Advancing the Role of Technology in Nigeria's Oil and Gas Supply Chain

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Abstract:

The midstream and downstream sectors in the global petroleum sector are becoming more defined by operational volatility, structural weakness, and growing pressure on real-time visibility in the interconnected activities in the supply chain. In light of these systemic pressures that the sector is facing, more precise digital technologies, specifically, Machine Learning (ML) and Blockchain as well as the Internet of Things (IoT) are emerging as potential strategic enablers to improve traceability, predictive capability, and end-to-end transparency. Their adoption is, however, not evenly distributed across the developing economies, with organisational, infrastructural, and regulatory obstacles limiting large-scale digital transformation.

This research examines how ML, Blockchain, and IoT (separately and jointly) can optimise midstream and downstream petroleum supply chains in Nigeria. The study will be based on a combined UTAUT-TOE theoretical framework, investigating industry-specific operation issues, and determinants of technology-adoption as well as the synergistic value generated when it is a cohesive digital ecosystem. A mixed-methods approach is used: qualitative data gathered through policymakers, refinery managers, depot operators, marketers, and logistics participants are used to inform a quantitative stage that empirically verifies the adoption factors and utilisation patterns.

The study contributes to the field as it provides a more in-depth scholarly insight into the potential of combining Machine Learning, Blockchain, and IoT to streamline petroleum supply chains in emerging economies. It offers empirical data of the organisational, environmental, and infrastructural preparedness of Nigeria towards digital transformation, which is a significant gap in the literature on this topic. The work also provides a context-specific integration framework on which researchers and practitioners can expand on to improve future research and practice in digitally enabled supply chain systems.

Keywords:

Machine Learning, Blockchain, IoT, Digital Supply Chains, Midstream and Downstream Operations.