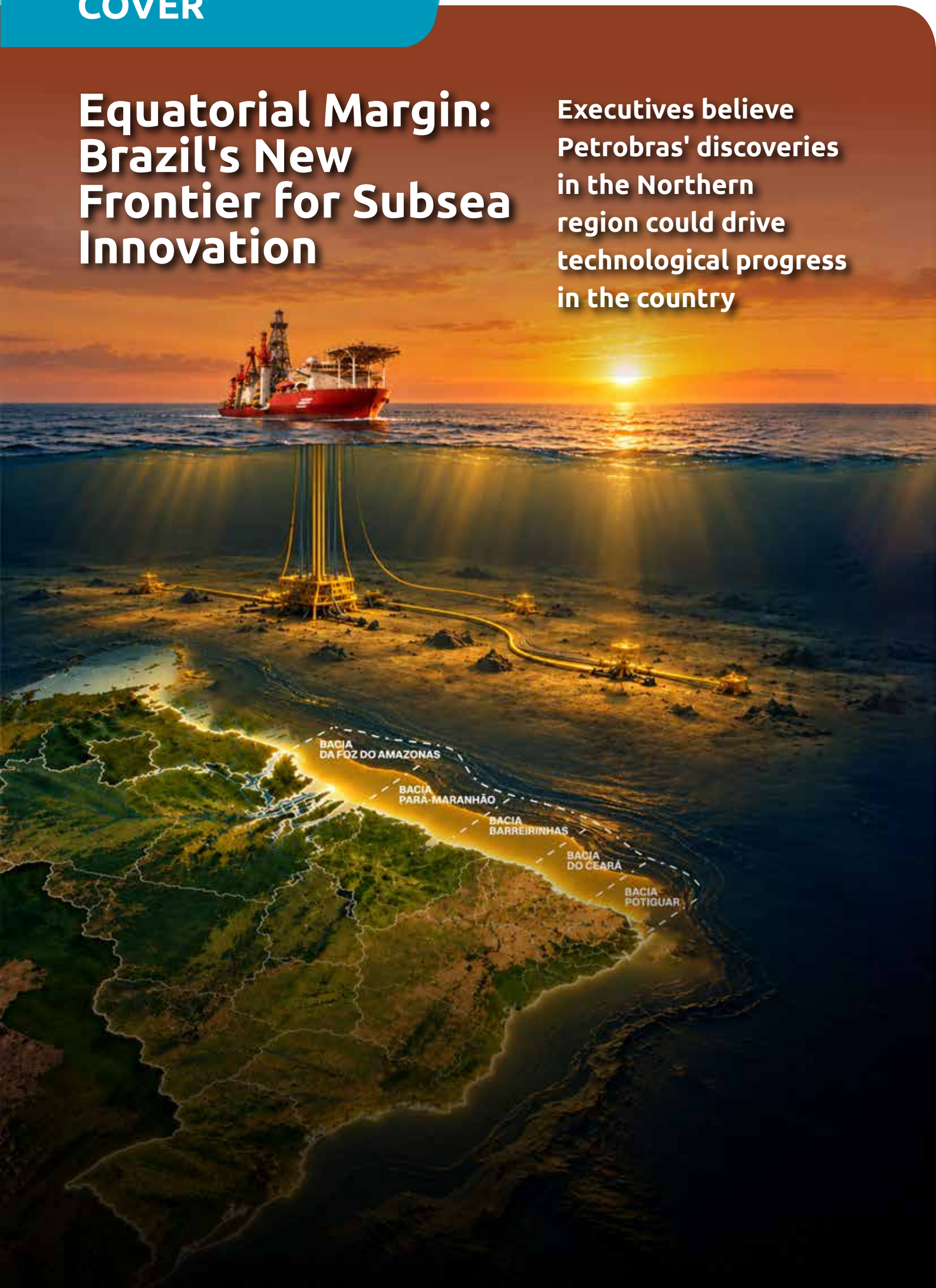
Equatorial Margin: Brazil's New Frontier for Subsea Innovation

Executives believe Petrobras' discoveries in the Northern region could drive technological progress in the country



The Equatorial Margin has grabbed the spotlight of the global offshore industry in this second half of the year. Three oil discoveries announced by Petrobras in ultra-deep waters off the coast of Amapá — one in August and two in October — have reinforced interest in the region as a promising new exploration frontier for Brazil. If exploration advances to field development and commercial production, the province has the potential to open up new opportunities for technological progress in Brazil's subsea segment.

Historically, projects in new exploration frontiers have driven innovation, because they require the industry to find safer, more efficient and more competitive ways to develop remote and technically complex



Mahesh Swaminathan
Photo: Courtesy

fields. McDermott's Senior Vice President for Subsea and Floating Facilities, Mahesh Swaminathan, said that, "The Equatorial Margin could have that effect in Brazil, although the applicable technologies will depend on the characteristics of each discovery and the development concept selected by the operator".

Among the solutions that could open up new technological possibilities in the region, the executive cites data-driven remote monitoring, automation, the use of artificial intelligence in integrity management and predictive maintenance, the electrification of subsea systems, boosting and other forms of subsea processing.

Swaminathan also believes that robotics will play a particularly important role in the region. He added that, "By reducing the need for human intervention in higher-risk activities, robotics can improve safety, increase operational consistency and enable more efficient inspection and maintenance in remote environments".

The executive notes, however, that the main advance will be seen in how these technologies are combined. Swaminathan considers that engineering will need to assess which solutions deliver real value for each field and how to integrate them into the production architecture from the earliest phases. He says that, "In this way, the Equatorial Margin could not only adopt new technologies, but also accelerate their qualification and application in future projects in Brazil".

Baker Hughes' Executive Director for Subsea Systems in Latin America, Priscila Farias, emphasizes that subsea processing systems could take center stage in the Equatorial Margin. These solutions include separation, pumping, compression and fluid


Priscila Farias
Photo: Courtesy



Photo: Petrobras Agency

reinjection equipment installed directly on the seabed. She considers that, "These technologies can improve recovery while reducing the load on topside facilities and improving overall project economics".

The executive also believes that the technologies currently used in Brazil's pre-salt layer provide a solid foundation. Nevertheless, since each basin has its own characteristics, adaptations may be needed in subsea arrangements, production architectures, gas processing and handling solutions and field configurations.

"Rather than a completely new generation of equipment, I expect an evolution of existing technologies, with increasing emphasis on configurable, standardized, and interchangeable solutions capable of serving multiple projects", she predicted.

Overall, Priscila believes that the future development of subsea systems will be defined upon three pillars: digitalization, industrialization and standardization. Offering simpler, replicable and configurable solutions at scale will be just as important as the actual emergence of revolutionary new technologies. She explains that, "This approach has the potential to unlock new developments, improve competitiveness and further strengthen Brazil's position as a global reference in offshore innovation".

Technical and Market Challenges

As with any new exploration frontier, the first challenge in the Equatorial Margin will be to reduce uncertainties regarding the subsurface. The exploration and appraisal activities currently underway should allow Petrobras to better understand the reservoir behavior, fluid properties and requirements for project development.

The information already released by Petrobras reinforces this appraisal stage. According to the company, the discovery announced in October will expand the knowledge about the area's exploration potential and provide additional data for the study of petroleum systems and resource potential. Laboratory analyses and the integration of data obtained during drilling process are still underway. In the case of the discovery announced in August, the company said it has already confirmed "the good quality of the oil found".

In addition to the reservoir and fluid characteristics, planning for any eventual development will depend on information about metocean conditions, seabed characteristics and logistics support for operations, as well as the intervention and maintenance strategies - while also taking into account the region's specific environmental peculiarities.

If the discoveries support future commercial projects, the subsea segment will have to turn the data obtained into reliable, technically feasible and economically competitive production architecture. Mahesh Swaminathan believes that one of the main challenges will be coordinating the different disciplines involved, all the way from the early planning stages.

He explained that, "Subsea architecture, flow assurance, flowlines, risers, floating

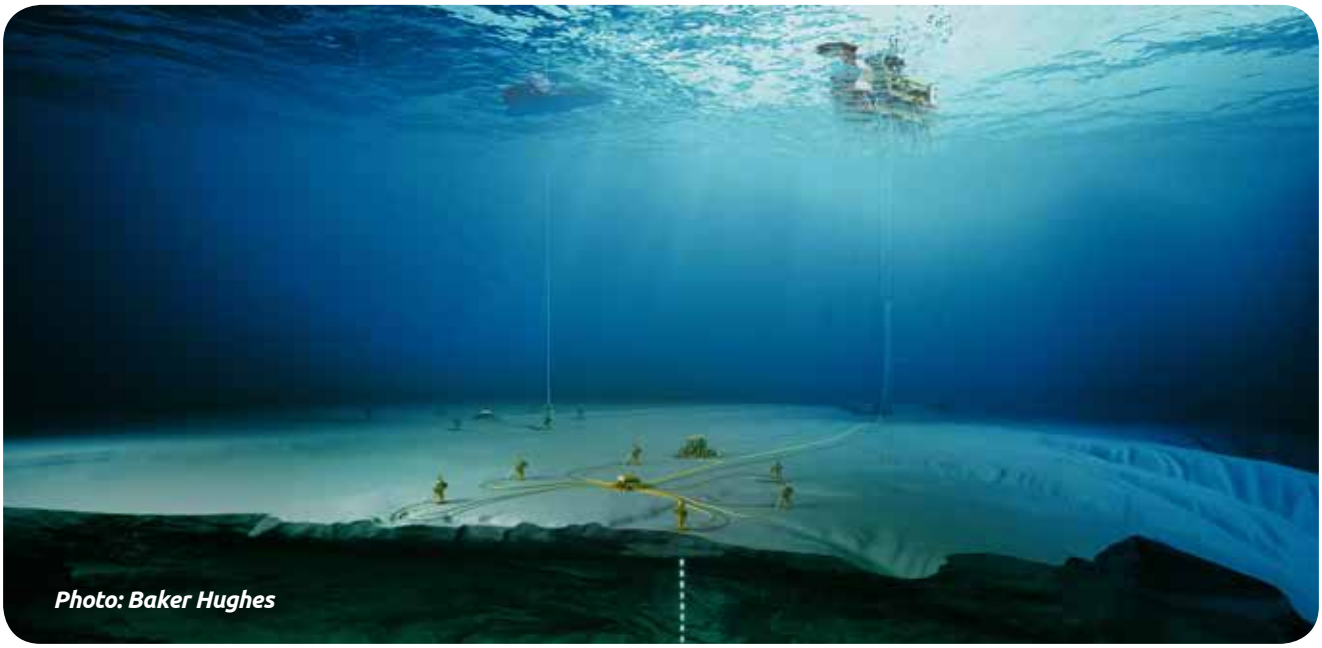


Photo: Baker Hughes

systems, installation, logistics and intervention strategy are interconnected. A decision in one of these areas can significantly affect the others". He added, "That is why, for a new frontier such as the Equatorial Margin, I therefore believe the principal challenge will be integrating these decisions early enough to develop the right solution for the field".

The determining of the necessary equipment and systems will also depend on the results of the appraisal phase. Swaminathan says that the selection and accreditation of solutions will need to to take into consideration the full operational structure established by the operator, including pressure, temperature, fluid composition, water depth, field operational lifespan and intervention strategy.

Both Swaminathan and Priscila Farias consider it premature to draw conclusions about the pressure regimes that could characterize the developments in the Equatorial Margin. Both of them emphasize, however, that the industry has been preparing itself to operate in increasingly challenging environments. The sector already has decades of experience in deep waters and in using technologies developed for high-pressure, high-temperature environments.

Priscila stressed that, "If future developments require operating conditions above 10,000 psi, pressure should not be viewed as a limiting factor. The key challenge will be selecting and qualifying the most appropriate technologies for the specific reservoir conditions identified as exploration progresses".

In addition to the engineering requirements, the capacity of the supply chain will be decisive in meeting any eventual expansion of the activities. In this regard, Brazil starts from a consolidated base of knowledge and performance in deep and ultra-deep waters, with experience in engineering, manufacturing, installation and operations.

The Baker Hughes executive believes that the experience accumulated in pre-salt projects, combined with the current standardization and industrialization efforts, should favor the sector with regard to any future opportunities. However, capitalizing on this potential will be reliant on conditions that allow the industry to prepare itself for demand that is still contingent upon the progress of the exploration and the definition of the projects.

She pointed out that, "Predictability enables suppliers to invest in capacity expansion, workforce development, and



NS-42 rig used in drilling operations off the coast of Amapá
Photo: Courtesy of Foresea

technology deployment in advance of demand peaks".

Planning and Talent Development

The opening up of a new production front in the Equatorial Margin raises questions about a possible overload in the availability of equipment, suppliers and workforce, which are all currently employed in pre-salt projects. Mahesh Swaminathan considers that the expansion of these activities could put pressure on the supply chain, especially if the Equatorial Margin and pre-salt projects progress according to similar schedules.

In the opinion of the executive, the most likely constraints would be related to the availability of vessels for installation, manufacturing capacity, equipment with a long-lead-time and specialized professionals. He says that, "This does not mean the new demand must compromise projects already in execution. The impact will depend on the sequencing of investments, the extent to which schedules overlap and the visibility operators and suppliers have to plan capacity".

The adoption of measures such as early engineering, clear definition of interfaces, the identification and procurement of long-lead-time items and project standardization, where appropriate, can reduce the risks. Demand predictability also makes it possible to reserve assets, expand manufacturing capacity and develop the necessary skills before the peak execution periods arrive.

Swaminathan predicts that "There may therefore be short-term pressure, but it can be managed through early planning, collaboration and continuous supply chain development. If well coordinated, the new frontier could also expand installed capacity and strengthen the Brazilian subsea market over the long term".

Priscila Farias also acknowledges that any significant increase in offshore activity imposes additional demands on the supply chain. Even so, the executive sees this issue less as a capacity problem and more as a planning challenge.

She stated that, "Diversifying the suppliers, strengthening the local content and expanding the manufacturing capacity, as well as closer collaboration between operators and suppliers, will play a key role in ensuring resilience and flexibility along the value chain". She reiterated that Brazil's subsea systems industry has repeatedly demonstrated its ability to scale up its operations whenever it has a predictable and sustainable project portfolio.