**Reservoir Geophysics as a Driving Force for R&D of Brazilian Startups**

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# Abstract

Solutions in automation and machine learning, specifically those involving artificial intelligence, have been the focus of various technological business initiatives. Among the motivations, we have the increasing need to manage and analyze massive amounts of data acquired through digital connectivity (e.g., cloud devices), along with the growing hardware capacity for processing this information. In addition, the culture based on data-driven decision-making allows for defining optimization metrics in process efficiency. Therefore, having a computing environment integrated into data centers that can handle the mountain of generated data is truly disruptive.

In this scenario, an era of entrepreneurship and the proliferation of technology startups emerges. The business model of startups is based on the philosophy of the build-measure-learn feedback loop. The short cycles and dynamic innovation process enable the generation of new technological solutions (e.g., plugins) customized to address the key challenges of the business area. Additionally, technology hubs integrated with the leading research centers in universities benefit the innovation ecosystem and companies.

The upstream sector, specifically the Exploration & Production (E&P) and research center (CENPES) segments of Petrobras, are part of this digital disruption, with massive investments in new technologies and significant uncertainties to be addressed, acting as a driver for R&D of Brazilian startups. The impacts are seen in terms of cost reduction, process acceleration, and risk mitigation in the sector.

Part of the efforts has been focused on developing carbonate reservoirs in the Pre-salt region of the Brazilian southeast margin. Due to their mineral composition and early diagenetic processes, these carbonate reservoirs undergo chemical and physical alterations from their genesis to the present time. Production development projects implemented in these reservoirs have revealed high structural and stratigraphic complexity, with a significant portion dominated by natural fracture systems and karsts. Therefore, investments have been made in seismic data acquisition using sensors installed on the ocean floor (Ocean Bottom Nodes - OBN).

The OBN technology proves to be disruptive due to the high quality of the processed data it provides. This is achieved through its greater azimuthal richness, homogeneous seismic coverage for the target intervals, utilization of long source-receiver offsets, and significant noise reduction during acquisition. However, the exponential increase in the volume of acquired information and the nature of the data (e.g., azimuthal richness) pose technological and cultural challenges for incorporating this information into quantitative interpretation workflows and uncertainty analysis.

In this work, we will address technological solutions that utilize artificial intelligence resources and are being conducted through R&D by national startups within the corporate program "Conexões para Inovação – Módulo Startups" to optimize and accelerate the incorporation of information revealed by data with azimuthal richness into reservoir models. The project aims to improve the seismic characterization of complex geological features and optimize production curves through better well positioning definition. Additionally, it aims to reduce the risks of well loss resulting from, for example, geohazard risks.

The expected solutions will be applications to be developed or optimized to meet the demands of the proposed challenge. These solutions involve providing tools for modeling applications (e.g., Petrel, DSG, Roxar, Epos) dedicated to seismic image processing, utilizing artificial intelligence (AI) resources, such as unsupervised and supervised deep learning algorithms. In addition, these solutions will integrate data at different scales, supports, and from different physical measurements, such as well logs and production data.