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SYNTECHSYS INTERNATIONAL LTD

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RESEARCH AND DEVELOPMENT SERVICES (TECHNOLOGY) FOR NIGERIAN OIL AND GAS SECTOR

CLIENTS

1. **SHELL NIGERIA EXPLORATION AND PRODUCTION COMPANY LIMITED**
2. RENNAISSANCE AFRICA ENERGY LIMITED
3. TOTAL FINAL ELF NIGERIA LIMITED
4. NIGERIA NATIONAL PETROLEUM COMPANY LIMITED

5. CHEVRON NIGERIA LIMITED

6. EXXON MOBIL

7. SEPLAT PETROLEUM

8. NIGERIAN CONTENT DEVELOPMENT MONITORING BOARD

9. NIGERIA UPSTREAM REGULATORY COMMISSION

10. NIGERIAN MIDSTREAM AND DOWNSTREAM REGULATORY AUTHORITIES (NMDRA)

11. NIGERIA LNG LIMITED

12. ELF PETROLEUM

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RESEARCH AND DEVELOPMENT PROGRAMS FOR NIGERIAN OIL AND GAS INDUSTRY

Research and Development (R&D) in the oil and gas sector focuses on creating innovative technologies to enhance efficiency, reduce costs, ensure safety, and minimize environmental impact across exploration, production, and distribution. Key technological advancements include artificial intelligence (AI), the Internet of Things (IoT), robotics, digital twins, and advanced subsea technologies for deep water exploration and marginal field development. R&D also drives the development of carbon capture and storage (CCS), methane detection systems, and more sustainable fuel options, aligning the industry with Environmental, Social, and Governance (ESG) goals.

Key Focus Areas

- **Environmental Protection:**

  R&D develops technologies like carbon capture, utilization, and storage (CCUS) and methane leak

detection systems to reduce emissions and enhance sustainability.

- **Operational Efficiency and Cost Reduction:**

The adoption of AI, automation, and advanced digital platforms helps to optimize operations, improve decision-making, and reduce capital and operational expenses.

- **Safety and Reliability:**

R&D focuses on creating safer working environments through robotic systems and developing technologies for the reliable inspection and maintenance of subsea assets.

- **Resource Maximization:**

Techniques like enhanced oil recovery (EOR) and the development of subsea processing technologies allow for the more efficient extraction of oil and gas from deeper and harder-to-reach reservoirs.

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Transformative Technologies

- **Artificial Intelligence (AI):**

  Used for tasks such as optimizing production, predicting equipment failures, and enhancing safety.

- **Internet of Things (IoT):**

Connects sensors and devices for real-time asset monitoring and data collection, enabling proactive management of operations.

- **Robotics:**

Deployed for hazardous tasks in exploration and maintenance, improving safety and efficiency.

- **Digital Twins:**

Virtual replicas of physical assets that allow for simulation and analysis to optimize performance and maintenance.

- **Advanced Subsea Technologies:**

Focus on developing reliable subsea systems for Deepwater applications and extending the operational life of subsea infrastructure.

Organizational and Regulatory Efforts

- **Professional Organizations:**

  Groups like the Society of Petroleum Engineers' (SPE) Research and Development Technical Section (RDTS) foster collaboration among R&D professionals to drive innovation in the upstream sector.

- - **Governmental and National Initiatives:**

Organizations such as the Nigerian Content Development Monitoring Board (NCDMB) promote R&D and technology transfer to support local content development and address specific regional challenges.

- Future Trends, Research and Development - Oil & Gas Portal

  SUBSEA PRODUCTION SYSTEMS TREND. The overall business Research and Developments is to find and expand solutions for subsea trees,

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Oil & Gas Portal

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Research & Development Technical Section - SPE Connect
By bringing together diverse perspectives, RDTS aims to address the complex challenges facing the energy sector and drive transformations.

How Multidisciplinary R&D Can Change the Future of the Oil & Gas Industry

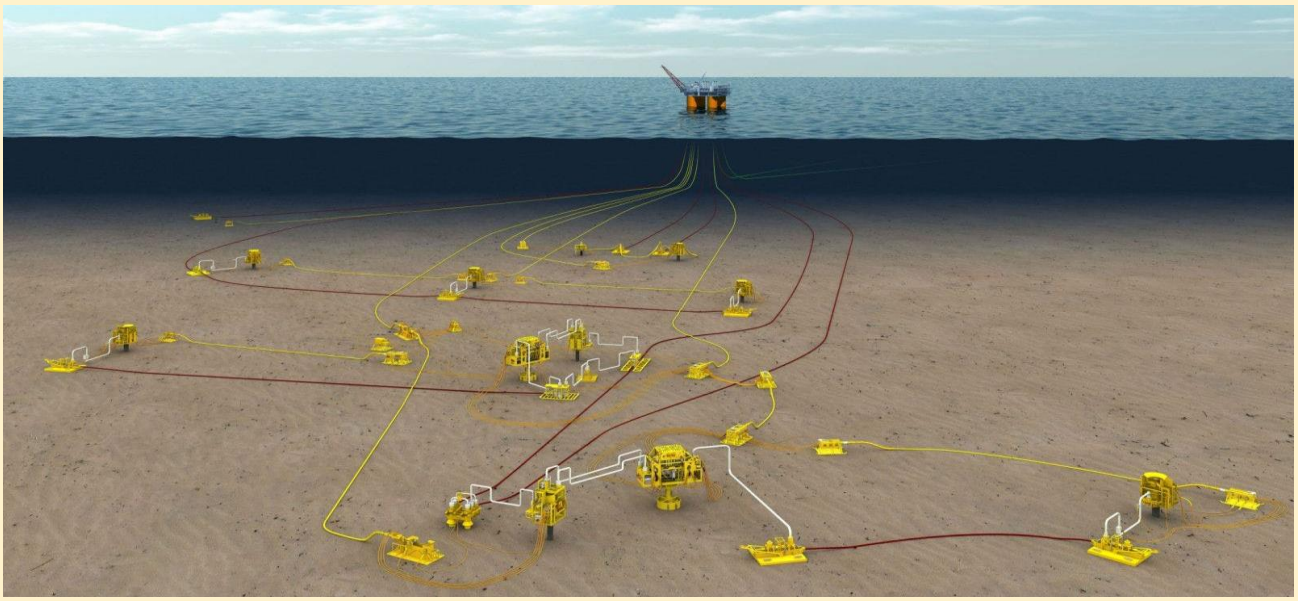
The **Oil & Gas (O&G) industry** in Nigeria is driven by a robust regulatory framework that fosters innovation. One of the most significant incentives comes from the **Nigerian Oil and Gas Content ACT 2010 and Regulation of**

Ministry of Petroleum Resources-Nigeria Oil and Gas Research and Development Regulation 2021 which mandates that operators (companies) invest 5% of their **gross annual revenue and submit Research and Development Plan that covers** from fields subject of operations (Engineering Studies, Geological and Geophysical Studies, Safety and Environment Studies , Local Materials Substitution Studies) to **Special Participation and Approval** in **Research, Development, and Innovation (R&D&I)** projects. This requirement, formalized in **Ministry of Petroleum Resources Regulation Resolution No. B2347-2357** ensures that operators continuously invest in Research and Development technological advancements, driving the sector's growth and competitiveness. These resources are often directed towards **collaborative initiatives** with universities, research centers, and technology providers, creating a thriving ecosystem for R&D in the O&G sector.

At **Syntechsys International Limited**, we understand that leveraging this opportunity requires a strategic and multidisciplinary approach. Our expertise lies in supporting operators through the entire R&D cycle, from **concept development** to **technical review and implementation**, ensuring that projects align with both **operational needs** and **regulatory standards**.

Our Multidisciplinary Approach to R&D in O&G

Developing new technologies and methods in the O&G sector requires a **comprehensive approach** that considers the **entire project lifecycle**. From **concept generation to prototype testing and field implementation**, Syntechsys International Limited R&D support is designed to drive innovation and boost operational efficiency, always with a **systematic and holistic approach** to optimize **field development, design, and operation**.



1. **Concept Development: Generating Ideas that Drive Change**

The first stage of any R&D project involves identifying **industry challenges** and **generating innovative ideas** to address them. At Syntechsys International Limited, we bring together experts from various disciplines, including:

- **Subsea engineering** for reliable Deepwater applications
- **Process engineering** to optimize production systems
- **Data analytics and digitalization** for smarter asset management
- **Structural and mechanical engineering** to enhance equipment resilience
- **Automation and control** to streamline operations and reduce human intervention

By fostering **interdisciplinary collaboration**, we encourage the creation of solutions that are not only technically viable but also economically and environmentally sustainable.

2. Technical Feasibility and Proof of Concept: Transforming Ideas into Reality

Once potential solutions are identified, our team conducts detailed **technical feasibility studies**. We evaluate:

- **Mechanical integrity and reliability** through advanced simulation and modeling
- **Process efficiency improvements**, including flow assurance and material handling
- **Automation potential**, leveraging AI-driven control systems
- **Economic feasibility**, ensuring that innovations are cost-effective and scalable

During this phase, Syntechsys International Limited R&D team collaborates closely with operators to align project goals with **operational realities** and **field conditions**. This partnership ensures that new concepts are not only innovative but also practical and readily implementable.

3. Prototype Development and Testing: Building and Validating Innovations

Once the proof of concept is validated, we move into the **prototype development phase**. This involves:

- **Designing functional prototypes** with a focus on scalability
- **Conducting lab and field tests** to validate performance
- **Iterating designs** based on testing data and stakeholder feedback
- **Risk assessment and mitigation planning**

By combining **theoretical analysis with practical testing**, **Syntechsys International Limited** ensures that prototypes are not only innovative but also **robust and reliable**. Our **global field experience** allows us to simulate diverse operational scenarios, from **subsea interventions to refinery process optimization**.

4. Field Implementation and Monitoring: Ensuring Real-World Success

Successful R&D projects do not end at prototype validation. Implementing new solutions in real-world settings requires:

- **Comprehensive field trials** to assess performance under operational conditions
- **Integration with existing systems**, ensuring compatibility and minimal disruption
- **Training and support** to enable smooth adoption by field personnel
- **Performance monitoring**, using digital dashboards to track key metrics

At **Syntechsys International Limited**, we prioritize **seamless integration** and **operator training** to ensure that innovations are **adopted effectively**. We remain involved during the entire implementation process, offering **on-site engineering support** and **post-implementation evaluations** to optimize results.

Adding Value to R&D Projects through Technical Review

Beyond project development, Syntechsys International Limited provides **technical review services** to enhance existing R&D initiatives led by operators or third-party collaborators. Our experts critically analyze:

- **Engineering assumptions and calculations** to validate accuracy
- **Process flow diagrams and system architectures** for optimization
- **Compliance with industry standards and regulatory requirements**
- **Potential risks and mitigation strategies**

By engaging our multidisciplinary team, operators can **increase the technical robustness** of their R&D projects, mitigating risks and identifying opportunities for **cost savings and performance improvements**.

Why Choose Syntechsys International Limited for Your R&D Projects?

At Syntechsys International Limited, we believe that **innovation is a collective effort**. Our strength lies in our ability to **integrate diverse engineering disciplines** into a **coherent R&D strategy** that addresses the unique challenges of the O&G sector. Whether you are developing **new technologies for offshore platforms**, **enhancing automation in processing facilities**, or **innovating in field monitoring**, we bring the technical expertise and **project management capabilities** to turn ideas into reality.

Our track record of **successful collaborations** with global operators demonstrates our commitment to advancing the

industry through **innovative, practical, and scalable solutions**. We understand that every R&D project requires a blend of **technical precision**, **creative thinking**, and **operational insight**.

Ready to take your next project from concept to reality? **Connect with Syntechsys International Limited today** to explore how our R&D support can make a difference in your operations.

RESEARCH AND DEVELOPMENT (TECHNOLOGY) IN NIGERIA OIL AND GAS INDUSTRY

Research and technology development have been crucial in the successful development of oil and gas resources in the Nigerian Oil and Gas Industry. A long-term commitment to research and development activities will also be vital when we embark on the next chapters of our petroleum history.

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Research and Technology Organisation of research activities

The Nigerian petroleum industry of today is very different from what it was in the late 1960s. Using a wide range of small and large technological revolutions, we are now able to produce oil and gas both more efficient and safer while at same time mitigating effects on the environment and climate.

So far, only 33% per cent of the estimated total recoverable resources on the Nigerian Oil and Gas Industry has been produced. Production of the remaining resources will generate substantial value creation. In order to take advantage of this potential, new knowledge and technology must be developed. This is a cornerstone in the management of Nigerian petroleum resources.

Research and technology development in the petroleum sector

Since the beginning of Nigerian petroleum activities, research, development and demonstration of new technology has been essential in order to find solutions on

how to discover, develop and produce Nigerian oil and gas both safely and efficiently. Technology is also a prerequisite for solving both current and future challenges in the petroleum industry.

The competitiveness and innovation of the petroleum industry has contributed positively to other industries in Nigeria including both the maritime industry and renewable energy. There is also competence- and technology transfers to very different industries, like the heath sector and aerospace. Technology developed at the Nigerian Petroleum Industry has given the Nigerian Oil and Gas service and supply industry in a competitive advantage international market.

The industry's competitiveness and innovation capacity have led to major positive spin-off effects and technological applications in other industries in Nigeria

Favourable framework conditions have given companies incentives to carry out research and technology development in Nigeria. Close collaboration between oil companies, suppliers and research institutions has underpinned the successful development of new technology and solutions.

Several new challenges lie ahead. There are fewer large discoveries and developments than before. It is more demanding to produce the remaining resources from

ageing fields than it was to produce oil or gas when the fields were young. All things being equal, it is thus more difficult for individual projects to finance technology development. In addition, it has become increasingly important to use technology that reduces greenhouse gas emissions.

To ensure value creation and reduced climate impact from petroleum activities in the future, it is important that oil companies, the service and supply industry and the authorities continue to invest in R&D. Such initiatives are needed to further develop the industry's expertise and competitiveness and to maximize safe recovery of the petroleum resources on the Norwegian shelf.

The Ministry of Petroleum Resources through the Nigerian Content Development Monitoring Board therefore encourages research, development and demonstration via research programmes where both companies, operators and research institutions may seek funding for specific projects. These programmes are administered by the Research Council of Nigerian Content Development Monitoring Board and Nigerian Upstream Regulatory Commission.

Organisation of research activities

In 2021, the Ministry of Petroleum Resources through Nigerian Content Development Monitoring Board and Petroleum Industry Act (PIA) established the strategy

"Nigeria Oil and Gas Research Development Regulations B2347-B2357 in the 21st Century" (OG21) in 2021 for **Commercial National Oil Corporation** (Nigerian National Petroleum Company Limited), Operators and the **Regulatory Entities** (**Nigerian Upstream Petroleum Regulatory Commission** and **Nigerian Midstream and Downstream Petroleum Regulatory Authorities** (NMDPRA) to address the regulatory and commercial challenges associated with Research and Development (Technology) output in National Oil and Gas Industry in efficient and responsible petroleum activities. The OG21 process has facilitated for oil companies, universities, research institutions, the supplier industry and the authorities to agree on a joint national technology strategy for oil and gas. The strategy has been revised several times, and was most recently incorporated in PIA 2021 and in Nigeria Oil and Gas Research Development Regulations B2347-2357.

The authorities encourage research and technology development primarily through legislation or other forms of regulation and through direct allocations to the Research Council of Nigeria Content Development Monitoring Board. Most of these allocations go to the PIA is to encourage research programmes with a combined budget from operators such as SNEPCO 5 billion USD Funding for Bonga North and other operators' guidelines for funding and research centers in Nigeria. These

programmes and centers contribute to achieving the objectives set out in the OG21 Strategy incorporated by Ministry of Petroleum Resources in the Nigeria Oil and Gas Research Development Regulation B2347-2357 in 2021 and make up the Research Council's petroleum and Nigerian Oil and Gas Content 2010 portfolio strategy which has its own board that is responsible for allocation of funding and making sure that the desired effects and outcome can be realized.

An evaluation undertaken by Nigerian Content Development Monitoring Board and Nigerian Upstream Regulatory Commission in 2023 shows that the programmes above have produced great value for the society as a whole.

The oil and gas sector have long been the pillar of world energy supply, powering economies and facilitating development across continents. But now, as the world grapples with energy shifts, environmental issues and an increase in demand, technology is no longer a supporting actor, it is right at the center of progress.

From production to exploration, and from sustainability to safety, technological innovation is transforming the oil and gas industry in unparalleled means.

In an industry characterized by precision, scale and complexity, there is one thing constant: the imperative to

change. Technology is not simply making the operations better, but changing the whole ball game. The digital revolution in the oil and gas sector is speeding up progress, optimizing performance, and unlocking new possibilities along the value chain.

How has the Oil and Gas Industry benefited?

The colossal impact of digital transformation on the **oil and gas sector** has led to companies achieving a lot more, such as lowering their costs, securing assets, strengthening customer relationships, driving greater efficiency and also creating new business models to thrive in highly competitive global markets.

Some of the advanced technologies that are powering progress in this industry:

1. Artificial Intelligence (AI)

AI is utilized to automate processes, improve decision-making, and detect possible problems. For example, AI might use sensor data to identify leaks in pipelines or forecast equipment maintenance needs.

2. Digital Twins & Predictive Maintenance

Among the most revolutionary tools of the past decade has been the development of digital twins—virtual copies of physical assets. Digital twins replicate performance,

identify anomalies, and forecast equipment failure before it happens. Predictive maintenance reduces downtime, enhances asset lifespan, and saves substantially.

3. Internet of Things (IoT)

The IoT is the act of connecting physical devices to the internet to enable them to gather and transmit data. The data helps with enhanced efficiency, safety, and environmental performance. IoT sensors, for example, can track pipeline temperature and pressure, helping prevent leaks.

4. Big Data Analytics

This entails evaluating large amounts of data to identify patterns and trends, to make improved decisions, optimize operations, and identify new opportunities. For instance, big data analytics can examine customer information to determine prospective markets or optimize oil and gas production.

5. Robotics

Robotics are used for risky or repetitive operations, improving safety and efficiency. For instance, robots can be used for cleaning pipelines or running drilling rigs.

6. Automation

An incredibly high degree of accuracy is possible only with automation, showcasing one among many benefits that the sector can reap from automated operations. Solid infrastructure and terminal automation investments enable outstanding watchfulness through the remote tracking of the entire pipeline network, identifying leaks. Weather surveillance systems may also identify variations in seismic activity, oceanic activity, and others.

Digital automation technologies have allowed businesses to increase reservoir capacities, and also obviates the necessity for employees to perform dangerous repairs in the field. Using augmented reality or drones can be used for repairs that are essential.

7. Workforce Transformation and Remote Operations

Post-COVID, remote operations and AR/VR-based training have become standard. These technologies allow offshore asset management from afar and offer immersive learning without on-site risk, attracting younger, tech-savvy talent.

AR/VR provides immersive learning and mitigates the necessity for on-site interventions. The COVID-19 pandemic accelerated the adoption of remote operations. Virtual reality (VR) and augmented reality (AR) are transforming training, enabling immersive learning

environments that replicate real-world conditions without the associated risks.

8. 3D Printing

3D printing is utilized to create prototypes, components, and tools, resulting in cost savings and enhanced efficiency. For instance, special parts for oil and gas equipment can be produced using 3D printing.

9. Sustainability-Driven Innovation

Technology is also making it possible for the industry to minimize its environmental impact. Carbon capture and storage (CCS), methane leak detection systems, and low-emission fuel options are becoming regular practices. AI algorithms are being employed to detect leaks earlier, while blockchain improves emissions reporting and carbon trading transparency. Moreover, digital technologies enable firms to become aligned with ESG (Environmental, Social, Governance) objectives, through enhanced monitoring, compliance, and engagement with stakeholders.

Recent Developments: Pioneering Efficiency & Accountability

In the last decade, the sector has emphasized heavily on:

- Advanced Data Application throughout exploration, field maintenance, and well decommissioning.
- Water Conservation through reuse technology and brine application.
- Materials Science Breakthroughs enhancing well integrity.
- Improved Oil Recovery (EOR), especially through CO_2 injection, balancing production gains with carbon sequestration.
- Oil Spill Prevention Technologies for Deepwater operations.
- R&D in Extreme Environments, particularly in Arctic and sensitive areas.
- Horizontal Drilling and Hydraulic Fracturing, extending the limits of drilling productivity and recovery.

The Upstream Advantage: Digital Transformation at its Core

Upstream activities ranging from geological mapping to drilling and production, are benefiting most from digital transformation. Technologies like:

- Automation, sensors, and big data analytics are streamlining performance and lowering costs.
- Drones, robotics, and 5G-enabled IoT devices improve accuracy and safety.
- Cloud computing and big data management software deliver real-time visibility and smarter decision-making.

These technologies are helping to advance recovery rates 3–4% and redefine exploration and production. Companies do need to transcend legacy system challenges through dedicated investment, leadership, and cooperation.

Conclusion

The **oil and gas industry** are at a critical juncture, between old systems and new innovation, between fossil and the transition to clean energy. Technology is more than an instrument of optimization; it's a force for reinvention.

At **Syntechsys International Limited**, we do not simply embrace technology, we integrate it into all parts of our

business. We aim to provide smarter energy solutions that power the world efficiently, safely, and sustainably. With the changing oil and gas environment, we will continue to lead through innovation, unlock value through technology, and drive progress that counts.

As the industry further adopts digital transformation, it will open new heights of efficiency, sustainability, and resilience. With powering progress through innovation, the oil and gas industry can remain a critical contributor to the global energy mix, by being smarter, cleaner, and more resilient than ever.