Lloyd's Register

Working together for a safer world

Brazil Oil & Gas Technology Radar

With support from ibp BRAZILIAN PETROLEUM, GAS AND BIOFUELS INSTITUTE

Executive Summary

The collapse in the oil price, combined with a large-scale corruption scandal that cast a shadow over operators, service providers and policymakers, have put serious pressure on the Brazilian oil and gas sector in recent months.

However, it has also led to a strategic re-think at a number of different levels within the industry. With ongoing improvements in oil and gas regulation, compliance, and a steady return to political stability, Brazil now looks well placed to remain one of the world's key oil and gas producers.

This research sought the perspectives of more than 240 companies in the Brazilian oil and gas sector, exploring attitudes towards new technology and innovation at a critical time for the country's economy.

It asks what the biggest barriers to innovation are today in Brazil, what challenges exist to the deployment of new technologies, and explores the impact of specific policies on the sector, such as the mandatory 1% levy on oil and gas production that is being redirected to local R&D.

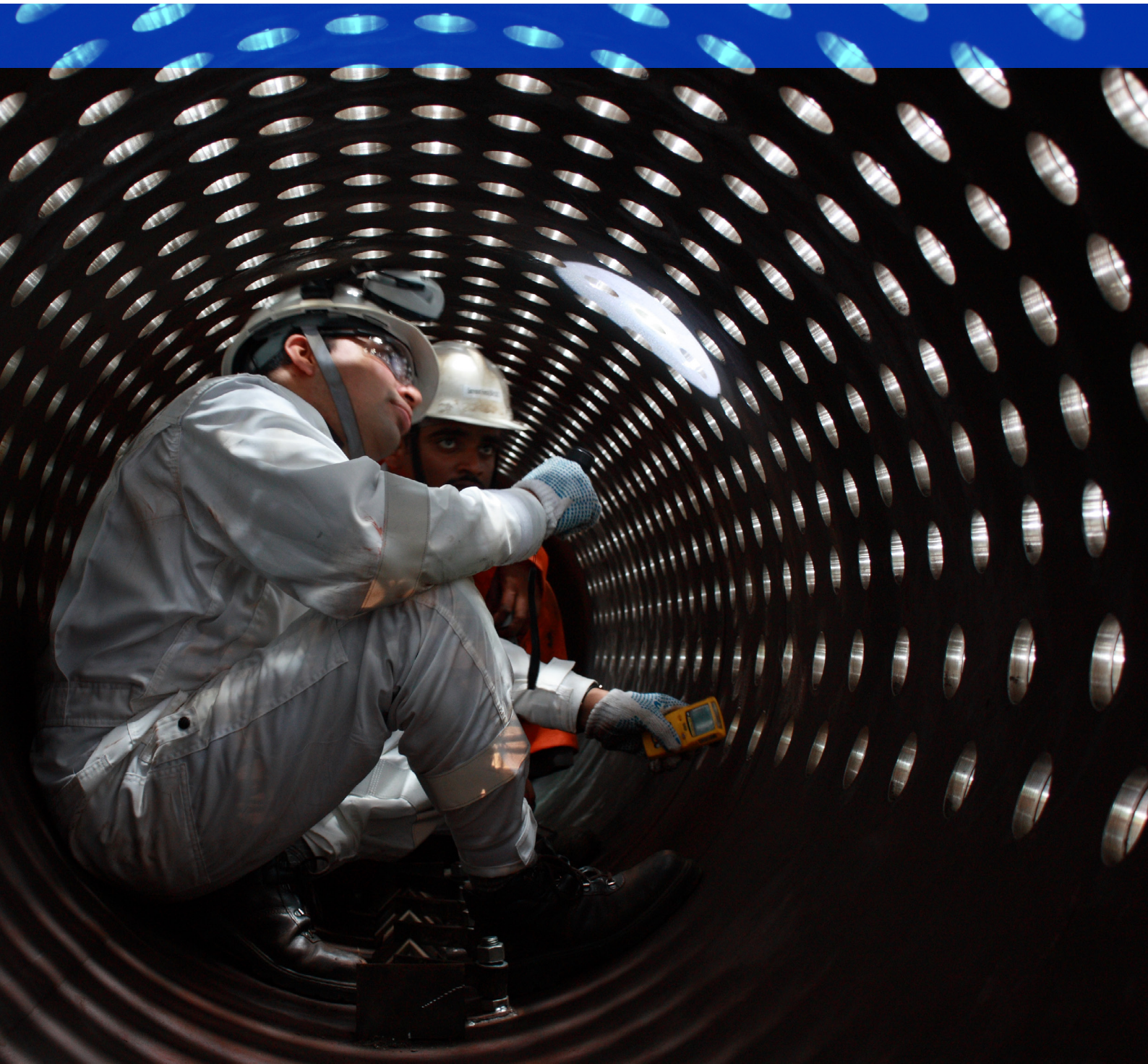
The survey also asked participants to rank a number of potentially game-changing technologies in terms of their short and longer-term impact on the sector.

Lloyd's Register would like to thank the Brazilian Institute of Oil, Gas and Biofuels (IBP) for their support in conducting this survey.

About the research

Between September 5 and October 3 2016, Lloyd's Register surveyed Brazil-based oil and gas leaders. Of these, 35% were oil and gas operators, 57% were contractors, service providers or suppliers, and 7% were regulators. 70% came from privately held companies, 15% from publicly-listed companies, 2% from joint ventures, and 7% from state-owned or hybrid companies. Respondents came from a wide range of functional areas, including R&D (22%), operations (20%), production (22%), strategy (6%), finance (11%) and senior management (19%).

Brazil's 2016 Tech Radar Results



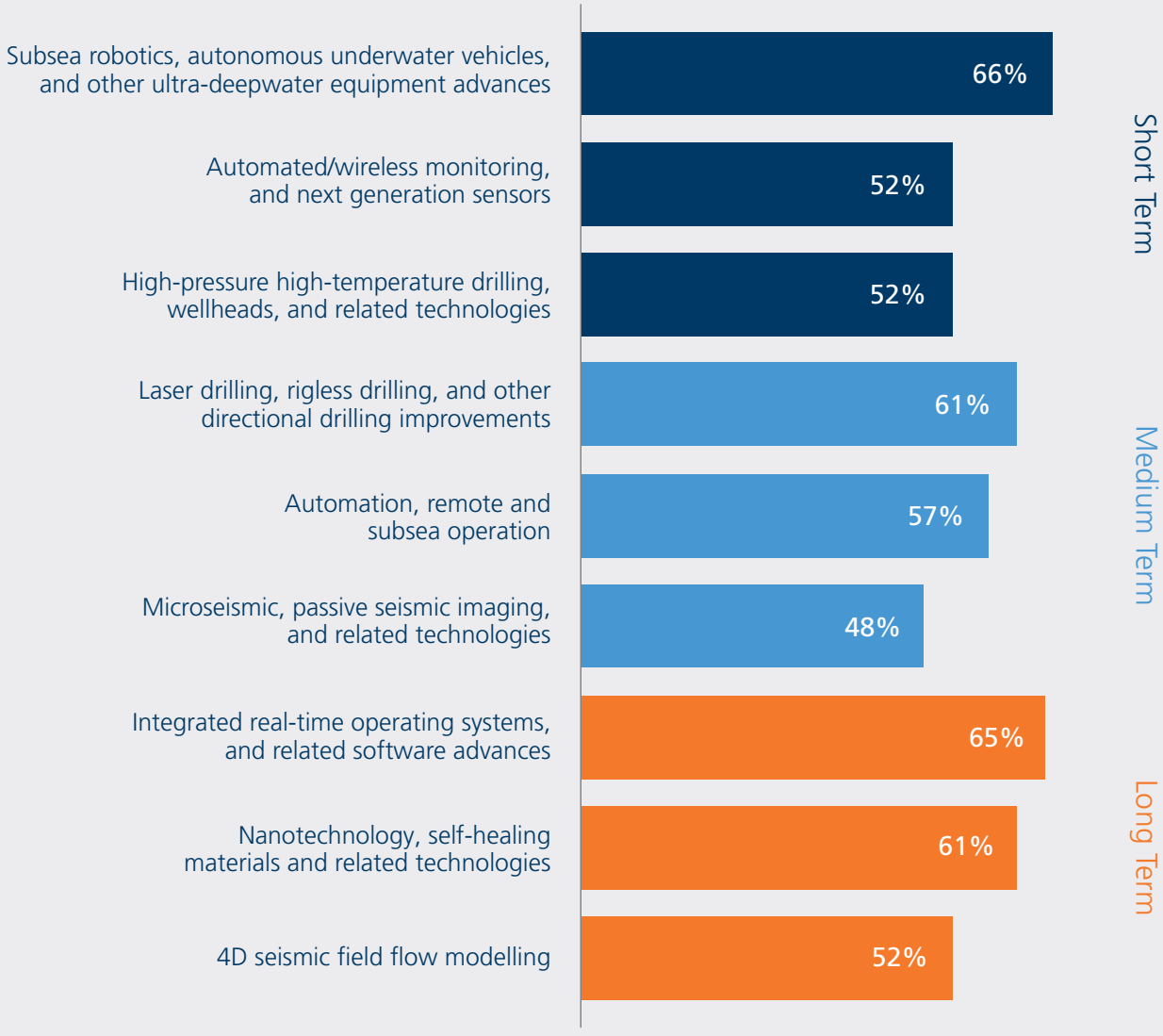
The 2015 edition of our Technology Radar, which surveyed more than 450 oil and gas professionals globally, identified a number of technologies with potential to transform the industry.

Of the 26 technologies listed in our 2016 survey, respondents believed all would have some impact in the future. Distinctions were made between those that would have a high or medium impact in the short term (before 2020), medium (2020-2025) or long term (2025 or later) time horizon.

The technologies that were selected as having a large impact over the short term were all incremental improvements on existing technologies: subsea robotics and other deepwater equipment advances, sensor technology such as wireless monitoring, and high-pressure high-temperature drilling.

In the medium term, technologies such as laser and rigless drilling were chosen, along with advances in remote, subsea operations, and microseismic or passive seismic imaging.

In the long term, the technologies that respondents believe will have most impact range from nanotechnology and self-healing equipment, through to 4D seismic field flow modelling, and software advances, such as integrated, real-time operating systems.



Other Key Findings

1

Oil price and deployment are seen as key barriers to innovation – and innovation expectations have been reset

The continued low oil price is putting a dampener on innovation – 74% of respondents either agree or strongly agree that it has led them to slow or halt most of their innovation initiatives.

However, it seems like the new low-price environment has reset expectations of what can be achieved in terms of innovation. Close to nine out of ten respondents say they have been successful at meeting their innovation goals and objectives over the past two years. A third of respondents say they have been highly successful at meeting or exceeding all of their goals and objectives.

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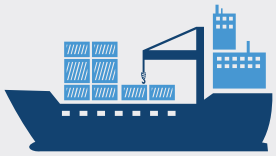

Deployment is also seen as a major barrier to innovation

More than a third of respondents (37%) believe that the average time taken to develop a technology from concept to deployment will stay the same over the next two years. A third (33%) believe it will increase, and 22% say they think it will decrease.

At the same time, 37% believe the total cost/effort of getting a new technology from development to deployment will increase, with 30% saying it will stay the same and 26% saying it will decrease.

3

From development to deployment: cost and uncertainty are the biggest barriers to technology adoption

The top three barriers to bringing a new innovation or technology to market, as selected by respondents, are:

1. Cost of development 63%
2. Uncertainty over returns 35%
3. Uncertainty over oil and gas prices 30%

A fifth (20%) say dealing with corruption is a barrier to bringing new technology to market. Local regulations being too stringent are less of an issue – it is cited as a barrier by just 17% respondents.

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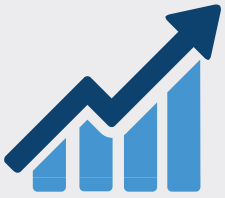

Expectations are growing for improved recovery rates from existing fields

Just under half (41%) of respondents believe their average recovery rate will increase over the next two years, with 33% expecting it to stay the same, and 11% expecting it to decrease.

More than a third of respondents (39%) say their level of proven reserves will stay the same over the next two years. 30%, however, say it will increase, with a smaller group (20%) saying their level of reserves will decrease.

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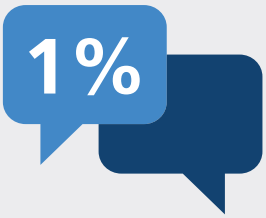

Opinions are mixed on Brazil's mandatory 1% levy on oil and gas production (Regulation 03/2015)

Over three quarters (78%) believe the levy is delivering according to its overall purpose. But it is in the details of the levy where respondent concerns are most prevalent. Nine in ten (90%) believe the 1% level of the levy should be more flexible – for example, it could be increased when the oil price is high, but reduced when it's low.

More than three quarters (81%) of respondents say that the levy has delivered limited advances in terms of new products, processes or materials relevant to the oil and gas industry. Although its relatively recent introduction could account for this number. Even more (95%) believe that the process for allocating R&D funds from the levy to local universities and smaller businesses needs to be improved, so that more organisations can participate.

And when asked about its overall impact on the industry, respondents are split down the middle: half agree that it has been strongly positive; half do not.

Interestingly for the oil and gas sector, nearly three quarters (70%) say that the renewables-focused element of the levy should be increased.

Overall, more than two thirds of respondents (76%) believe the regulation will provide a net improvement to Brazil's R&D environment, although the same number believes it poses a challenge to how companies register and protect their IP rights.

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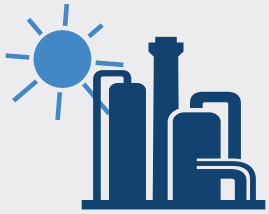
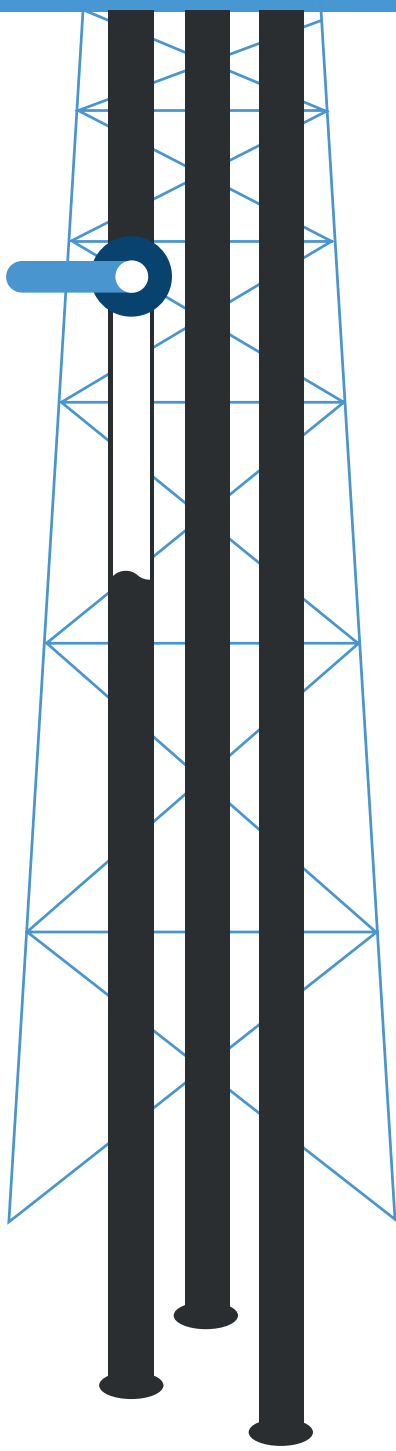


Environmental impact and operational efficiency are key drivers for innovation investment

'To comply with local legislation' was the factor that the majority of respondents chose as their biggest driver for investment in local R&D, but when looking at top three drivers combined, operational efficiency came top.

Top three reasons for investing in innovation in Brazil, when combining all responses, are:

1. To improve operational efficiency 44%
2. To reduce costs 41%
3. To reduce environmental impact 33%



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