minimum requirements of each Research Centre in the Nigerian Oil and Gas is to achieve the goals of Nigerian Oil and Gas Industry Content Development Act (2010). Individual Research Centres may modify them provided they do not go below the minimum benchmark.

## **3.0 Philosophy, Aim and Objectives of the Benchmark Minimum Research Standards**

### **(a) Philosophy**

To promote the development and utilization of in-country capacities for the industrialization of Nigeria through the effective implementation of the Nigerian Content Act.

### **(b) Aim**

To make the national Oil and Gas industry to become a highly efficient locally driven sector using cutting edge R & D programmes that meet the highest R & D protocol, and safety and corporate governance standards.

**(c) Objective:** To maximize the profits of the Oil and Gas industry through:

- a) Increase in local participation in R & D in Oil and Gas- Indigenization.
- b) Domiciliation of World Class R & D Infrastructure in Nigeria.
- c) Research Centres identifying and solving local problems using excellent R &D within the period specified by the guidelines.
- d) Building creative confidence and self-efficacy in the Oil & Gas Industry through technology transfer and manpower development.

## **4.0 Research Regulations handbook should be well publicized and strictly adhered to**

Every Research Centre should have in place and in use its own research regulations, which is contained in a research policy handbook. The research regulations should include policies, guidelines, rules regulations and penalties governing the conduct of research at the Research Centre.

## **5.0 Benchmark Minimum for Physical Facilities and Equipment**

This section sets the minimum standards for Physical Facilities and Equipment

## 5.1 Office Accommodation

The standard space requirements shown below shall apply:

S/N	Category of Staff	m <sup>2</sup>
1	Principal Investigator	13.50
2	Senior Research staff	7.00
3	Research Staff	7.00
4	Research Laboratory	18.50
5	Secretariat Space	7.00

## 5.2 Research Laboratory Specifications

Each Research Centre should have a standard laboratory that provides a state-of-the-art setting for innovative research in the sciences and engineering; acts as a flexible space structure for dynamic postgraduate work groups, and research zones.

- a) The core areas of research Laboratory units should be 33m<sup>2</sup> (10 x 3.3m) or 40m<sup>2</sup> (12 x 3.3m) with laboratory support units of 24m<sup>2</sup> (7.2 x 3.3m) and a 4.5m floor to Ceiling height in laboratory areas for services accessibility and reticulation.
- b) Support spaces should open off the main laboratories with more particular functions that require separation to meet performance criteria, including equipment rooms, instrument rooms, cold rooms, balance and chemical storage, storerooms, dark rooms, etc.
- c) The main laboratory space is to be separated from adjacent office and non-laboratory areas by full height glazed walls to allow for maximum visibility between the laboratory and non-laboratory environment.
- d) Laboratory areas shall be provided adequate natural or artificial illumination to ensure sufficient visibility for operational safety.
- e) All furniture must be sturdy. All work surfaces (e.g., bench tops and counters) must be impervious to the chemicals. The counter top should incorporate a lip to help prevent run-off onto the floor.

## 5.3 Minimum Equipment Requirement for Engineering Studies

### 5.3.1 Reservoir Management

- a) **Fluid Flow: Pour Point Tester PPT 45150**  
For Measurement of pour points in oils and oil products. With complete accessories:
  - Transport case
  - Software WinPPT
  - Windows-PC
  - Calibration thermometer
- b) **Flocculation Titrimeter FT5**  
For Measurement of precipitation and crystallization of asphaltenes in very dark, undiluted crudes and oil products.

- c) **NHJQ Constant Speed Mixer for preparation of cement slurry samples. With complete accessories:**
- Step-Down Transformer for 230 Volt operations
  - Stainless Steel Container 946 ml
  - Blending Assembly for 946 ml Container
  - Blender Blade for 946 ml Container
  - Stainless Steel Container 1.9 L
  - Blending Assembly for 1.9 L Container
  - Blender Blade for 64 oz (1.9 L) Container
- d) **NZCQ HTHP Consistometer** for simulating high-temperature and high-pressure downhole well conditions as well as for measuring consistency and thickening time of oil well cement continuously. With complete accessories:
- Pressure control and display
  - Hesitation Squeeze Software
  - Pre-installed printer, power cord ready for your local plug requirements
  - Mineral oil calibrator with weights, slurry cup assembly, potentiometer mechanism, slurry cup and pot mechanical bails, ASE wrenches, fuses, O-rings, diaphragms, rupture discs, hoses and fittings to connect to laboratory utilities.
- e) **Rotational Viscometer for measuring rheological parameters of well cementing slurry samples.** With complete accessories:
- Time-test viscosity tubes
  - Standards for cold-cranking simulator
  - Low-viscosity adapter
  - Small sample adapter
  - Rotational viscometer helix path drive unit
  - Rotational viscometer software
  - Viscometer temperature probe
  - Replacement viscometer spindle
  - Viscosity reference standards

### 5.3.2 Production Facilities

#### a) Spectra surface multiphase flowmeter

#### b) Low pressure filter press with interval timer. With complete filter press accessories:

- Sealing ring
- Press nozzles
- Anti-corrosion tubes
- Filtering fan cloth
- Gripper press handles

#### c) Crude Assay Analyzer. With complete accessories:

- Operating manual
- Calibration samples
- Reference samples
- Startup kit
- Carrier gas filters
- Oven exhaust detector

### 5.3.2 Drilling Research

#### a) Mud testing kits. With complete accessories:

- Marsh funnel viscometer
- Plastic measuring cup, 1000ml

- Metal mud balance
  - pH strips
  - Shockproof digital stopwatch
  - Sand content kit
- b) **PVT Analyzer.** Accessories for Digital Power Analyzers include:
- Various voltage and current transformers
  - Clamp-on current probes
  - Safety Terminal Adapter Set B8213ZA
  - Measurement lead 758933
  - Connection Cable 705926
  - B8506WA Measurement Lead Set
  - BNC cable 366925
  - Safety Terminal Adapter Set
- c) **Gas Analysis.** Accessories for gas analysis include:
- Signal horns (small & large versions)
  - Rotating mirror and warning lights, Flasher
  - Warning Banners in English or other languages
  - Test gas bottle, pressure regulator
  - Gas extraction pipe, installation parts
  - Heated extraction pipe, pH-probe
  - Space probes
  - Gas samplers
  - Filters
  - Washers
  - Peltier coolers
  - Driers
  - Manual change-over switches
  - Automatic selectors for up to 24 measuring points
  - Transducers for output: 0-(4)-20 mA
  - Limit monitors
  - Calibration gases
  - Charger units
  - Complete ventilator-control cabinets for ventilation units

#### 5.4 Minimum Equipment Requirement for Local Materials Substitution Studies

Materials Science and Engineering (MSE) laboratories should offer the following research capabilities:

- a) Atomic Spectroscopy
- b) Fluorescence Spectroscopy/Fluorometry
- c) X-Ray Diffractometer (XRD Instruments)
- d) Particle Size Analyzer
- e) Brinell hardness Testers. With complete accessories:
  - Specimen holders
  - Indenters
  - Vices and jaws
  - Test blocks
  - Objective lenses
  - Anvils
- f) Vickers Hardness Testers. With complete accessories:
  - X – Y tables
  - Indenters
  - Lenses

- Specimen holders
- g) Universal Tensile Tester. With complete accessories:
  - Tensile grips and fixtures
  - Compression test fixtures
  - Flexural bend test fixtures
  - Peel test fixtures
  - Environmental chambers
  - Extensometers
- h) Elasticity of Materials and Young's *Modulus Testers*. With complete accessories:
  - Expanded table
  - Drip tray
  - Extensometer interface
- i) Interfacial Shear Rheometer ISR-1 for the measurement of interfacial shear properties of layers between two fluid (liquid/liquid or liquid/gas). It allows unique shear rheological experiments.
- j) Ring and Plate Tensiometer TensioCAD for the measurement of the surface tension and interfacial tension. It can also perform CMC, Contact Angle, Powder Wettability (Washburn method) and Density measurements.
- k) Drop Bubble Profile Analysis Tensiometer PAT-2 for the measurement of the surface tension and interfacial tension of liquids.
- l) High-temperature tube furnace-controlled ramp rate up to 1100°C; a high-temperature box furnace-controlled ramp rate up to 1700°C.
- m) Chemical synthesis facilities, including a porosimeter; scanning electron microscope
- n) Laboratory dryers, ovens, and washers
- o)  $\mu$ -VIS high resolution X-ray computed tomography (CT)
- p) X-ray computed tomography (CT) systems

## 5.5 Minimum Equipment Requirement for Safety and Environmental Studies

The equipment or "engineering control" required for the elimination or reduction of exposure to a biological, chemical or physical hazard includes:

- a) **Biosafety Cabinet (BSC)**
- b) Chemical Fume Hoods
- a) Water Distillers, Merit Water Still Distillation Units & Accessories
- b) Ion Chromatography (IC) Analyzer
  - Sample Conductivity and pH Accessory
  - Vials, bottles, sample loops, and other accessories
- c) Laboratory Sterilization Equipment. With complete accessories:
  - Data loggers
  - Baskets, trays and foil.
- d) Biochemical Oxygen Demand Analyzer. Accessories for Biochemical Oxygen Demand (BOD) testing include:
  - Bottles
  - Incubators
  - Probes and calibration equipment.
- e) Controlled-environment optical irradiation chamber with in-situ spectroscopic analysis, closed-loop helium cryogenic cooler.
- f) Low Emission Air Heaters
- g) Heat Recovery Systems

## 5.6 Minimum Equipment Requirement for Geophysical Research

### 5.6.1 Seismology

- a) 24 Channel SmartSeis SE (Contact Geometrics for quotation). With complete accessories

- Geophones
- Cables
- Hammer Switch
- Hammer
- Battery
- External Charger
- Analysis Software

#### **5.6.2 Electrical Prospecting**

- a) Abem Terrameter SAS 4000 (Contact Abem for quotation)
- b) Booster SAS 2000 With Complete accessories:
  - Four reels of cables
  - 8 Metal Electrodes
  - Battery
  - External Charger
  - Analysis Software – Resix (Interprex) for DC Resistivity and IP
  - RES2DINV Analysis Software
- c) SAS Log borehole Tool with its accessories and software

#### **5.6.3 Magnetic Prospecting**

- a) G-858 Cesium Magnetometer (Contact Geometrics for quotation). With complete accessories
  - Analysis Software

#### **5.6.4 Gravity Prospecting**

- a) LaCoste & Romberg Gravimeter (Contact Lacoste & Romberg for quotation). With Complete accessories:
  - Battery
  - External Charger
  - Computer
  - Acquisition Software

#### **5.6.5 Positioning System**

- a) Hand Held Global Position System (GPS) includes Altimeter and field precision Clock (Contact Garmins for Quotation)

## 6.0 Research Staff

The staff mix is to comply with the Nigerian Oil and Gas Industry Content Development Act which is reflected as minimum target in the performance matrix.

S/N	Category of Staff	Qualification		Job Skill
		University Based Research Centre	Industry Based Research Centre	
1	Principal Investigator	Professor with a doctoral degree and at least 12 years of post-qualification job experience. The person must have evidence of publications index in <i>Journal Citation Reports</i> (Clarivate Analytics) or <i>Scopus</i> (Elsevier).	Any person with a doctorate in a subject related to the field of research. This will be associated with at least 12 years of proven existing experience in a relevant industry leading research teams to develop new technologies and implement them into new projects. This experience backed up with evidence of publications in oil and gas domain index in <i>Journal Citation Reports</i> (Clarivate Analytics) or <i>Scopus</i> (Elsevier).	Leadership and management skills, budgeting ability, communication and presentation skills, ingenuity and creativity
2	Senior Scientists	Senior Lecturer with a doctoral degree and at least 6 years of post-qualification job experience. The person must have evidence of publications index in <i>Journal Citation Reports</i> (Clarivate Analytics) or <i>Scopus</i> (Elsevier).	Any person with a master's degree or a doctorate in a subject related to the field of research. This will be associated with industrial experience in the Oil & Gas domain, ideally within another oil firm or service provider. The person must have evidence of publications index in <i>Journal Citation Reports</i> (Clarivate Analytics) or <i>Scopus</i> (Elsevier).	Communication and presentation skills, ingenuity and creativity
3	Research Scientists	Lecturer I with a doctoral degree and at least 3 years of post-qualification job experience	Any person with a master's degree or a doctorate in a subject related to the field of research. However, such person must have at least 3 years research experience with evidence of publications index in <i>Journal Citation Reports</i> (Clarivate Analytics) or <i>Scopus</i> (Elsevier).	Communication and presentation skills, ingenuity and creativity
4	Postdoctoral Researcher	Lecturer II with a doctoral degree and at least 1 year of post-qualification job experience	Not Applicable	Communication and presentation skills, ingenuity and creativity

### 6.1 Non Research Staff

- a) Ratio of Senior Technical Staff to Research Staff: 1:10
- a) Ratio of Junior Technical Staff to Research Staff: 1:10
- b) Ratio of Senior Administrative Staff to Research Staff: 1:10
- c) Ratio of Senior Administrative Staff to Research Staff: 1:10

## 7.0 R & D Budgeting

Strategic investment in R & D fosters global competitiveness in the Oil & Gas sector and promotes the development and utilization of in-country capacities for the industrialization. Hence funding of research projects is essential in ensuring the realisation of the research goals and objectives. In the absence of appropriate R & D investment, it will be difficult for a Research Centre to meet its capital and recurrent expenditures. In this light, the R & D budgeting is required to comply with the performance target matrix below.



## 8.0 Performance Target Matrix

The section specifies the benchmark minimum in performance indicators for five years in line with the NOGICD Act minimum target. These targets are based on the fact that growth in the targets should be incremental up to a ceiling which is informed by the fact that globally no industry operates in isolation; there must be cross-border collaborations and interdependency.

### 8.1 Performance Matrix for Engineering Studies, Reservoir Studies, Facilities and Drilling

Performance Measure	Baseline	Minimum Target Year I	Minimum Target Year II	Minimum Target Year III	Minimum Target Year III	Minimum Target Year IV	Minimum Target Year V
1. Ratio of domiciled R & D budget to Total R & D budget per qualified contract	60%	60%	70%	75%	80%	85%	85%
2. Ratio of in-country Spent to budget	60%	60%	70%	75%	80%	85%	85%
3. Ratio of Staff with doctoral level degree to total number of staff.	60%	60%	70%	75%	80%	85%	85%
4. Ratio of Staff of professorial cadre to total number of staff.	60%	60%	70%	75%	80%	85%	85%
5. Workforce diversity: Ratio of Nigerians research staff to total number of staff	60%	60%	70%	75%	80%	85%	85%
6. Ratio of Nigerian staff benefitting from Staff Development Programme to total staff in the last fiscal year.	60%	60%	70%	75%	80%	85%	85%
7. Ratio of available in-use requisite physical facilities above benchmark minimum research standard to total facilities.	60%	60%	70%	75%	80%	85%	85%
8. Ratio of available in-use requisite equipment above benchmark minimum research standard to total equipment.	60%	60%	70%	75%	80%	85%	85%
9. Ration of Research plans approved to number submitted.	60%	60%	70%	75%	80%	85%	85%
10. Ratio of successful research collaborations to collaboration total number of request per project.	60%	60%	70%	75%	80%	85%	85%
11. Ratio of research intellectual property patents to total number of approved research plans.	60%	60%	70%	75%	80%	85%	85%
12. Ratio of publications in Scopus or Clarivate Analytics Master Journal list to approved research plans per fiscal year.	60%	60%	70%	75%	80%	85%	85%
13. Ratio of new excellent technologies developed locally and deployed to total number of approved research plans.	60%	60%	70%	75%	80%	85%	85%
14. Ratio of local products developed to global standards and deployed to total number of approved research plans.	60%	60%	70%	75%	80%	85%	85%
15. Ratio of local problems solved to total number of problems identified by the project per fiscal year.	60%	60%	70%	75%	80%	85%	85%

16. Ratio environmental disaster remediated to year to total number of environmental disaster identified by the project per fiscal year.	60%	60%	70%	75%	80%	85%	85%
17. Ratio of staff supervising postgraduate students to total number of research staff on the project.	60%	60%	70%	75%	80%	85%	85%

## 8.2 Performance Matrix for Geological and Geophysical Services

Performance Measure	Baseline	Minimum Target Year I	Minimum Target Year II	Minimum Target Year III	Minimum Target Year III	Minimum Target Year IV	Minimum Target Year V
1. Ratio of domiciled R & D budget to Total R & D budget per qualified contract	80%	80%	85%	85%	85%	85%	85%
2. Ratio of in-country Spent to budget	80%	80%	85%	85%	85%	85%	85%
3. Ratio of Staff with doctoral level degree to total number of staff.	80%	80%	85%	85%	85%	85%	85%
4. Ratio of Staff of professorial cadre to total number of staff.	80%	80%	85%	85%	85%	85%	85%
5. Workforce diversity: Ratio of Nigerian research staff to total number of staff	80%	80%	85%	85%	85%	85%	85%
6. Ratio of Nigerian staff benefitting from Staff Development Programme in the last fiscal year.	80%	80%	85%	85%	85%	85%	85%
7. Ratio of available in-use requisite physical facilities above benchmark minimum standard to total available facilities.	80%	80%	85%	85%	85%	85%	85%
8. Ratio of available in-use requisite equipment above minimum standard to total available equipment	80%	80%	85%	85%	85%	85%	85%
9. Ratio of Research plans approved to number submitted.	80%	80%	85%	85%	85%	85%	85%
10. Ratio of successful research collaborations to collaboration request per project.	80%	80%	85%	85%	85%	85%	85%
11. Ratio of research intellectual property patents to total number of approved research plans.	80%	80%	85%	85%	85%	85%	85%
12. Ratio of publications in Scopus or Clarivate Analytics Master Journal list to approved research plans per fiscal year.	80%	80%	85%	85%	85%	85%	85%
13. Ratio of new excellent technologies developed locally and deployed to total number of approved research plans.	80%	80%	85%	85%	85%	85%	85%
14. Ratio of local products developed to global standards and deployed to total number of approved research plans.	80%	80%	85%	85%	85%	85%	85%
15. Ratio of local problems solved to total number problems identified by the project per fiscal.	80%	80%	85%	85%	85%	85%	85%
16. Ratio environmental disaster remediated to year to total number of environmental disaster identified by the project per fiscal year.	80%	80%	85%	85%	85%	85%	85%
17. Ratio of staff supervising postgraduate students to total number of research staff on the project.	80%	80%	85%	85%	85%	85%	85%

### 8.3 Performance Matrix for Safety and Environment

Performance Measure	Baseline	Minimum Target Year I	Minimum Target Year II	Minimum Target Year III	Minimum Target Year III	Minimum Target Year IV	Minimum Target Year V
1. Ratio of domiciled R & D budget to total R & D budget per qualified contract	75%	75%	80%	85%	85%	85%	85%
2. Ratio of in-country Spent to budget	75%	75%	80%	85%	85%	85%	85%
3. Ratio of Staff with doctoral level degree to total number of staff.	75%	75%	80%	85%	85%	85%	85%
4. Ratio of Staff of professorial cadre to total number of staff.	75%	75%	80%	85%	85%	85%	85%
5. Workforce diversity: Ratio of Nigerians research staff to total number of staff	75%	75%	80%	85%	85%	85%	85%
6. Ratio of Nigerian staff benefitting from Staff Development Programme to total number of staff in the last fiscal year.	75%	75%	80%	85%	85%	85%	85%
7. Ratio of available in-use physical Facilities above minimum research standard to total available facilities.	75%	75%	80%	85%	85%	85%	85%
8. Ratio of available in-use requisite equipment above minimum research standard to total equipment.	75%	75%	80%	85%	85%	85%	85%
9. Ratio of Research plans approved to number submitted.	75%	75%	80%	85%	85%	85%	85%
10. Ratio of successful research collaborations to collaboration request per project.	75%	75%	80%	85%	85%	85%	85%
11. Ratio of research intellectual property patents to total number of approved research plans.	75%	75%	80%	85%	85%	85%	85%
12. Ratio of publications in Scopus or Clarivate Analytics Master Journal list to approved research plans per fiscal year.	75%	75%	80%	85%	85%	85%	85%
13. Ratio of new excellent technologies developed locally and deployed to approve research plan.	75%	75%	80%	85%	85%	85%	85%
14. Ratio of local products developed to global standards and deployed to total number of approved research plans.	75%	75%	80%	85%	85%	85%	85%
15. Ratio of local problems solved to total number problems identified by the project per fiscal.	75%	75%	80%	85%	85%	85%	85%
16. Ratio environmental disaster remediated to year to number of environmental disaster identified by the project per fiscal year	75%	75%	80%	85%	85%	85%	85%
17. Ratio of staff supervising postgraduate students to total number of research staff on the project.	75%	75%	80%	85%	85%	85%	85%

#### 8.4 Performance Matrix for Local Substitution

Performance Measure	Baseline	Minimum Target Year I	Minimum Target Year II	Minimum Target Year III	Minimum Target Year III	Minimum Target Year IV	Minimum Target Year V
1. Ratio of domiciled R & D budget to total R & D budget per qualified contract	75%	75%	80%	85%	85%	85%	85%
2. Ratio of in-country Spent to budget	75%	75%	80%	85%	85%	85%	85%
3. Ratio of Staff with doctoral level degree to total number of staff.	75%	75%	80%	85%	85%	85%	85%
4. Ratio of Staff of professorial cadre to total number of staff.	75%	75%	80%	85%	85%	85%	85%
5. Workforce diversity: Ratio of Nigerians research staff to total number of staff	75%	75%	80%	85%	85%	85%	85%
6. Ratio of Nigerian staff benefitting from Staff Development Programme to total staff the last fiscal year.	75%	75%	80%	85%	85%	85%	85%
7. Ratio of available in-use physical Facilities above benchmark minimum Standard total available facilities	75%	75%	80%	85%	85%	85%	85%
8. Percentage of available in-use equipment above minimum standard to total available equipment.	75%	75%	80%	85%	85%	85%	85%
9. Ratio of Research plans approved to number submitted.	75%	75%	80%	85%	85%	85%	85%
10. Ratio of successful research collaborations to collaboration request per project.	75%	75%	80%	85%	85%	85%	85%
11. Ratio of research intellectual property patents to total number of approved research plans.	75%	75%	80%	85%	85%	85%	85%
12. Ratio of publications in Scopus or Clarivate Analytics Master Journal list to approved plans per fiscal year.	75%	75%	80%	85%	85%	85%	85%
13. Ratio of new excellent technologies developed locally and deployed to approve research plan.	75%	75%	80%	85%	85%	85%	85%
14. Ratio of local products developed to global standards and deployed to total number of approved research plans.	75%	75%	80%	85%	85%	85%	85%
15. Ratio of local problems solved to total number of problems identified by the project per fiscal year.	75%	75%	80%	85%	85%	85%	85%
16. Ratio environmental disaster remediated to total number of environmental disaster identified by the project per fiscal year	75%	75%	80%	85%	85%	85%	85%
17. Ratio of staff supervising postgraduate students to total number of research staff on the project.	75%	75%	80%	85%	85%	85%	85%