

Upstream Technology and Innovation (UTAI)

New Directions for Oil & Gas Technology

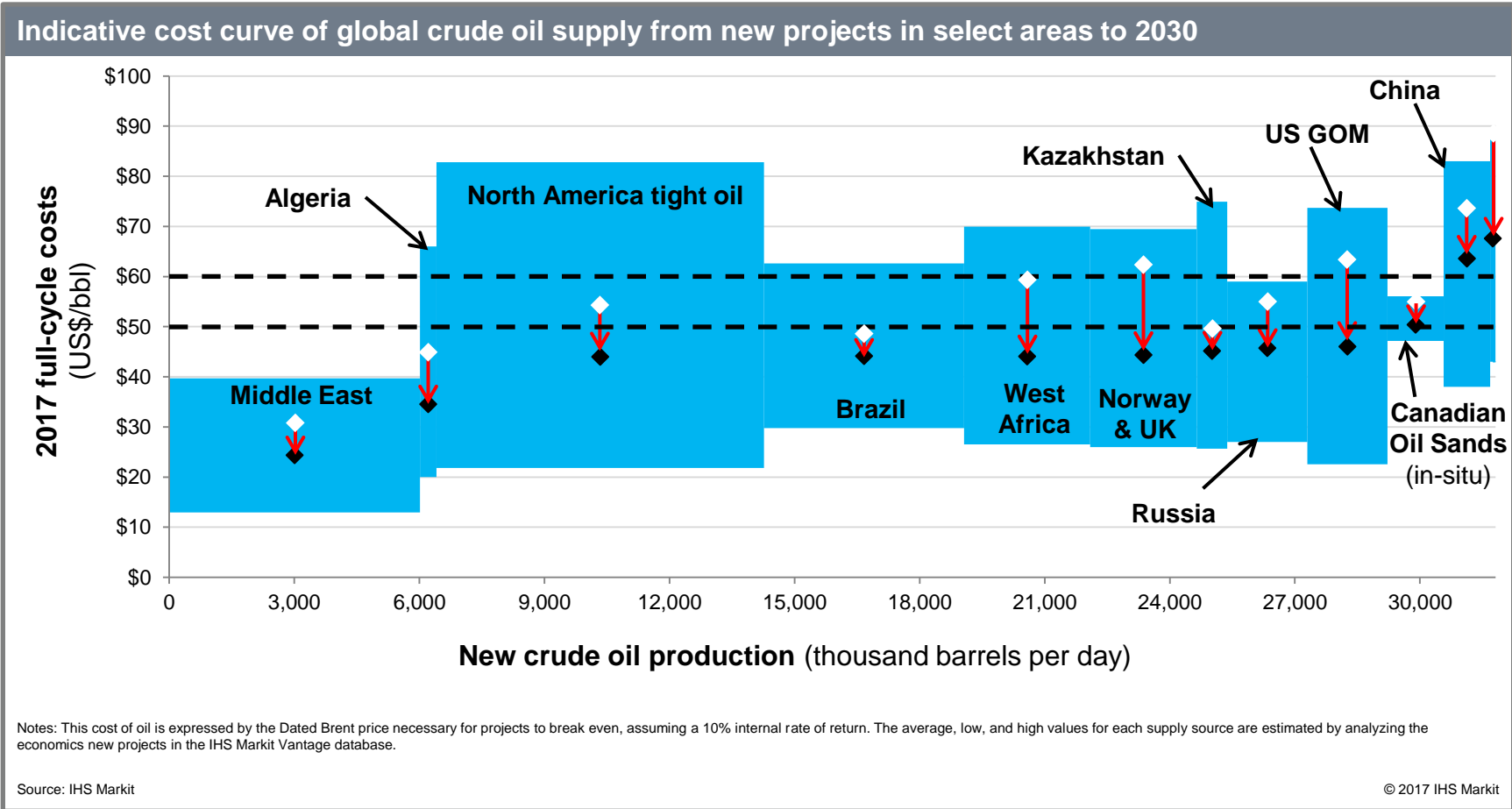
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JOGMEC Techno Forum — International Technology Innovation Panel

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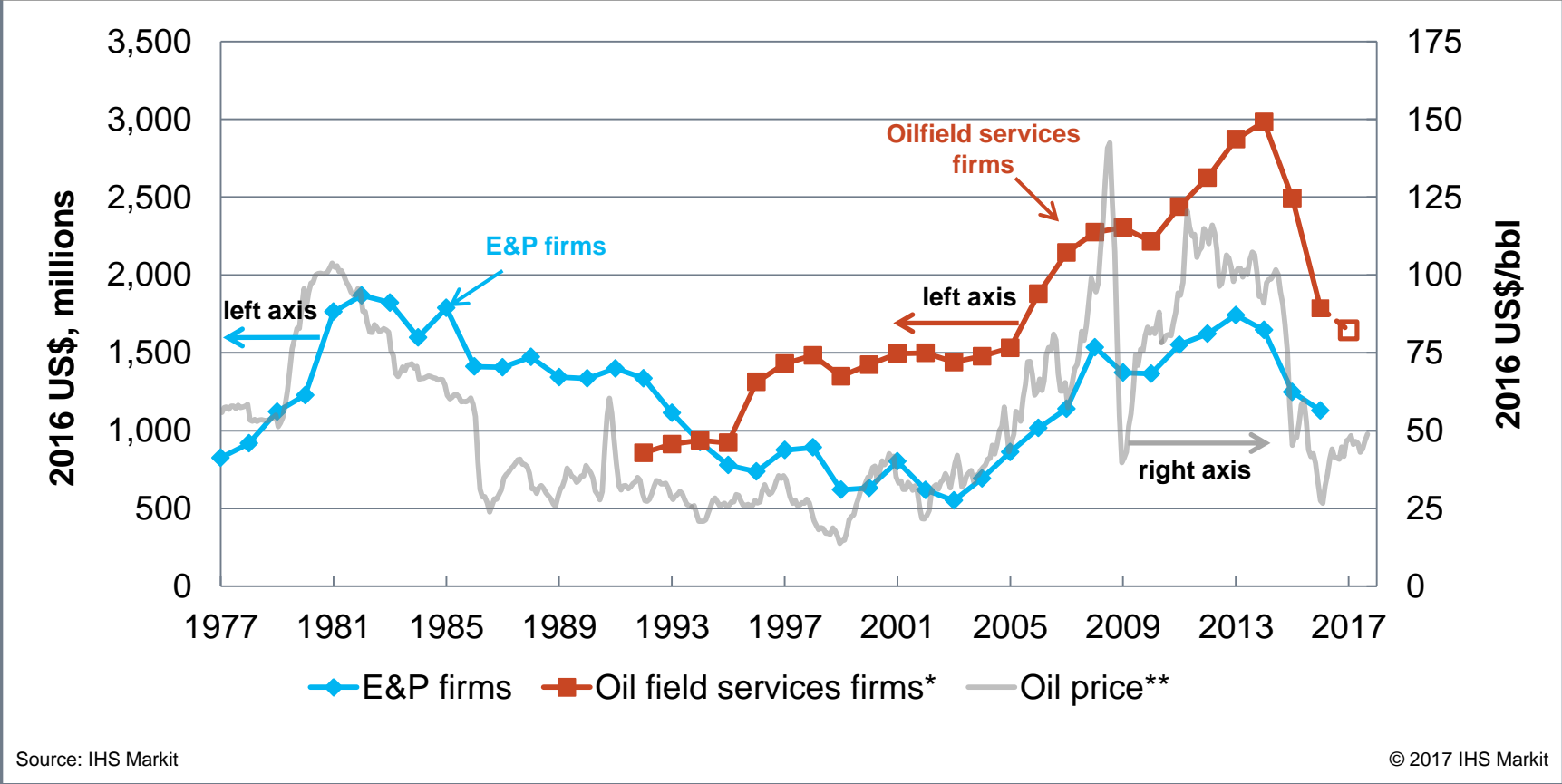


The upstream sector has re-set its cost structure through a combination of cyclical and structural factors



Substantial technology investment cuts are beginning to moderate as E&P organizations look in new directions

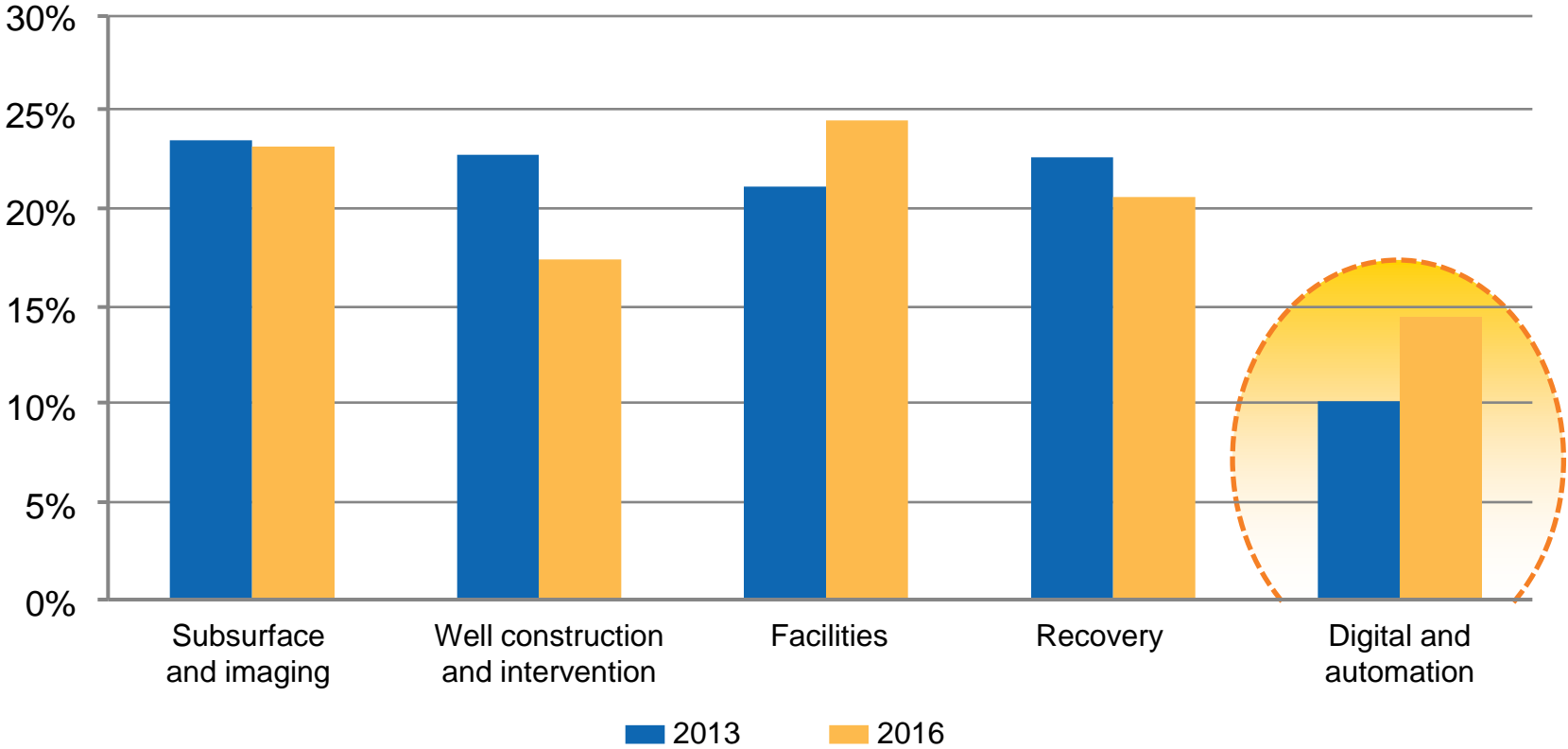
Upstream R&D spending of select E&P and oilfield services firms



Notes: *US-based public oil and gas companies and the US-based subsidiaries of public foreign oil and gas companies that had at least 1% of US oil or gas production or reserves; sources: Department of Energy, EIA, IHS Markit analysis
 ** Leading oilfield equipment and service firms (24 firms examined); sources: Annual Reports, IHS Markit analysis

E&P players are adjusting technology priorities to compete in a low price environment—digital and automation technologies are rising

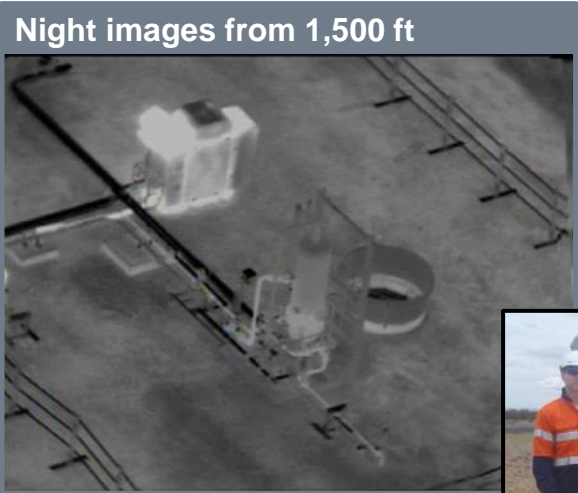
Upstream technology development focus areas*



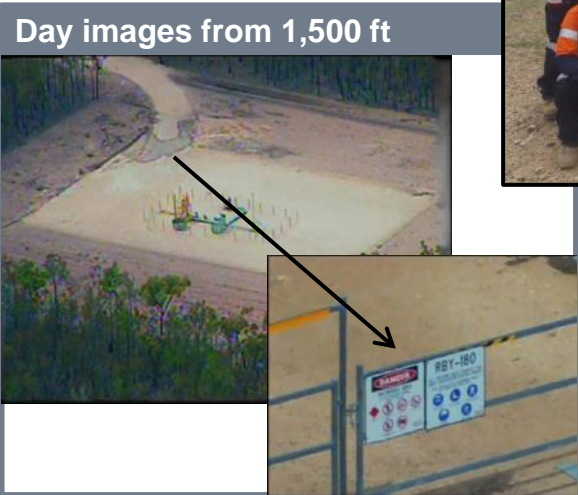
Notes: *806 technology focus areas of 29 E&P firms and OFS/EPC firms for 2013 and 891 technology focus areas of 34 E&P firms and OFS/EPC firms for 2016.
Source: IHS Markit

Digitalization is delivering real business value

Robots, drones, autonomous vehicles



1.4 million fewer km/month driven



Mobility



6% production uplift

The downturn has encouraged E&P organizations to pursue more diverse technology sourcing strategies—how best to balance them?

Expanding sources of upstream innovation

Formal, research center-based R&D

- Shift toward resource holder countries
- Seeking “clusters”

Open innovation

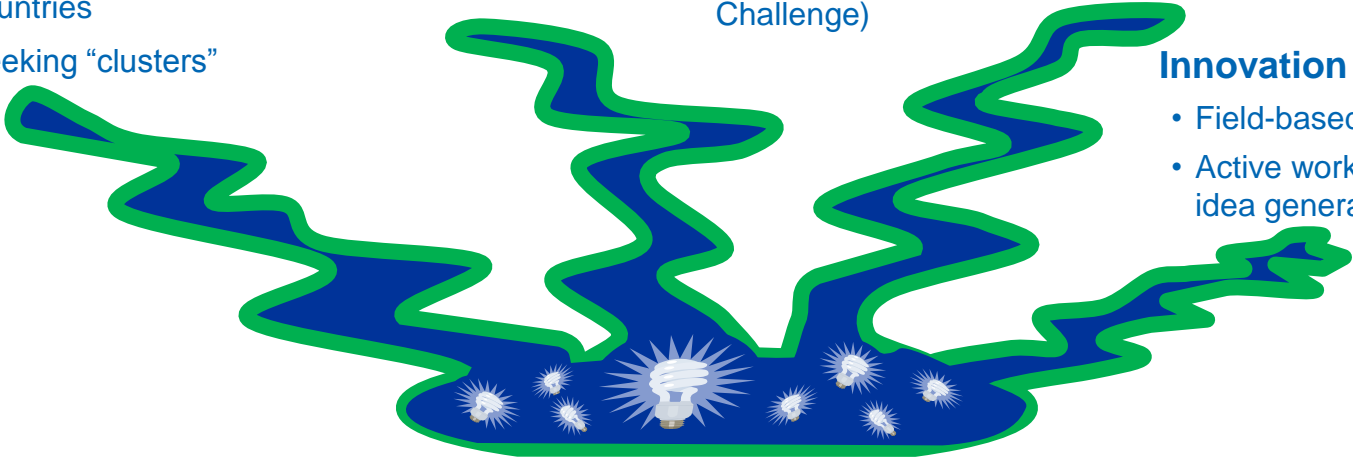
- Partnerships and alliances with and between industrial suppliers
- JIPs (e.g., OGCI, COSIA, Project 20K)
- Crowd sourcing (e.g., Robotics Challenge)

Corporate venture groups

- Access early stage technology outside core focus areas

Innovation at the edges

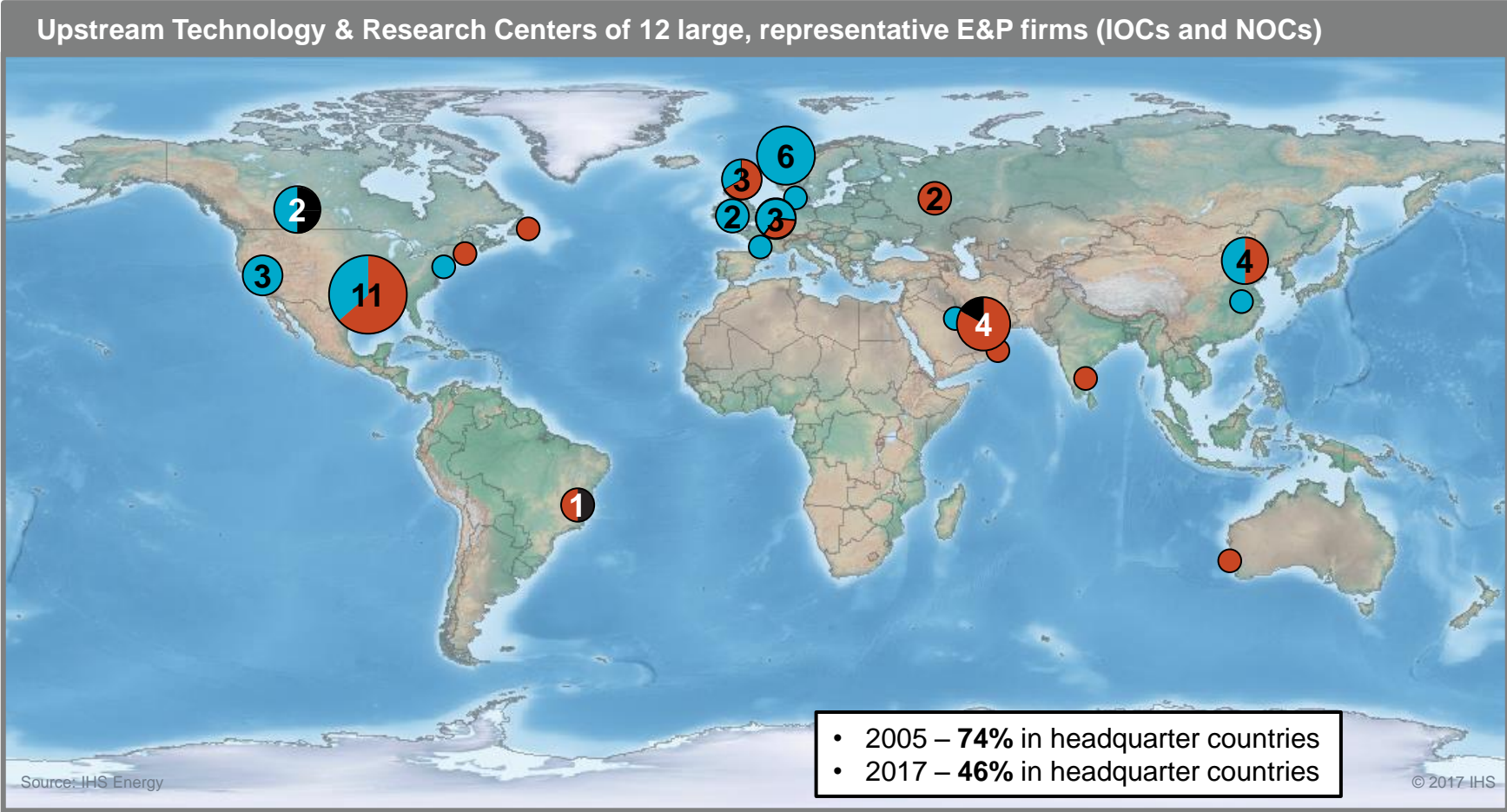
- Field-based experimenting
- Active workforce innovation idea generation



Source: IHS Markit

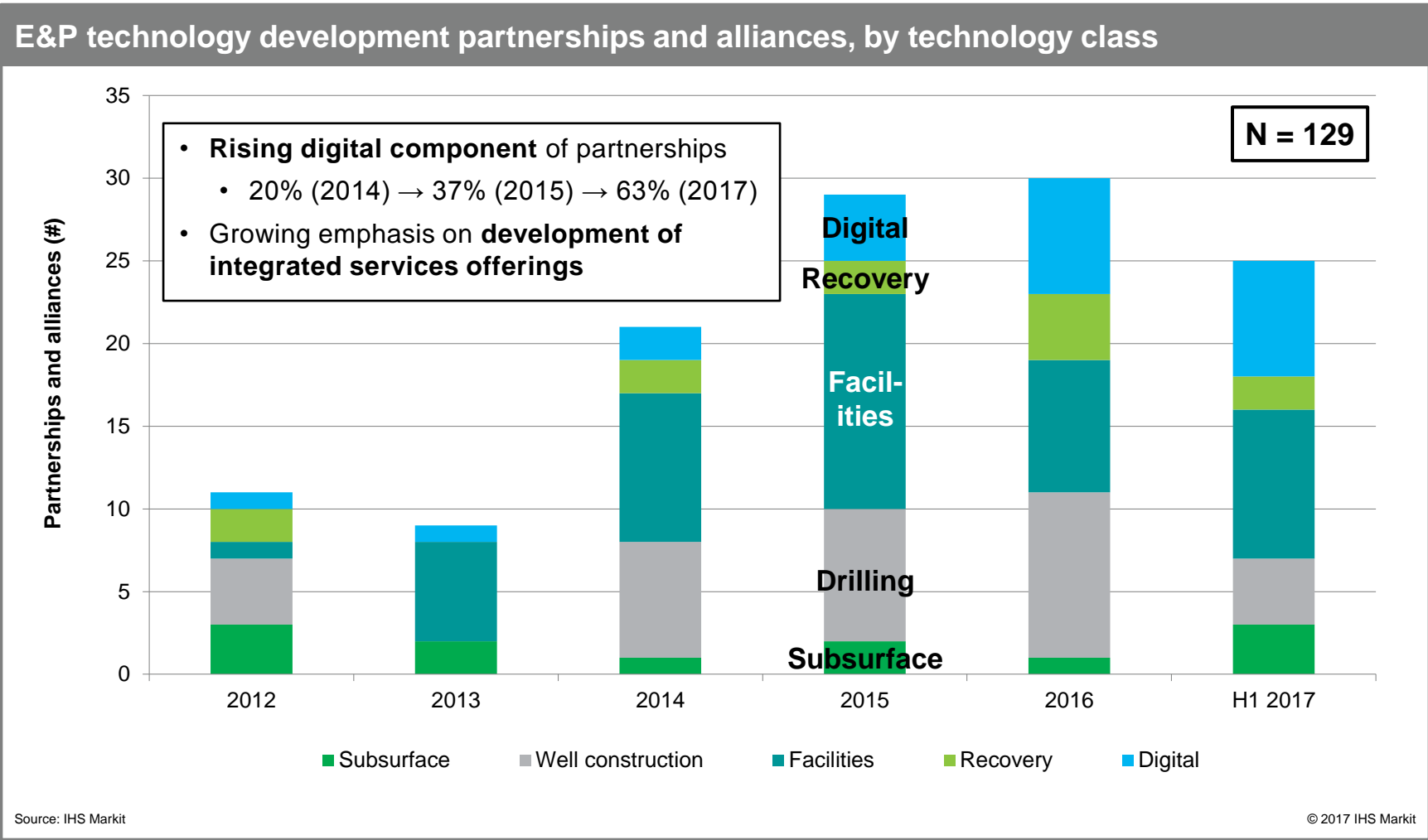
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The Globalization of Innovation

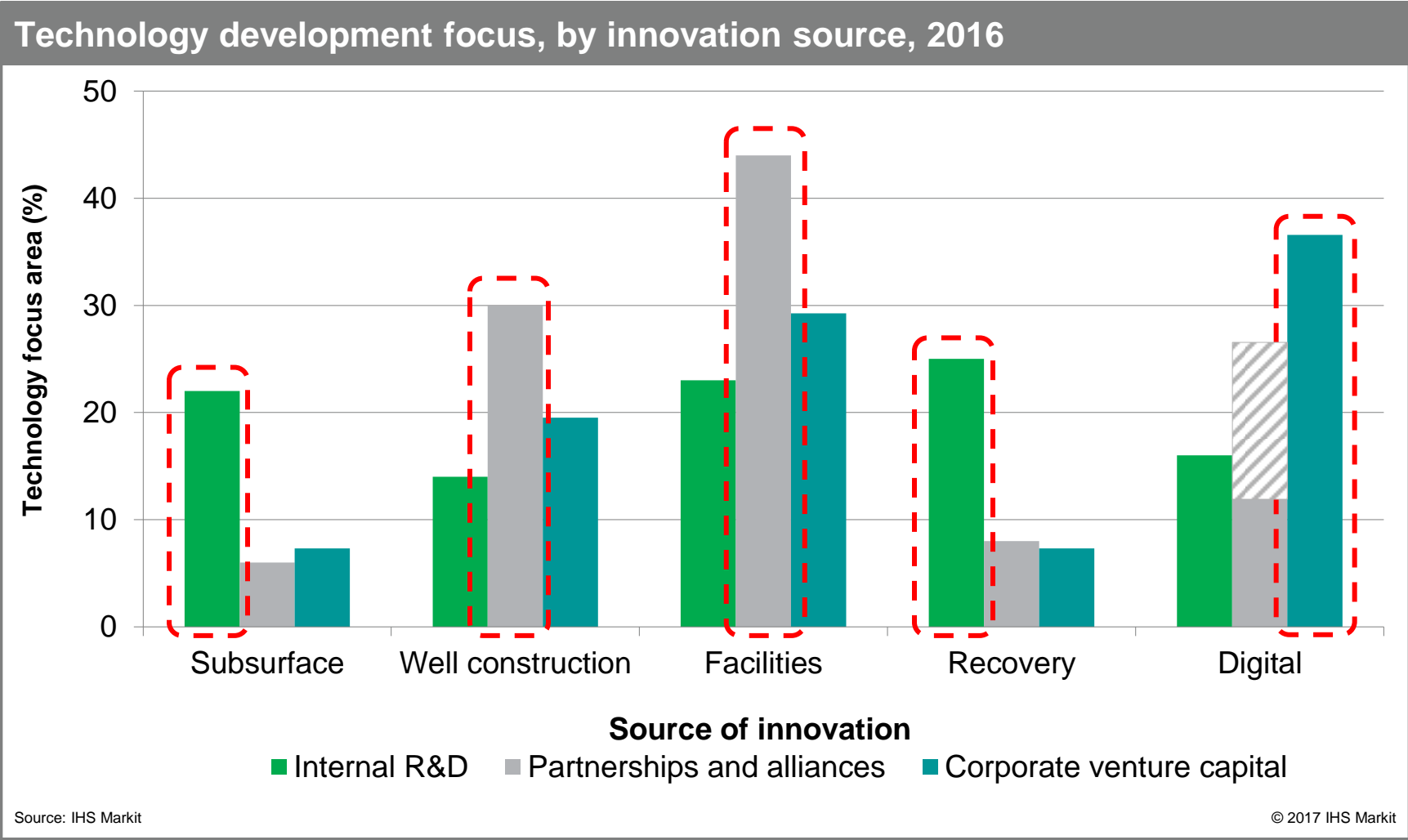


● In place in 2005 ● Constructed since 2006 ● Closed since 2014

The growth and evolution of technology development partnerships reflects expanding innovation portfolios



E&P organizations are pursuing increasingly portfolio-based approaches to technology development



Upstream Technology and Innovation

Valuable insights into the technology trends and developments taking place across the exploration and production value chain, including how best to source, manage, and advance them



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