RystadEnergy

The $500 billion case for digital and AI in upstream oil and gas

Whitepaper

A Rystad Energy Advisory analysis

Rystad Energy Advisory
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The size of the prize

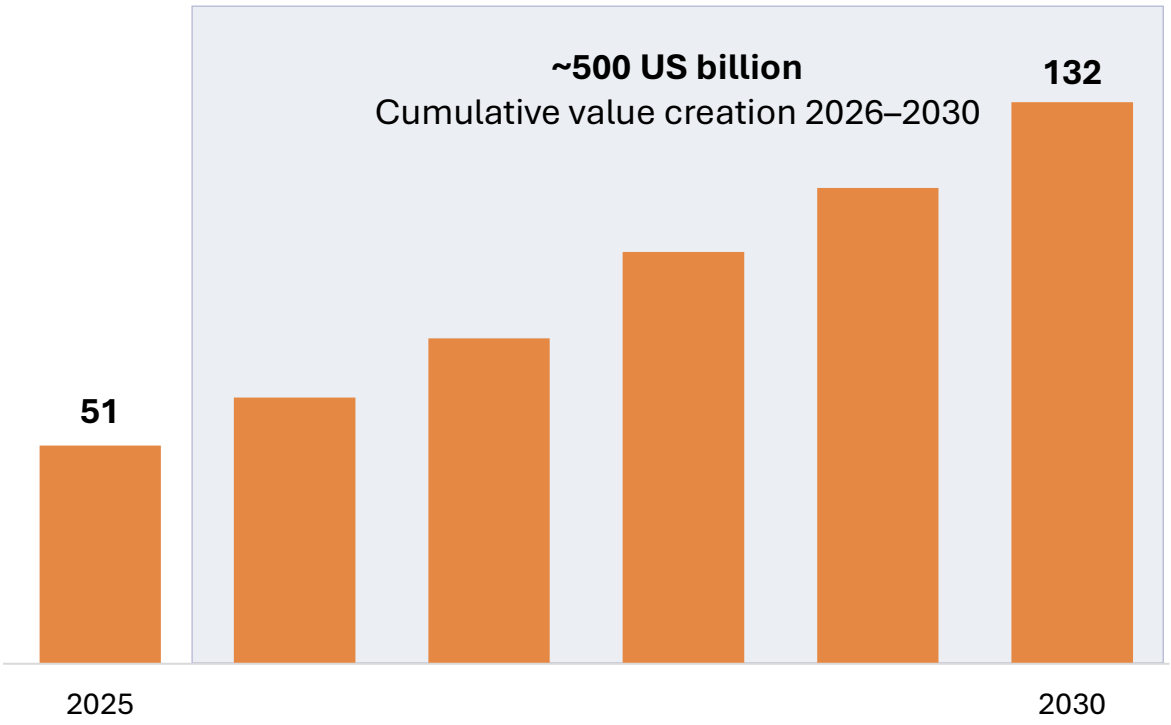
Digitalization and artificial intelligence (AI) will create more than $80 billion in additional value for the world's oil and gas players in 2030 compared to 2025 by reducing costs, boosting output and shortening development timelines, according to Rystad Energy estimates. In total, exploration and production (E&P) players currently investing in digital and AI are expected to generate close to $500 billion in cumulative value between 2026 and 2030 (Figure 1).

The most intuitive value is direct cost savings from doing multiple workflows more efficiently, such as preventative maintenance. This can also be tied to cost avoidance , for instance by reducing overall rig time because of faster drilling and completion activities. Digital initiatives can also increase production, with additional volumes coming from either higher uptime or increased recovery from the subsurface. Volumes from higher uptime would typically represent a net present value (NPV) effect where volumes are produced faster. Finally, time savings from doing field development work faster also have a NPV effect by cutting the time from early-phase planning to first oil/gas.

Of these three main value-creating pools, cost reductions and production increases are the largest factors, contributing roughly equal amounts of value through 2030 (Figure 2). These are direct, measurable asset-level values. In addition comes indirect value creation at the corporate level, such as better health, safety and environment (HSE) performance, faster decision cycles and better capital allocation – though these potential effects are less obvious to quantify and are not included in our $500 billion figure.

The returns from digital investments are already visible in the industry. Abu Dhabi-based operator ADNOC reported $500 million in AI-driven value already in 2023, and the UAE state giant has committed $1.5 billion in digital capital expenditure targeting $1 billion in annual value creation. Norway's Equinor generated around $200 million in AI-related savings between 2021 and 2024, before reporting $130 million in 2025 alone. The trajectory is not linear, however: digital value creation follows a compounding curve as adoption increases and organizational capabilities mature.

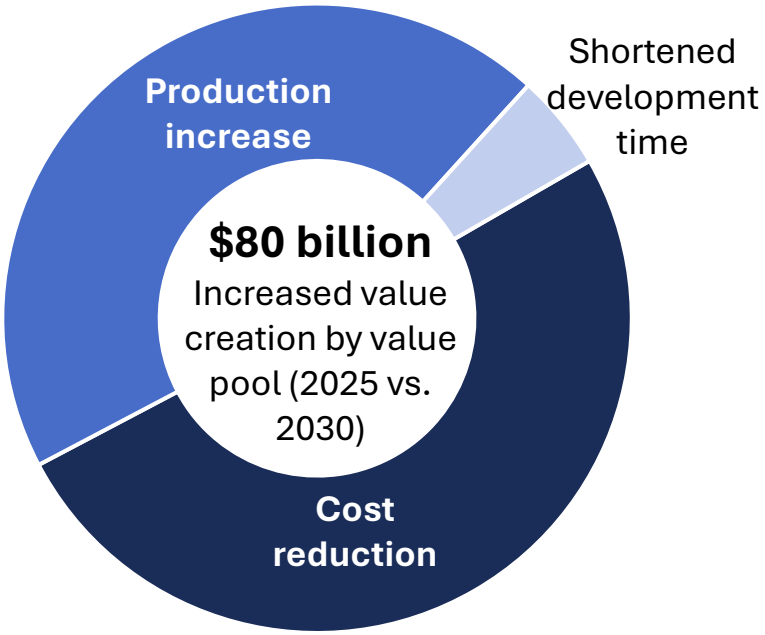
Figure 1: Annual value creation 2025–2030 from digital and AI initiatives in upstream oil and gas
USD billion



Source: Rystad Energy research and analysis

Three main pools of value creation

Figure 2: Additional value creation by value pool, 2030 vs. 2025
USD billion



Source: Rystad Energy research and analysis

Estimating the value creation potential from digital and AI across upstream workflows can be summarized by combining three main inputs. First, we define different workflows (see Chapter 2 for more details), where we assess the performance impact of digital initiatives, drawing on observed operator outcomes, public case studies and interviews with various industry experts to establish impact ranges.

Second, these impact estimates are combined with adoption curves that reflect where early adopters, followers and laggards currently sit and how quickly each group is likely to scale up. Adoption timelines and potential impact are further adjusted for asset-level factors, including asset age, supply segment and lifecycle stage. Older or late-producing assets face additional instrumentation and integration constraints that slow adoption and reduce impact.

To put this in context, Norwegian operator Aker BP is currently developing the offshore Yggdrasil project which is scheduled to start production in 2027. The facility is designed to be remotely operated from the start, taking advantage of all the latest digital developments. The same company also operates an asset that is less than 15 years old, but where gathering and contextualizing data from existing sensors was a big lift and at first it was only able to contextualize about 10% of the data. For older assets, operators will need to perform cost-benefit analyses before deciding to spend money to retrofit the hardware needed to benefit from the latest digital and AI tools. Additionally, different supply segments stand to gain more than others, such as deepwater drilling versus US shale.

Finally, the workflow-level estimates are connected to Rystad Energy's underlying asset-level production and spending data to translate improvements into USD terms. This anchors the value creation figures to the actual cost base and production volumes each workflow operates against (more detail in Chapter 3).

Source: Rystad Energy research and analysis

Where the value sits

Figure 3: Upstream workflow categories

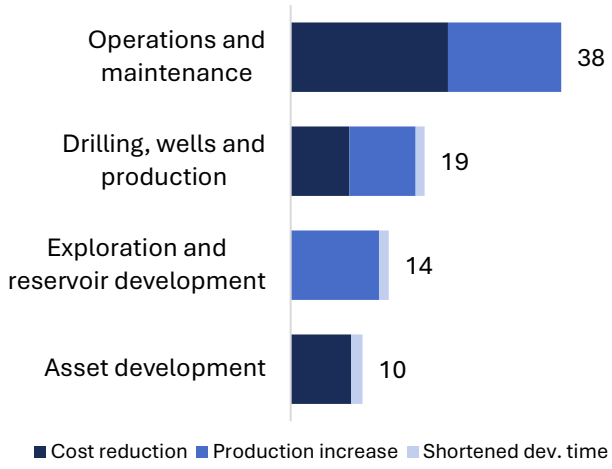
	Planning & development	Operations
Surface	**A Asset development** 1 **A1. Studies & planning** *Field development excluding reservoir development, engineering and planning of surface-level installations* 2 **A2. Construction & equipment** *Construction, topside and subsea installations, vessel operations, commissioning, major equipment, decommissioning, etc.*	**B Operations and maintenance** 1 **B1. Maintenance** *Preventive, predictive and reactive maintenance* 2 **B2. Asset operations** *Inspections, surveillance, operational staff, etc.* 3 **B3. Logistics** *Vessel logistics, helicopters, road freight, etc.*
Subsurface	**C Exploration & reservoir development** 1 **C1. Exploration** *Geological studies, seismic surveys, interpretation, appraisal* 2 **C2. Reservoir modelling and development** *Well & reservoir modelling, monitoring, field planning and development*	**D Drilling, wells & production** 1 **D1. Drilling & well completion** *Drilling, well construction (excluding fracking)* 2 **D2. Hydraulic fracturing** *(Excluding drilling scope)* 3 **D3. Stimulation and production** *Production, stimulation, EOR, artificial lift*

The $500 billion value creation opportunity in upstream oil and gas spans four main workflow categories, which can be further broken down into sub-categories, as defined in the matrix in Figure 3. We distinguish between workflows tied to surface versus subsurface, and operations versus planning. Some workflows, such as artificial lift, could cover several of these definitions, but this grouping is used consistently to estimate the value creation.

Each of these main workflows is at a different stage of digital maturity. Historically, operators have deployed a wide range of digital tools into various workflows, especially within exploration and reservoir development. When it comes to newer deployments, operations & maintenance is seeing more rapid adoption, primarily through predictive maintenance and remote operations that deliver double-digit cost reductions for leading operators. For instance, a significant part of Equinor's stated AI savings are driven by predictive maintenance.

Subsurface workflows hold a large, untapped value potential, especially from getting more volumes out of the ground and reducing drilling costs. Several operators have, for instance, compressed seismic interpretation timelines from months to less than 10 days, and the next step is to transfer this increased reservoir knowledge into real value. Figure 4 summarizes the estimated value creation figures by main workflow and value pool.

Figure 4: Increased value creation by workflow and value pool, 2030 vs 2025
USD billion



Source: Rystad Energy research and analysis

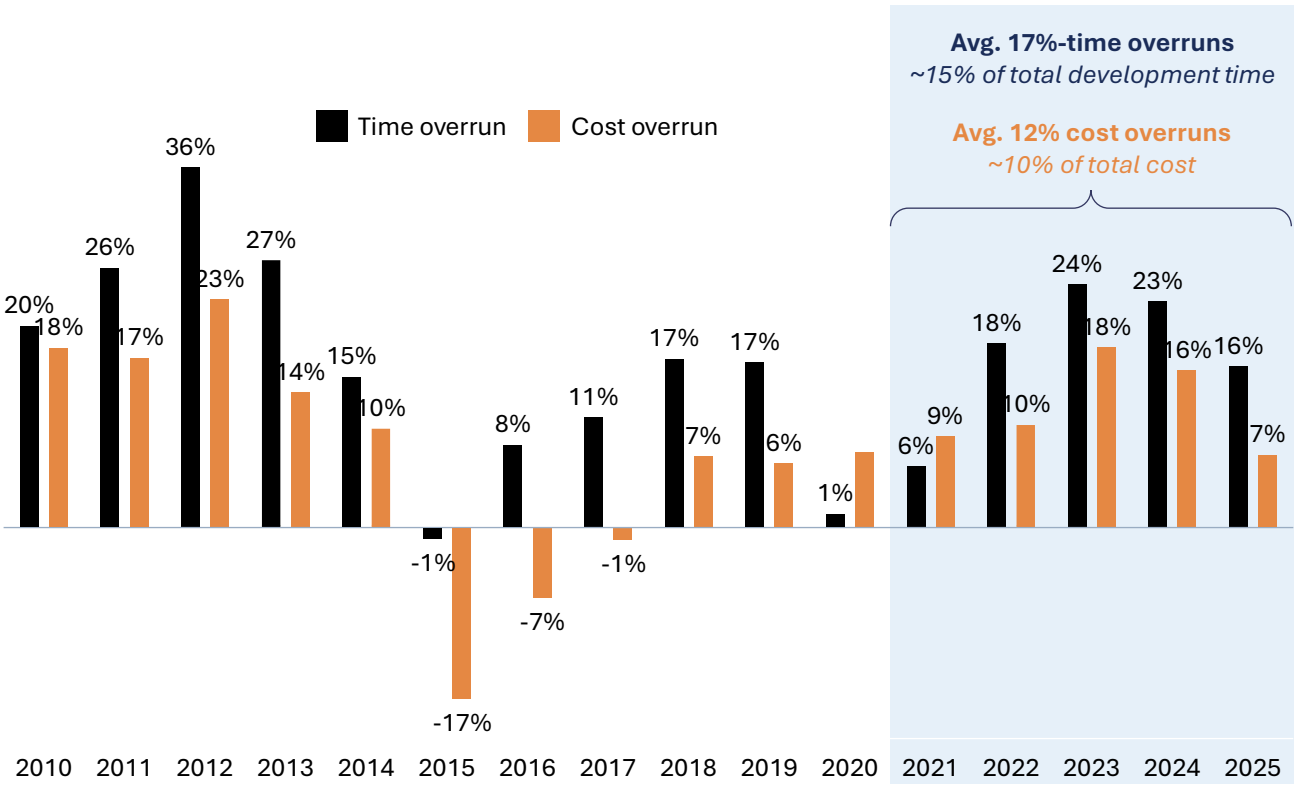
Top AI and digital adopters set the standard

A key structural finding across all four workflow categories is that AI, in general, does not necessarily raise the ceiling for the best operators – but it lifts the rest of the industry toward the performance level that the best operators already achieve. In drilling, the dynamic is already visible as leading US shale operators are close to physical drilling limits: the best wells can still improve, but the biggest effect would come from lifting the average well.

One leading US independent is for instance using AI to track what the rate of penetration should be for each individual well compared to best-in-class performance, and the operator can then track reasons for deviating from that. We estimate that the average improvement potential for US land is close to 10%, while for more complex deepwater wells the potential savings can be far greater – more than 50% in more extreme cases, although 15–20% is more representative of the average. Another way to highlight the impact of raising the floor of performance is looking at the average time and cost overruns in large oil and gas projects (Figure 5).

> *The world of oil and gas operations is physically constrained, and there are limits to how much better the current best-in-class can become. Instead, we expect digital and AI to standardize "top" performance – lifting the performance of the bad, to the level of the good.*
>
> Leading NOC

Figure 5: Average time and cost overruns for large oil and gas projects by year
Share of budget or planned development time



Source: Rystad Energy research and analysis

The supply chain enables the value

Digital value creation does not require E&Ps to fundamentally rebuild how they operate. Upstream operators' capital (capex) and operational (opex) expenditure totaled an estimated $1,300 billion last year, of which about $750 billion represented purchases from the supplier industry (Figure 6). As such, the digital opportunity is large not just because the technology is exceptional in isolation, but because the addressable cost base is enormous and largely under-served by digital investment today.

Capturing the value at stake requires investment in digital tools, infrastructure and integration, and E&Ps are estimated to have spent around $25 billion on digital and AI purchases last year (Figure 7). The market for providing these tools and services includes many legacy tools and software solutions in addition to cloud platforms and AI solutions and is dominated by a handful of provider types (Figure 8).

Traditional oilfield service (OFS) providers with domain expertise, and technology experts such as system integrators or hyperscalers are among the most important partners for E&Ps seeking to translate digital investment into operational returns. We estimate that digitally advanced OFS companies and system integrators account for just under 30% of the market each, with OFS providers historically concentrated in domain-specific offerings such as reservoir software and seismic processing, and system integrators focused on implementation and data architecture (Figure 8). Industrial software providers, typically companies that also supply control systems to the field, represent the third-biggest bucket, while cloud infrastructure, typically offered by hyperscalers, is similar in size. The remaining share is split across market intelligence providers and specialized analytics tools.

> *We have multiple alliances with suppliers. The whole point is that when a vendor is genuinely better at part of the process, there's no reason to do it yourself. You give them access to the data, and they run with it on their own tools. We are also testing agent-to-agent interaction between our own and vendors.* – Leading Independent

Figure 6: Total E&P spending by workflow, 2025
USD billion

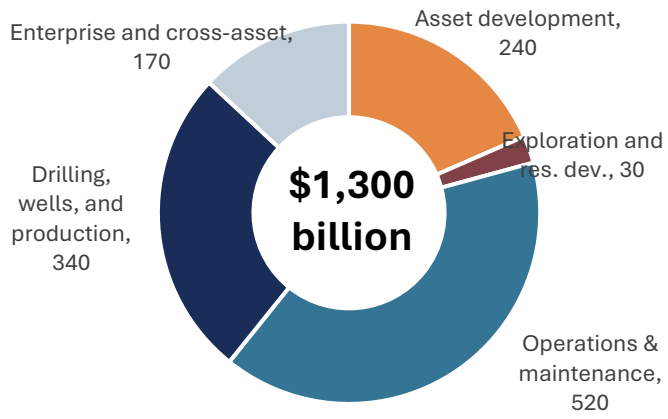


Figure 7: Digital purchases by workflow
USD billion

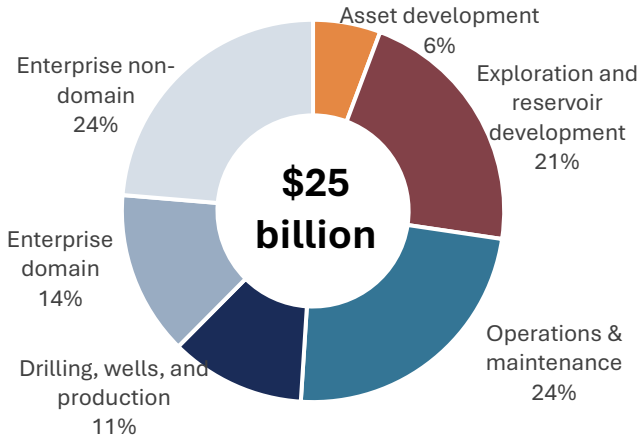
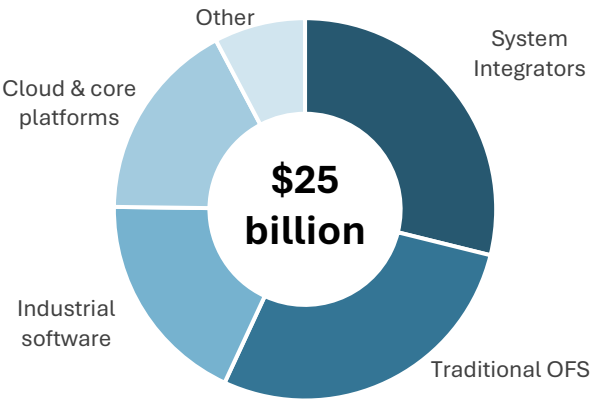


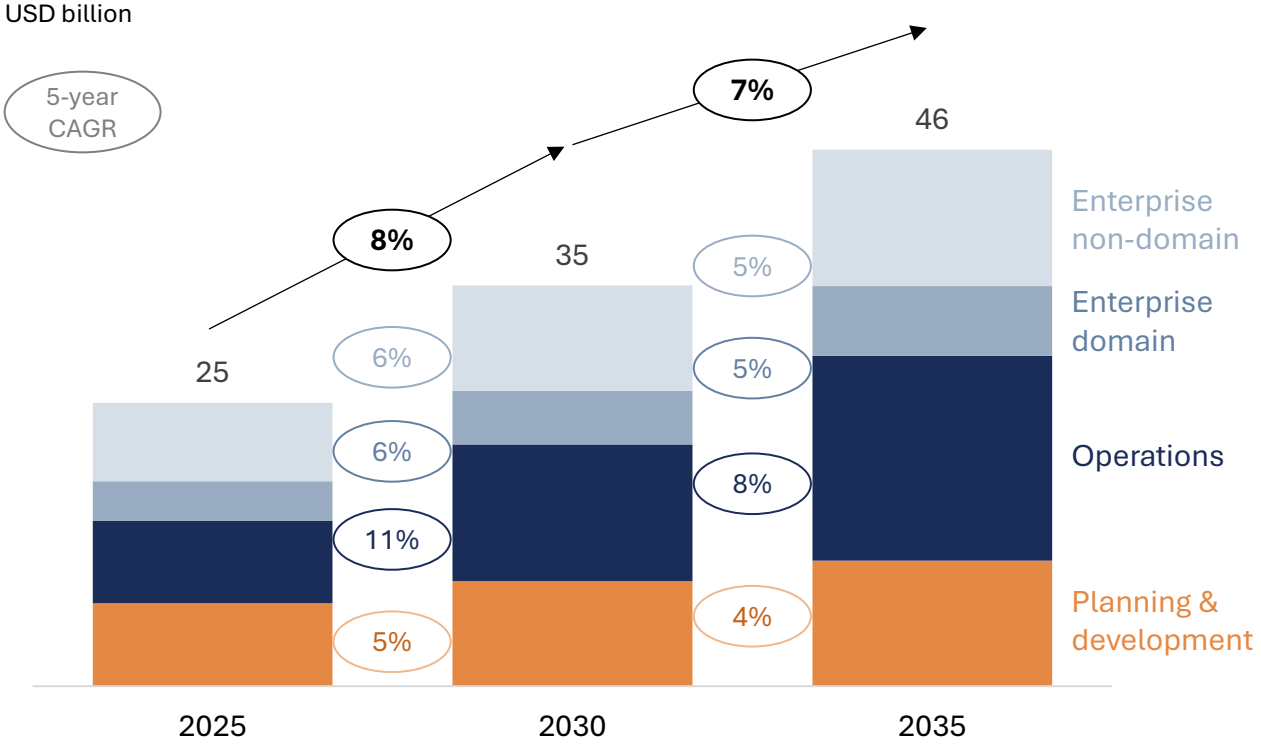
Figure 8: Digital purchases by supplier type, 2025
USD billion



Source: Rystad Energy research and analysis; ServiceDemandCube

Fast-growing market for digital purchases

Figure 9: Upstream digital purchases by main workflow categories
USD billion



The market for digital and AI-related purchases by upstream oil and gas companies is expected to grow by more than $10 billion by 2030, surpassing $35 billion in total annual market size, before growing closer to $50 billion by 2035 (Figure 9). Note that this includes digital platforms, applications and services, while investments in sensors and other hardware would come in addition. The growth is driven by increasing adoption among followers and the continued scaling up by early adopters across their asset portfolios.

For E&Ps, the operators extracting the most value are those that have built partner ecosystems collectively covering domain expertise, system integration and scalable cloud infrastructure, underpinned by a platform architecture that allows these layers to connect rather than operate as isolated point solutions.

Source: Rystad Energy research and analysis

Competitive stakes and the value of moving early

Digital adoption does not distribute evenly across the upstream industry. Rystad Energy's analysis segments the operator universe into three groups:

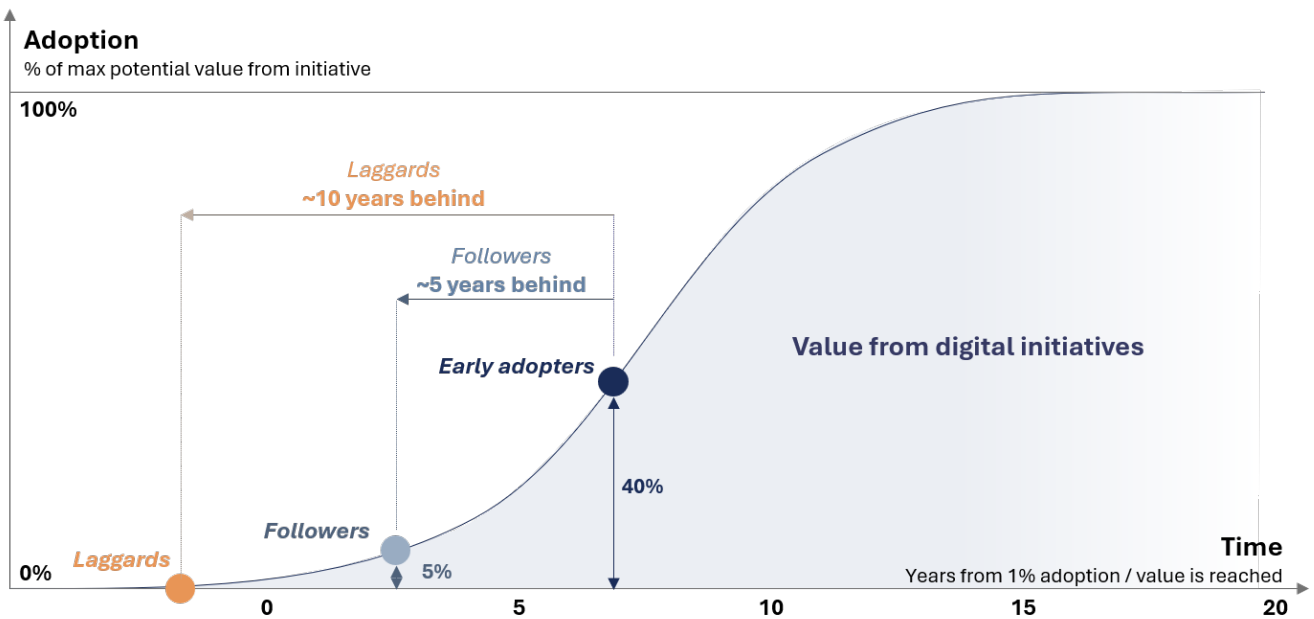
- *Early adopters*: These are typically energy majors, digitally advanced national oil companies (NOCs) and leading independents, which are investing now and solving the data and organizational challenges that AI deployment requires. These companies typically have digitalization and AI as an integral part of their strategy.
- *Followers*: a broad middle group that includes most mid-sized independents and several NOCs. These are watching the early movers and waiting for the business case to be proven before fully committing.
- *Laggards* are risk-averse and, in a higher oil-price environment, face limited urgency.

According to our indicative adoption curve assumptions, we estimate that the early adopters have a headstart of four to five years on the followers, and close to a decade on the laggards (Figure 10).

The relationship between digital investment and value creation is not linear. Early investment builds the data assets and organizational foundations that later investments operate on, which means returns accelerate over time rather than accumulate steadily.

The Equinor example highlighted earlier illustrates this directly: the company generated roughly $200 million in digital value over the four years from 2021 to 2024, a period focused on data infrastructure and organizational change. In 2025 alone, it generated $130 million. The same pattern holds at the asset level. Cross-asset intelligence – the ability to benchmark performance, train models across multiple fields and optimize capital allocation at the portfolio level – only becomes available once several assets reach individual digital maturity. A follower that begins investing in 2028 acquires the same tools as an early adopter but starts without the data history, without the organizational experience and without the portfolio-level learning that the early adopter has spent years accumulating. The tools are replicable. The foundation on which they operate is not.

Figure 10: Conceptual adoption curve by operator type



Source: Rystad Energy research and analysis

High case could lift value creation more and faster

Despite many breakthroughs, most current AI applications in upstream oil and gas rely on traditional machine learning models trained on equipment and workflow-specific data. That training data takes years to accumulate, and models rarely transfer across assets without significant rework. Newer AI approaches may change this dynamic, for instance through agentic AI automating tasks and augmenting humans in a way that breaks down organizational silos.

Furthermore, some companies suggest that newer models can generate useful outputs from less structured and complete data, without requiring the full data abstraction and contextualization step that traditional machine learning demands. In this framing, generative AI acts as a contextualizing layer that can synthesize information across varied data types, potentially reducing the time and data volume required before a model generates actionable insight.

At this stage, this is an emerging capability rather than a proven solution. Nevertheless, we have defined a high case – which one of our interviewees dubbed "AI or die" – to reflect the key choice companies must make with regards to AI. In this scenario, the main conditions are met: that newer AI models demonstrate reliable performance on less structured and less complete operational data, reducing the data preparation burden that currently hampers adoption for most followers, and that agentic AI matures sufficiently to automate cross-workflow integration that today requires significant manual effort. Both conditions are already visible in early deployments, making this mostly a question of timing. In the "AI or die" case, we then assume higher adoption across all operator groups, which is also tied to operators achieving higher impact from the various digital initiatives. As a result, annual value creation from digital initiatives in this scenario reaches $150 billion already in 2030 (Figure 11), with potential to grow past $300 billion by 2035 – compared to the base case of $178 billion in 2035.

The base case is built on adoption assumptions that reflect realistic but conservative estimates of how quickly followers and laggards will scale up. The "AI or die" case represents the implied value of closing the gap between current and potential adoption rates across the follower segment. This accelerated scenario would also require additional spending on digital solutions, up to $50 billion annually in 2030 (Figure 12), representing average annual growth of more than 15%, and then growing about 8% annually to get close to $80 billion by 2035. For individual operators, the implication is more direct: moving from follower to early adopter status within the next three to five years is not simply a question of capturing more value in aggregate – it is the difference between accessing the compounding returns that define the high case or remaining on the shallower curve that characterizes the base.

Figure 11: Additional value creation, 2030 vs. 2025
USD billion

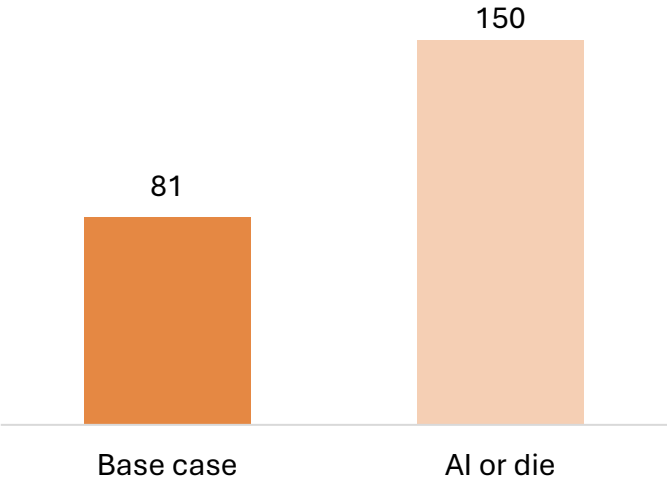
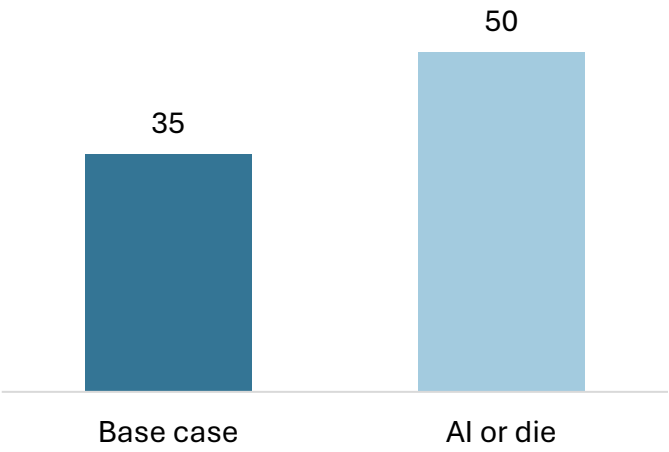


Figure 12: Digital purchases in 2030 by scenario
USD billion



Source: Rystad Energy research and analysis

From ambition to execution

Most digital programs in upstream oil and gas do not fail at the pilot stage. They fail at the point of scale. Legacy assets built before the 2010s typically lack the sensor infrastructure and connectivity needed to feed AI models with usable data and do not have actuators in place to automatically respond to the models. Where sensors exist, the data has tended to require years of engineering context and tagging before it is ready for advanced analytics.

Moving from a successful pilot on a single platform to consistent performance across 10 or 20 assets of varying age, geography and configuration compounds each of these constraints. Industry-level initiatives such as the Open Subsurface Data Universe (OSDU) are addressing part of this problem by establishing a standardized, cloud-based data framework that reduces the integration burden across vendor environments. Advanced E&Ps, and those with less capabilities to start, opt for partnerships with suppliers and technology experts to reduce complexity and simplify integration across equipment, assets and different parts of their organization. The key is to get the technical capability to build and maintain integration across vendor environments, navigate asset-level variation, and as such build solutions that transfer across a portfolio rather than being rebuilt from scratch each time.

As agentic AI takes on more autonomous decision-making across workflows, the risk of model errors and hallucinations becomes a material operational concern. Domain expertise is what makes it possible to define the guardrails, validation logic and cybersecurity requirements needed to trust AI outputs at scale. Without that engineering context embedded in the solution, scaling up agentic AI introduces risk rather than reducing it. The most commercially durable partnerships are therefore those where the provider combines deep domain knowledge with the platform infrastructure to make scaling operationally straightforward, ensuring that the systems built are not just technically integrated but also operationally trustworthy.

Physical constraints are real, but they are in theory investable. The harder barrier is organizational. Conversations with various industry stakeholders highlight the challenges to scaling caused by limitations to organizational readiness (Figure 13). Traditional cloud migration can take several years, cybersecurity gates add months, while cross-silo collaboration requires cultural shifts that no software can automate. These barriers reflect measurable differences in adoption rates, data infrastructure maturity and organizational capability that translate directly into how much of the value creation potential each group can achieve within the next 5 to 10 years.

Figure 13: The case for and against accelerated AI adoption: what industry players say

AI is lowering adoption barriers	Physical and organizational constraints remain
AI accelerates adoption *"With AI simplifying development and implementation, the distance between adopters and laggards has shrunk, less capital investments are needed to catch up."* **– Advanced NOC**	**Laggards are still present** *"Digitalization is really about integrating data and then utilizing it across multiple processes and workflows. We have digital twins of all our biggest assets, but there are probably many operators out there who are far away from connecting all the dots."* **– Major**
Data abstraction could be less of a barrier with AI *"Probabilistic AI doesn't need the full abstraction step. If you have some data, you don't need to build the complete model first."* **– Hyperscaler**	**Still wait-and-see approach from many** *"Current value is incremental rather than revolutionary. Many operators still want clearer results before going further."* **– North American independent**
Decision cycles compressed *"For several subsurface tasks we have been able to reduce time spent from months to about a week, opening for significantly more scenario analysis."* **– Major**	**Organizational challenges must be overcome** *"Legacy mindsets, legacy processes and technical debt will be the largest obstacles keeping the industry from widespread adoption of AI."* **– OFS**
Compounding speed effects *"AI-assisted coding allows small teams to build tools in weeks that once required a large team of data scientists for a full year."* **– North American independent**	**Though potential still clear** *"There are many horses running in a race — the premium for the first one is huge. When it is more proven, the flood gates will open."* **– AI-focused OFS**

Source: Rystad Energy research and analysis; Industry interviews

The fastest movers stand to reap the biggest reward

The performance gap between early adopters and the rest of the industry is real and currently widening. At the same time, developments in AI are compressing certain prerequisites for adoption in ways that did not hold in earlier waves of digitalization. What AI does not change is the underlying logic of compounding: it accelerates what happens inside a digitally capable organization, but it does not accelerate the process of becoming one. A follower that moves quickly today can close the operational performance gap faster than was possible five years ago. The data maturity gap and the organizational readiness gap close on a different, slower timeline, and those are precisely the layers on which early adopters continue to extend their advantage.

The $500 billion figure in the base case does not show the entirety of what digital and AI will deliver to the industry – it is a projection of what operators which invest deliberately, build their organizational foundations early and scale up beyond individual assets stand to capture over the next five years. The "AI or die" scenario suggests that the prize could be even larger for those who move fastest, through lower relative cost savings, higher recovery rates and faster project delivery. For companies that have yet to step on the accelerator of AI and digitalization, the competitive question they have to face – soon – is which side of the compounding curve they intend to be on when the gap between early adopters and the rest of the industry becomes difficult to close.



Contributors



Jon Marsh Duesund
Partner, Rystad Energy Advisory
Email: jonm@rystadenergy.com



Andreas Bakke Moan
Project Manager, Rystad Energy Advisory
Email: andreas.moan@rystadenergy.com



Olav Braathen
Title: Senior Consultant
Email: olav.braathen@rystadenergy.com



Victoria Anthonsen
Consultant
Email: victoria.anthonsen@rystadenergy.com



Maiken Økern Hågård
Consultant
Email: maiken.hagard@rystadenergy.com

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1. the data is not used to train, fine-tune, or otherwise improve any AI model for the benefit of third parties
2. the data is not disclosed or made available to the public, and
3. all processing is limited to defined, case-specific tasks such as internal summaries, comparisons, extraction of relevant information, responses to internal inquiries, or similar support functions.

For the avoidance of doubt, the Client shall not use the Product or any related data to (i) train or improve any Internal AI system in a general or ongoing manner (i.e., beyond the scope of specific, limited tasks described above), (ii) develop or operate automated tools (such as report generators) that replicate or compete with Rystad Energy's Products, or (iii) engage in any other form of unauthorized use of the Product in connection with the Client's Internal AI.

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RystadEnergy

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Headquarters
Rystad Energy AS,
Akersgata 51, 0180 Oslo, Norway

EMEA
(+47) 240 04 200
info@rystadenergy.com

Americas
(+1) 713 980 3800
houston@rystadenergy.com

Asia Pacific
(+65) 690 93 718
singapore@rystadenergy.com

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