

Spotlight on oil and gas megaprojects



Building a better
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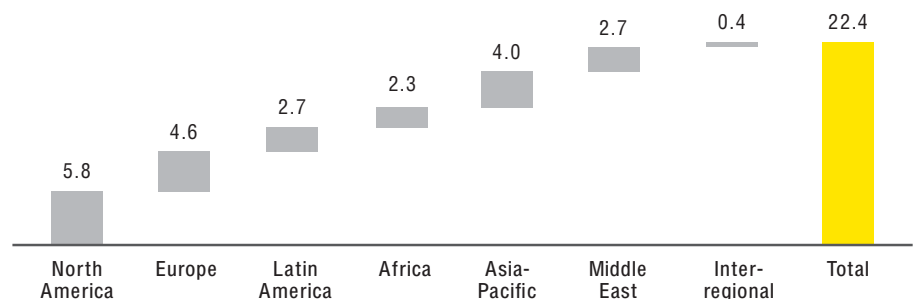
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Megaprojects – the new norm in the oil and gas industry

The oil and gas industry is witnessing an unprecedented wave of capital spending, driven by the need to build capacity to meet growing energy demand from emerging markets and to replace depleting supply sources. This capital expenditure has, to date, been underpinned by consistently higher oil prices, globally and gas prices outside North America. This trend is expected to continue. In its World Energy Investment Outlook 2014, the International Energy Agency (IEA) estimates a cumulative investment of US\$ 22.4t in the global oil and gas sector between 2014 and 2035, equivalent to an average annual spend of more than US\$ 1t. As shown below in Figure 1, spending will be dominated by North America (particularly the US), Europe and Asia-Pacific.

Figure 1: Regional cumulative oil and gas investment between 2014 and 2035 (US\$ t)



Source: *World Energy Investment Outlook*, International Energy Agency, June 2014.

In its Outlook, the IEA expects oil and gas spending to increase sharply, increasing by almost 50% from its average of US\$ 678b per year over the 2000–2013 period. Industry spending will continue to be dominated by spending in the upstream segment – accounting for about 77% of total industry spending. Midstream or transportation-related spending, in particular for pipelines and storage, will account for about 13% of total spending, with cumulative natural gas transportation spending of about US\$ 1.9t and oil transport spending of about US\$ 1t over the 2014–2035 period. Downstream spending will account for the remaining 10%, with cumulative spending in oil refining of US\$ 1.4t and spending on liquefied natural gas (LNG) projects of about US\$ 0.7t. In total, oil-related spending will account for about 61% of total spending, with the remaining 39% made up of natural gas-related spending

Megaprojects are fast becoming the norm and are critical for stakeholders.

As the era of “easy oil” approaches its end, industry players are looking to diversify their portfolios by tapping into emerging opportunities in unconventional oil and gas and frontier areas, such as:

- Shale gas
- Light tight oil
- Oil sands
- The Arctic
- Coal seam gas
- LNG liquefaction
- Ultra-deepwater

To commercialize these opportunities as well as unexploited conventional reserves, companies are increasingly engaging in multibillion-dollar technically and operationally demanding projects called megaprojects.



The effect of project delivery on share price:

- A multinational oil and gas company's share price fell in September 2013 after the company lowered its production outlook for 2014, citing delays in the start-up of projects in Nordics and Middle East.
- An integrated energy company's share price dropped in February 2013 after it had booked a cost increase of US\$ 1.65b for an Australian LNG plant.

Where organizations develop a reputation for successful delivery and environmentally conscious development of megaprojects, they will often develop a competitive advantage.

Given their size and scale, megaprojects have strategic importance for all stakeholders involved:

- Oil and gas companies often must invest huge sums over a long payback period. If executed well, these projects create a competitive edge and enhance enterprise value; however, where execution is poor, the result may be a project that is economically uncompetitive. To limit risk exposure, many of the larger oil and gas companies often participate in megaprojects through complex operator or non-operator joint venture agreements. This added complexity, combined with the high-risk, high-value nature of the projects, presents a challenge for companies in managing their total portfolio risk.
- Governments and local communities have an equally keen interest in these projects as they have the potential to drive a region's environmental and economic development. The decision to unlock natural resource wealth needs to be balanced against longer-term interests and environmental issues. High-profile environmental incidents mean that local groups are acutely aware of the importance of safe, environmentally sensitive developments.

The increased technical and commercial complexity, along with the commercial, environmental and political cost and risk, means that oil and gas megaprojects are under intense and growing stakeholder scrutiny.

Consequently, high levels of transparency, value-adding assurance and proven delivery capabilities are needed to secure economically attractive funding, resource access rights and corporate approvals. These prerequisites are vital to successfully delivering megaprojects on time and on budget.

Where organizations develop a reputation for successful delivery and environmentally conscious development of megaprojects, they will often develop a competitive advantage over their less successful rivals, becoming a preferred partner, gaining preferential access rights and cheaper finance, and (most tangibly) seeing an increase in share price.

Yet despite the risk and opportunity, projects continue to exceed budgets and deadlines.

Our comprehensive research into the performance of 365 megaprojects shows that despite the importance of project performance as it relates to enterprise value and share price, a high percentage of projects fail to deliver on time or meet approved budgets. While our research is a detailed review of current industry performance, longer-term industry outlooks suggest that project delivery success is actually decreasing, especially in certain segments of the industry, such as deepwater, where complexity is considerably higher.¹

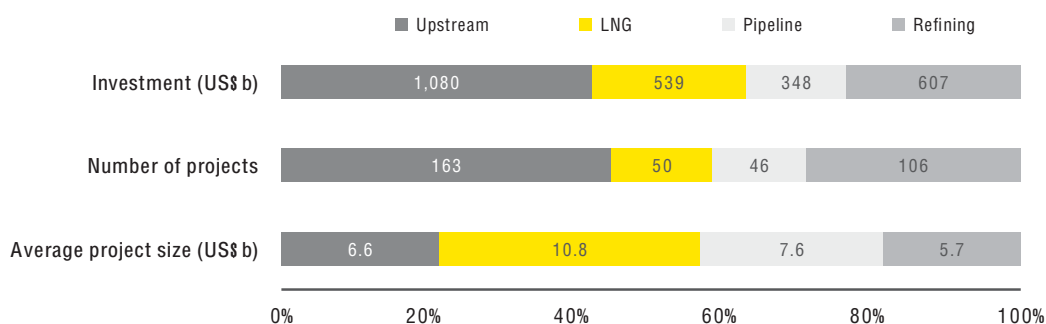
In this, the first of our Capital Projects series, we review project performance in the oil and gas industry across the project life cycle (before and after the final investment decision) and introduce the varied causes of project failure to meet planned targets.

¹ For details pertaining to methodology and sources, please refer to the "Research methodology" section at the end of this report.

Evaluating the performance of megaprojects

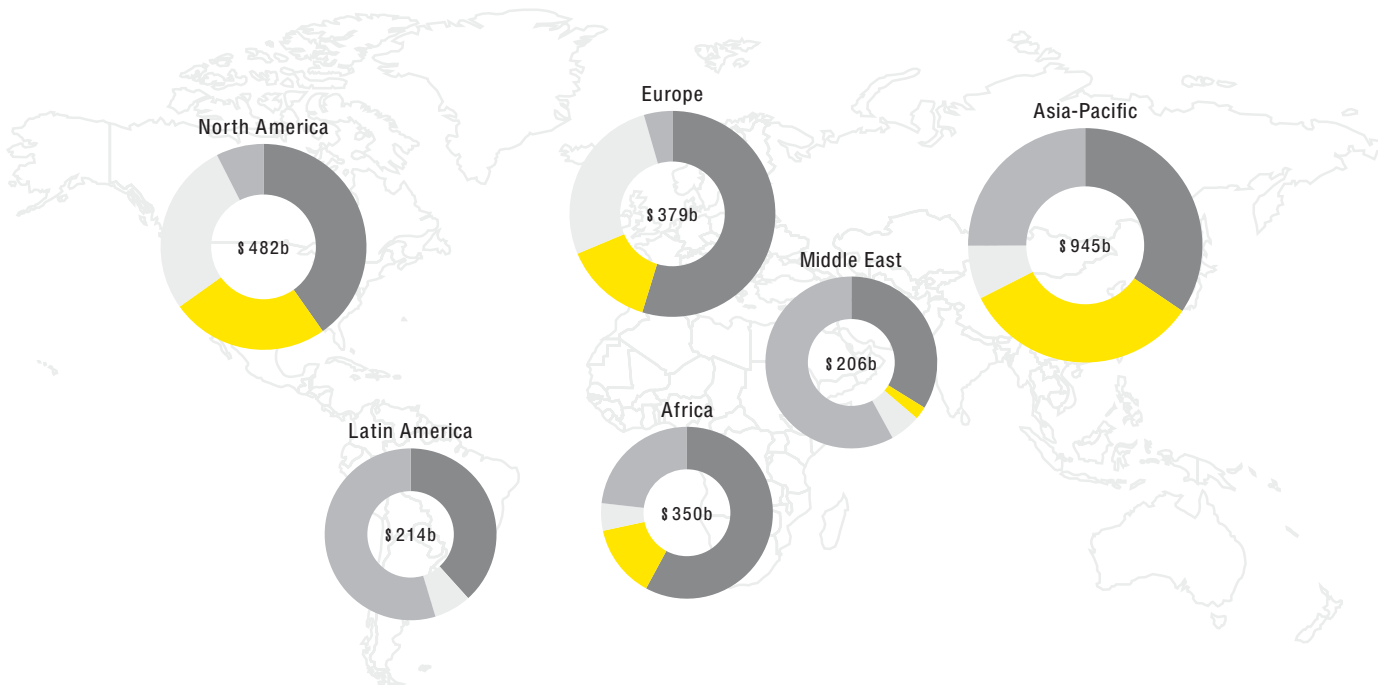
We conducted a study to gain a greater understanding of the challenges associated with the delivery of megaprojects in the oil and gas industry. As part of the study, we identified 365 projects with a proposed capital investment above US\$ 1b in the following industry segments: upstream, LNG, pipelines and refining. These comprise projects that have been proposed but have yet to reach the final investment decision (FID), as well as those that have passed the FID and are in the construction phase but have yet to begin operations. Cumulatively these projects comprise approximately US\$ 2.6t and are globally distributed across the four segments (Figures 2 and 3).

Figure 2: Investment and number of projects by segment



Source: EY research and analysis.

Figure 3: Distribution of investment by region (US\$)



Source: EY research and analysis.



Our research shows that the majority of projects are facing delays and/or cost escalations and these overruns are prevalent in all of the segments and geographies.

64% of the projects are facing cost overruns.

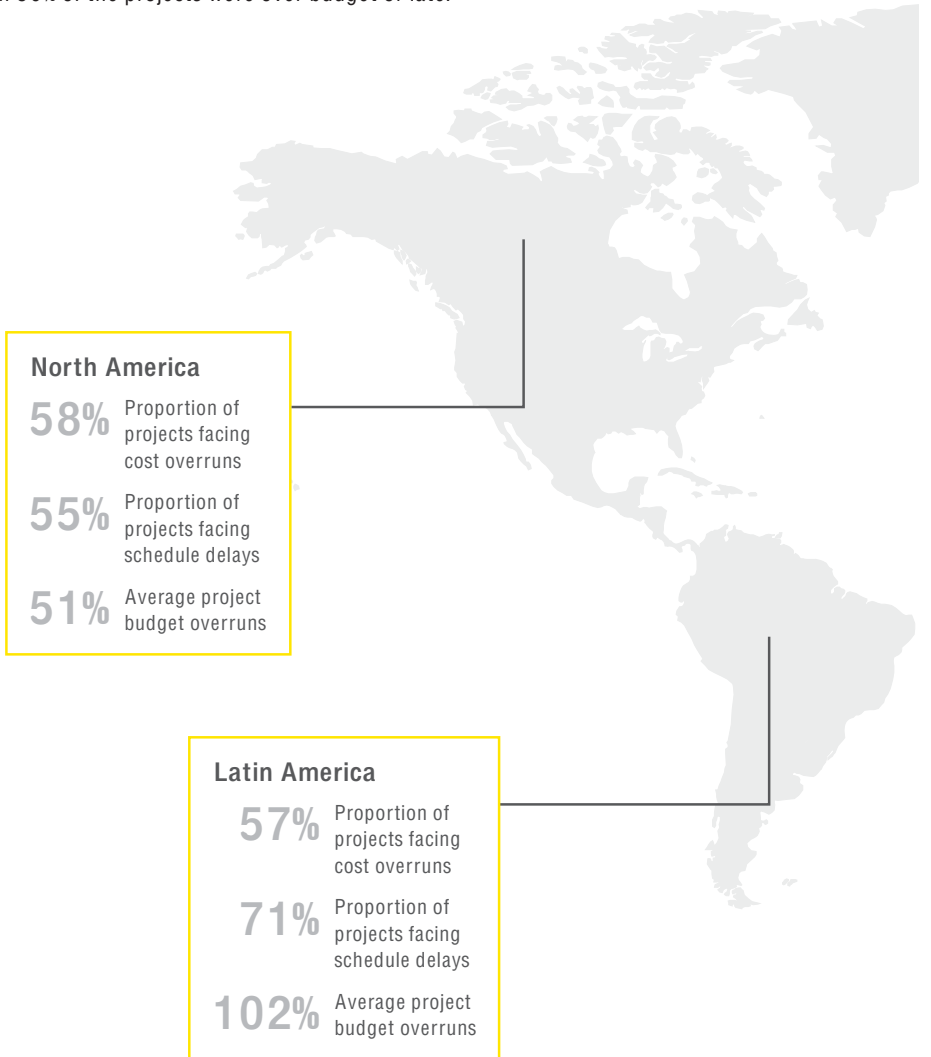
73% of the projects are reporting schedule delays.

We evaluated the performance of megaprojects on two criteria – cost and time – to gauge the proportion of projects that are forecast to fail to deliver on budget and schedule. Of the 365 megaprojects, cost data was available for 205 projects and time data for 242.

The study revealed that the majority of the projects were delayed and/or faced cost overruns when measured against estimates made during the initial stages of the project life cycle.

We found that cost and schedule overruns were common in all industry segments and regions, though the data set out in Figure 4 and the map below suggest that certain segments and geographies perform far more poorly than others.

Our findings are largely aligned with the observations of the Independent Project Analysis (IPA) 2011 industry study. In that study, the agency found that 78% of upstream megaprojects faced either cost overruns or delays, a deterioration from 2003, when 50% of the projects were over budget or late.²



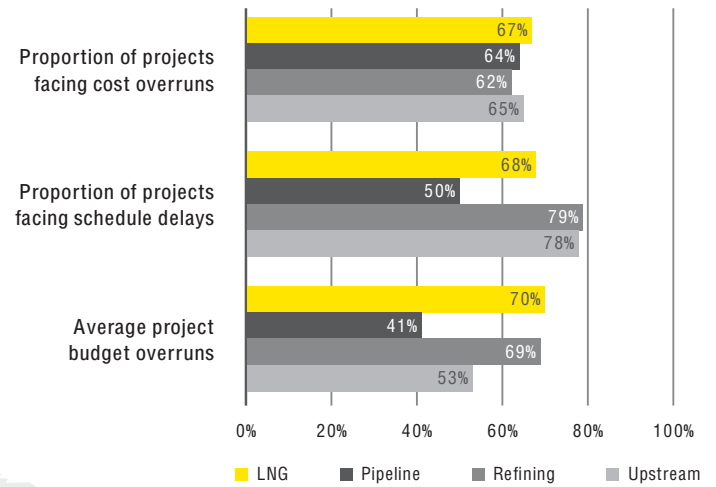
² "Oil services & equipment, subsea perspectives from an industry observer," Jefferies, 24 January 2014, via Thomson One.



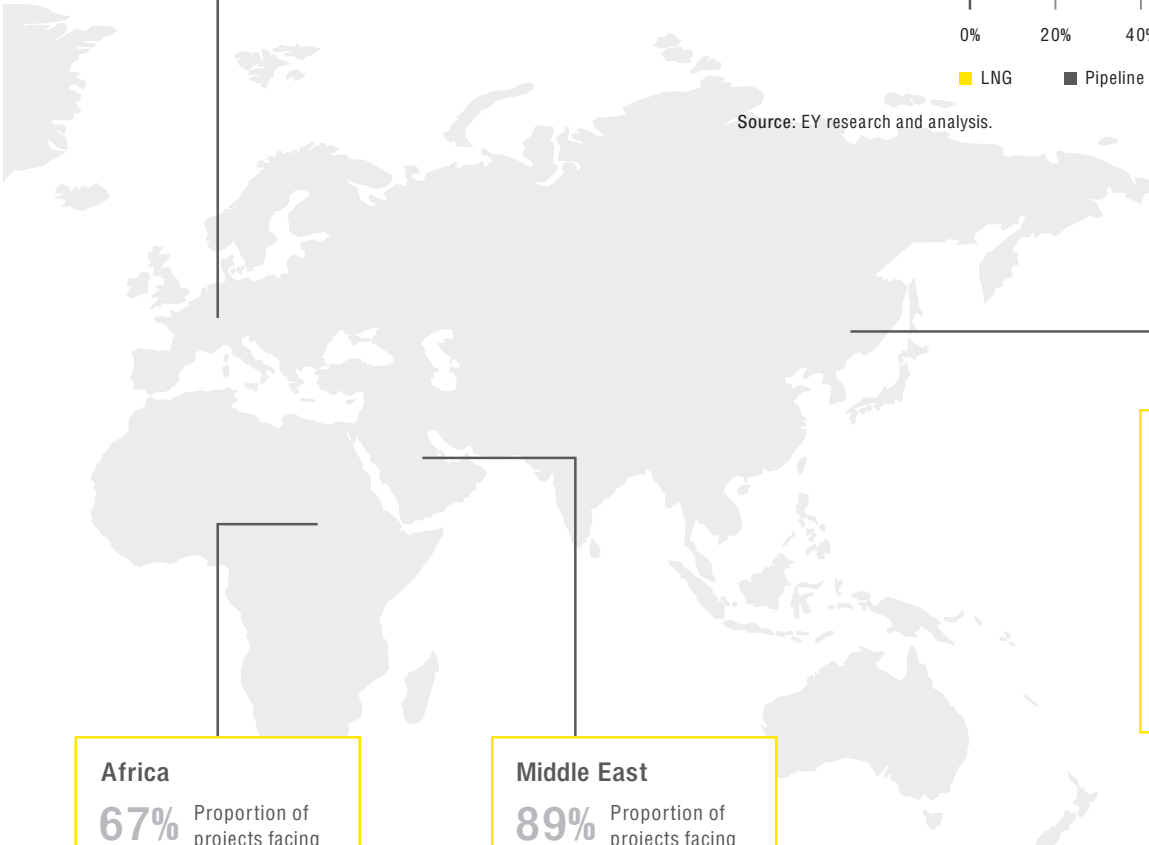
Europe

- 53%** Proportion of projects facing cost overruns
- 74%** Proportion of projects facing schedule delays
- 57%** Average project budget overruns

Figure 4: Proportions of projects facing cost overruns, schedule delays and average project budget overruns



Source: EY research and analysis.



Africa

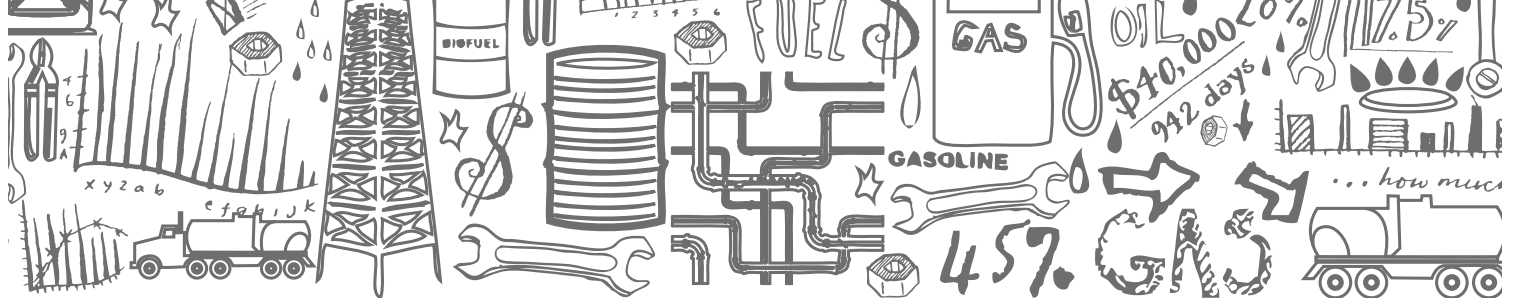
- 67%** Proportion of projects facing cost overruns
- 82%** Proportion of projects facing schedule delays
- 51%** Average project budget overruns

Middle East

- 89%** Proportion of projects facing cost overruns
- 87%** Proportion of projects facing schedule delays
- 68%** Average project budget overruns

Asia-Pacific

- 68%** Proportion of projects facing cost overruns
- 80%** Proportion of projects facing schedule delays
- 57%** Average project budget overruns



High cost escalations exacerbate underperformance

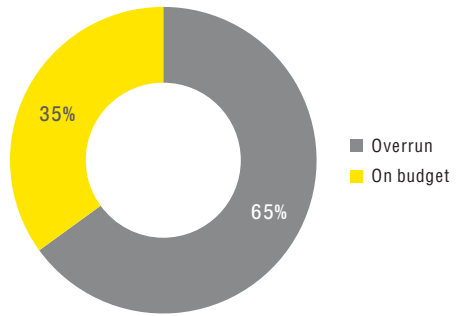
For the 205 projects where cost data were available, we see that current project estimated completion costs were, on average, 59% above the initial estimate. In absolute terms, the cumulative cost of these projects has increased to US\$ 1.7t from an original estimate of US\$ 1.2t, representing an incremental cost of US\$ 500b. Interestingly, due to the nature of the projects we assessed and the “point-in-time” approach we took to reviewing them, the final cost of projects was not assessed. It is therefore possible that cost and schedule delays measured at project completion may be even higher than we report in this paper.

The results indicate that this problem is prevalent across all segments (Figure 4) and geographies (please see map on preceding page) but that causal differences exist due to the profound impact of certain segment- and/or region-specific issues, such as local content regulations or labor relations.

Post-FID performance is equally poor

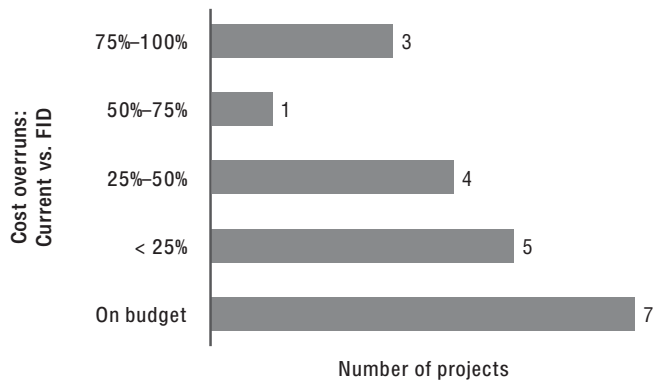
While the escalation of cost pre-FID is important, in that project estimated cost often affects project selection and approval decisions, it is in the post-FID, project delivery phase that capital expenditure (and therefore risk) increases significantly. Noting the importance of project delivery post-FID, we also analyzed a sample made up of the largest 20 post-FID projects. Sixty-five percent of the projects analyzed were facing cost overruns (Figure 5) with an average escalation of 23% from the approved FID budget; the distribution of the overruns is provided in Figure 6.

Figure 5: Proportion of post-FID projects facing overruns



Source: EY research and analysis.

Figure 6: Cost variance distribution — post-FID projects



Source: EY research and analysis.

Completion costs are 59% higher



than initial cost estimates, on average, representing an incremental cost of US\$ 500b.



Are such levels of overrun sustainable?

Oil and gas price increases during the past decade have masked many of the consequences of megaproject overruns, but this trend seems unlikely to continue. Unconventional discoveries have already had an impact on the economic viability of many megaprojects. Therefore, if the industry is to secure the required investment to supply future energy demand, it must deliver improved performance in the delivery of its capital projects, especially megaprojects.

In the post-downturn economic environment, where predictability is highly valued, companies need to be certain that their capital programs are successful, that benefits are realized and that productivity levels are sustainable. Failure to effectively deliver projects on time and budget or within environmental/regulatory requirements (as projects continue to become larger and more complex) will have major repercussions on an organization's revenue performance and the willingness of investors to participate in future ventures, as outlined below:

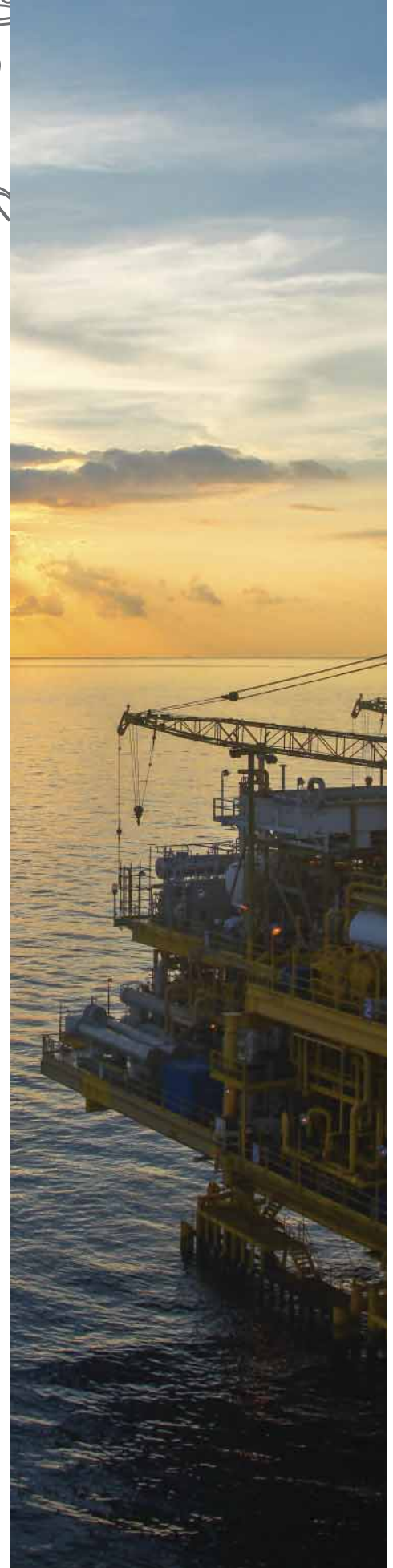
- **Project economics:** Missing critical project milestones typically leads to projects losing momentum and often entering a vicious cycle of overruns and underperformance, ultimately eroding project value. In 2013, UBS reported that projects that were unable to deliver planned production levels in line with budget and schedule saw their net asset values (NAVs) reduced between 12% and 65%, depending upon the rates of return, life of project, capital intensity and fiscal regime.³

To add to this risk, many of the projects (currently in delivery or the later stages of development) were commissioned when oil and gas prices were on an upward trajectory that no longer exists. Over time, price stability and, in some cases, falling prices (e.g., gas prices in North America) have weakened the economics of many projects, with margins under increasing pressure.

- **Company performance:** The nature and size of megaprojects mean that participating companies must commit enormous resources and take on significant risk. Therefore, missing targets in one or more of these multibillion-dollar projects can have major implications for company financial performance, either through increased demand on capital (potentially leading to lost opportunities and increased cost of borrowing) or loss of revenue through missed production dates.
- **Shareholder expectations:** In the current business environment, in order to secure economically attractive project funding, companies must respond to the ever-increasing pressure and increased scrutiny from stakeholders to prove that they are rapidly and effectively delivering on their plans and strategy. Stakeholders increasingly demand improved return on investment and capital discipline, along with reduced risk and exposure. There is a strong emphasis on the speed of converting projects into productive assets, in line with the agreed-upon schedule and within budget. A failure to meet these expectations has in many instances resulted in loss of shareholder confidence and an increase in cost of capital.

The high number of overruns in oil and gas megaprojects which we identified in our research is not particular to the industry and also has been identified in other sectors, including government, real estate construction, mining, and power and utilities.

However, these repeated failures do raise serious questions as to the oil and gas industry's ability to develop accurate, unbiased FID budgets/schedules and subsequently to deliver to them. Noting the impact of poor megaproject delivery on a company's success, in the next section we outline the typical root causes of project failure.



³ "European E&P – sector reflector," UBS, 5 December 2013, via Thomson One.



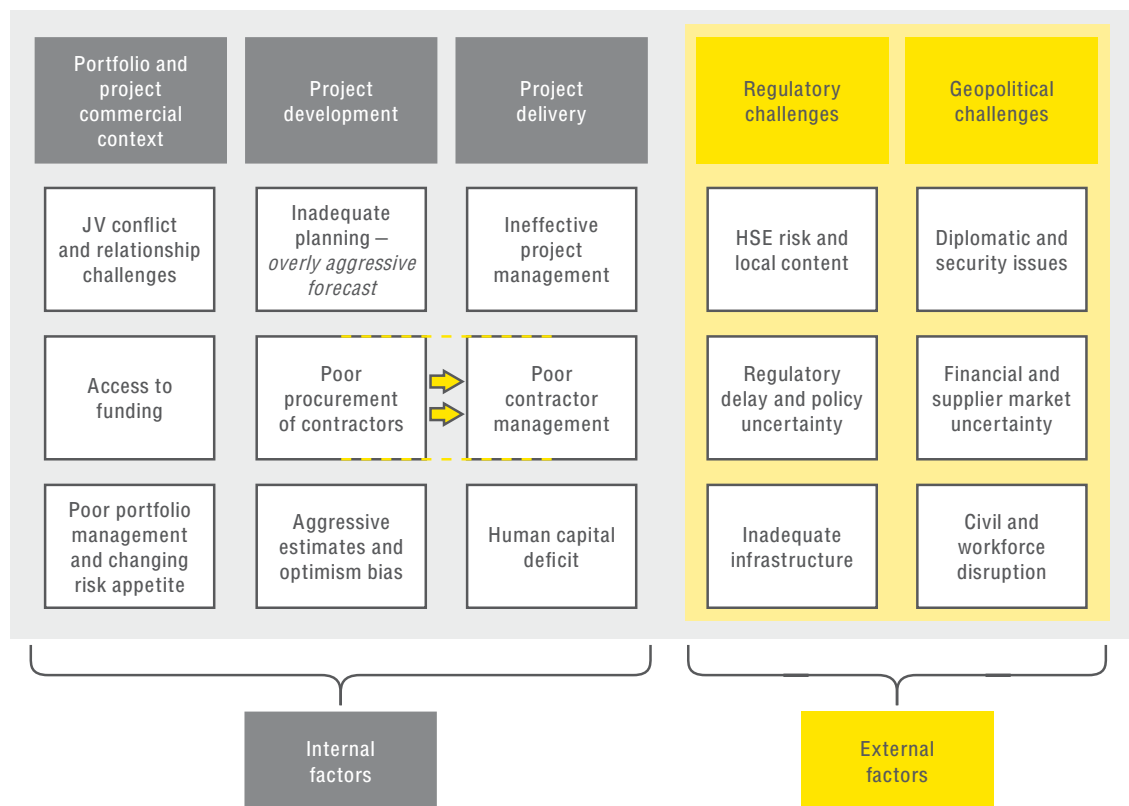
Root causes of cost overruns and delays

Industry performance data suggests that the factors that result in budget overruns or schedule delays are common across oil and gas projects; however, due to their scale, complexity and cost, the impact is more profound on megaprojects.

Industry research suggests that non-technical issues are responsible for the majority of the overruns; Credit Suisse's takeaways from the Offshore Technology Conference 2013 were that 65% of project failures were due to softer aspects such as people, organization and governance. A further 21% were caused by management processes and contracting and procurement strategies, with the remaining 14% of the failures due to external factors such as government intervention and environment-related mandates.⁴

In the following section and Figure 7 below, we set out the key non-technical internal and external factors commonly behind project delays or overspend.

Figure 7: Factors responsible for cost overruns and delays



⁴ "Quarterly – Brazil tracker," Credit Suisse 20 January 2014, via Thompson One.



1. Portfolio and project commercial context

The commercial context in which projects are developed is critical to project success, often determining:

- Skills and resources available
- Cost of capital
- Partners involved
- Total risk taken on by each stakeholder

Key challenges:

- **Joint ventures (JVs):** joint ventures are becoming increasingly common across the industry, especially on complex projects in challenging environments, or in emerging markets where resource access agreements between the national government and the international oil company (IOC) often stipulate involvement of the national oil company (NOC). These agreements can be complex, and delivery issues are often exacerbated by divergent investment rationale, project assessment criteria and tolerance for project risk.
- **Access to funding:** the stake given up to investors, the cost of capital and the mechanism for sharing risk are key factors to consider when embarking on the development of a megaproject, with each component potentially impacting project economic viability.
- **Portfolio management and project selection:** frequently a lack of clear strategic direction and project selection criteria means that over time, organizations develop overly diverse and poorly aligned project portfolios, which often unnecessarily stretch resources, increase portfolio risk and dilute the potential value of inter-project linkages. It is therefore critical to select and subsequently approve appropriate projects that align to company capability, experience and strategy.

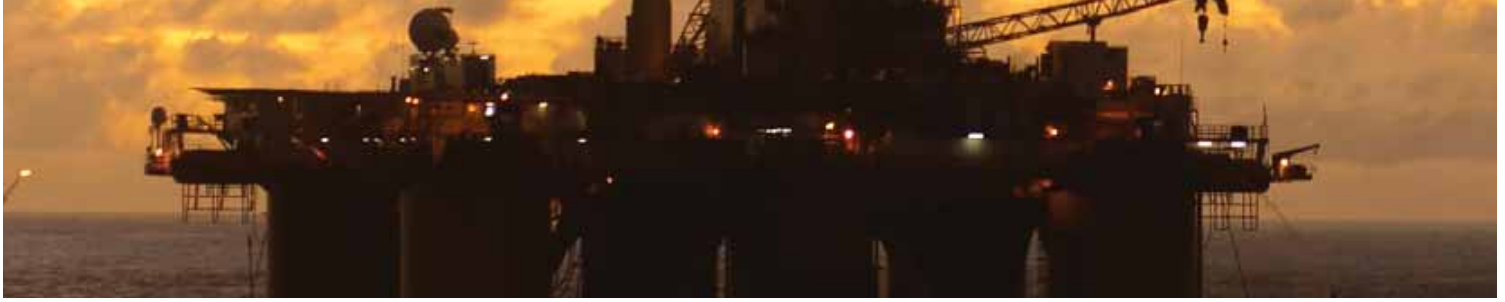
By developing a balanced portfolio of projects, with each project being delivered under an appropriate commercial agreement (JV structure, partners, funding, etc.) and with adequate support (internal sponsorship and resources), organizations position themselves well to effectively manage the various challenges associated with successfully delivering megaprojects.

2. Project development

In line with the adage “Failing to plan is planning to fail,” experience shows that a lack of appropriate front-end loading and an unhealthy focus on project sanctioning often results in the setting of unrealistic, overly aggressive goals which become serious delivery issues as projects move beyond FID into delivery.

Key challenges:

- **Inadequate planning:** failure to appropriately consider design, construction, commissioning and operational issues (including external factors such as cycles of extreme weather) during project initiation and FEED stages has a detrimental effect in subsequent project phases. This often leads to changes in project scale or design (including revisions to key target markets and sources of supply) and typically results in significant rework for both the company and contractors.
- **Procurement of materials and delivery contractors:** selection of contractors and the contracts through which an organization engages with its third parties are key to project success, because poor selection decisions have significant consequences. Frequently we see decisions based too heavily on cost, with insufficient emphasis placed on quality, despite the known impact of quality on project cost and schedule performance later in the project life cycle.
- **Aggressive estimates and optimism bias:** linked to contract cost forecasts, a key question when assessing project performance to cost and schedule targets is whether the targets set out at the preceding milestone (most critically at FID) were accurate or achievable. The mechanism by which projects are proposed and selected within organizations, frequently through sponsorship by individuals closely involved in project development, means that selection is open to the risk and influence of optimism bias and an underestimation of project risk and complexity. Where optimism bias goes unrecognized or unchallenged, there is a risk that projects with unsound commercial grounding are taken forward, creating problems for project teams later in the project cycle and adding unknown and unnecessary risk to an organization's wider project portfolio.



3. Project delivery

The delivery of megaprojects is an expensive, highly complex task that entails the combination of leading-edge technology, operation in new geographies and multiparty governance. The sheer size and scale of current and proposed projects present challenges for the project team and owner organizations throughout the project life cycle, especially in delivery, where capital expenditure and schedule demands are at their greatest.

Key challenges:

- **Ineffective project management:** project plans often leave out the necessary schedule management elements of schedule development, acceptance, progress measurement and reporting, and their relationship to and interdependence with other project disciplines, meaning that project teams fail to fully understand critical activities and the full effect of change on the schedule and other work packages. The challenge of working with multiple contractors, each with separate but often interlinked work scopes, exacerbates this planning problem as real-time data is challenging to recover. As a result, performance and the impact of change are difficult to model or assess. Best-practice examples exist where effective, interlinked work breakdown structures exist with real-time data input; however, these are too often set up as a response to poor project performance, instead of as a pre-emptive measure.
- **Poor contract management:** inadequate equipment capacity and poor quality of service from vendors are common challenges for large projects. A surge in upstream activities worldwide has resulted in a sharp rise in demand for equipment and services, particularly for high-specification equipment and specialized services. Against this backdrop, a lack of adequate suppliers – including Engineering, Procurement and Construction Management (EPCM) and Engineering, Procurement and Construction (EPC) contractors with the requisite capabilities, processes and systems – has created bottlenecks in the entire supply chain. Inadequate contractor supervision at each stage of the project life cycle increases supply chain risk, exposing projects to excessive variations or contractor claims, often without the resources or expertise to challenge them.
- **Human capital deficit:** heightened project activity in the global oil and gas sector has been exerting pressure on key resources such as labor, and as a result, companies are struggling to secure the capabilities, capacity and expertise required to effectively manage their most challenging projects. The challenge of securing resources is aggravated by the rising complexity of projects, increasingly stringent local content regulations in emerging economies, and a gradual shift in focus from conventionals to unconventional, where the talent pool is under even greater strain.

4. Regulatory challenges

Increasing focus on the environmental impact of projects, greater regulatory requirements and continued policy uncertainty all impact project performance. These regulatory demands are likely to continue to increase.

Key challenges:

- **Health, safety and environment (HSE) and local content:** in the “zero tolerance to accidents” environment that now exists, megaprojects are increasing their expenditure on compliance to HSE standards. While there is no doubt that this is a positive move, without close management, costs can quickly escalate. Similarly, investment into compliance with local content regulations is increasing in an attempt to overcome the short- and medium-term logistical challenges of sourcing goods and services in a local market.
- **Regulatory delay and policy uncertainty:** oil and gas companies worldwide have faced hurdles in obtaining timely regulatory approval for their megaprojects, with delays caused by issues such as the need to obtain permits from multiple government bodies, unclear regulatory requirements and overly bureaucratic processes.
- **Inadequate infrastructure:** limited existing infrastructure has meant that in many developing markets, companies are required to invest in the development of water, power, rail, road and accommodation projects to gain access to resources. The challenge of these often costly and time-consuming ancillary activities is aggravated by remote locations and extreme climatic conditions.

Implementing project management tools and best practices, including interlinked work breakdown structures with real-time data input, at the outset of a project can improve performance and reduce risk of cost overruns and schedule delays.



5. Geopolitical challenges

External market and political forces also influence the progress of megaprojects. Given the value of the investments at stake, the impact of any major change in these forces can be severe on the overall project economics, meaning that in some instances companies may consider delaying or even canceling projects.

- **Diplomatic and security issues:** oil and gas companies have been forced to delay investment in megaprojects on account of unstable political situations and persistent security concerns, such as the sectarian insurgencies in the Middle East and North Africa. Failure to resolve points of conflict can result in delays or even postponement of projects. Noting the growing tensions in some oil-rich regions, companies must now carefully consider the potential cost of investment, as the perceived value of investment must be balanced against the political and ethnic environment, as well as the potential impact of current investments on future opportunities.
- **Financial and supplier market uncertainty:** some megaprojects have been delayed due to changes in market fundamentals.
 - **Global economic downturn:** after the 2008 global economic crisis, many oil and gas companies chose to delay their less time-sensitive refinery projects or delay their projects to reduce capital spend.
 - **Commodity constraints and pricing:** increased demand for raw materials such as steel and concrete ultimately feeds through to higher prices. While commodity prices have now subsided, organizations need to be aware of how the lag between investment case preparation and project construction can affect project commodities spend.
 - **Exchange rate fluctuations:** major fluctuations in local currency exchange rates can affect project costs where they are accounted for in currencies different from those of funding/investor organizations. A case in point is Australian projects, where appreciation of the local currency against the US dollar has been a contributing factor to project cost escalations.
- **Transformation in the natural gas industry:** weak gas demand from Europe, rising shale gas production from North America and competition from new LNG projects have created uncertainty around the future demand for and price of natural gas. This has impacted the assumptions, business case scenarios and ultimately the competitiveness of potential gas projects under consideration.

- **Civil and workforce disruption:** the power of local communities, environmental groups and other interested parties to influence or even disrupt the sanction of megaprojects continues to increase. High-profile project delays in recent years (for example, Ichthys LNG and Keystone XL Pipeline) show organizations should gain the support of local groups and a “social license to operate.” Organizations developing megaprojects, where workforces are large or typically highly unionized, must also consider the risk of workforce disruption. For example, LNG projects in Australasia have been particularly affected as heightened activity across Australasia strained the supply chain, leading to competition for a limited pool of workers. The issue was then compounded by workplace laws requiring companies to negotiate agreements with unions before initiating work but without any time limit for negotiations.⁵

It's critical to determine how controllable these factors are and the extent to which they could result in cost and time overruns. Clearly the external environment and regulatory- and policy-related changes are less controllable or predictable than project management issues, stakeholder conflicts and resource constraints. However, while these issues aren't so easily controlled or able to be forecast, the industry can do far more to mitigate and prepare for them so that their effects can be more adequately managed within the project environment.

In the subsequent articles within this series, we will explore the issues introduced here in more detail, highlighting the risks of inaction as well as industry best-practice management/mitigation strategies for overcoming project delivery challenges and, where possible, taking advantage of them.

⁵ “High-cost Australia may miss \$180 bln LNG expansion wave,” Reuters News, 11 April 2014, via Factiva, © Reuters.

How EY can help

Given the range of disparate factors that make up the oil and gas landscape, and the challenges and pitfalls inherent in the delivery of megaprojects, companies are struggling to effectively deliver on their agreed-upon plans and strategies. Compounding these delivery challenges, capital projects are now delivered in an environment where stakeholders increasingly demand improved performance, reduced risk and greater transparency over delivery decisions.

Prior to and during investment, stakeholders increasingly ask for independent assessment of key decisions and plans. While often stakeholder-driven, the benefits derived from independent assessment and challenge, both in terms of pacifying stakeholder demands for transparency and ensuring unbiased assessment of project business case, delivery plans, budgets and key stage-gate decisions, mean that it is now a valued tool for portfolio managers and board executives who wish to avoid the optimism bias commonly seen on failing projects.

With our closely linked transactions advisory, tax and advisory service teams, and our global team of mobile capital projects industry professionals, EY is able to provide independent, whole-life support and advice to our clients. We have proven industry skills covering the full life cycle of a capital project, from inception and setup of the commercial delivery structure through feasibility studies and into project delivery, construction and commissioning.

The depth of our commercial knowledge, across sectors and project life cycles, means that our capital projects team is ideally positioned to help you manage the risk of your capital projects and portfolio, uniquely acting through direct intervention; supporting management teams on specific projects in development, construction or commissioning; or advising on portfolio risk and performance and stage-gate approval decisions at the board level.

We have a history of helping global oil and gas organizations overcome the different capital project issues outlined within this document, gathering and developing leading practices collaboratively with our clients. That experience and our close working links with the major construction and engineering firms mean that we are able to play an active and valuable role in almost any team and can quickly source skills and advice as and where our clients' needs arise.

Research methodology

The section on “Evaluating the performance of megaprojects” in this report is based on the review of 365 projects with a proposed investment of above US\$ 1b in the upstream, LNG, pipeline and refining segments of the oil and gas industry. We have covered projects that have been proposed but have yet to reach the final investment decision (FID) and those that have passed the FID and are in the construction phase but have yet to begin operations. Of the total number of megaprojects (365), updated cost data and time data was available for 205 and 242 projects, respectively.

The following steps were used to prepare a projects database:

Step 1. Projects were identified based on the above-mentioned criteria using the following sources:

1. “Upstream Projects Database,” Business Monitor International, accessed in May 2014.
2. “World’s LNG liquefaction plants and regasification terminals,” Global LNG Info, www.globallnginfo.com, accessed in July 2014.
3. “Global Refinery Projects,” A Barrel Full website, <http://abarrelfull.wikidot.com/>, accessed in July 2014.
4. “FMC Technologies: Tour d’ FMC - a confluence of cycles,” Macquarie Research, 12 June 2013, via Thompson One.
5. Company websites and reports.

Step 2. Post-project identification, the initial feasibility stage, FID and current cost estimates, as well as the planned start-up date, were identified using the following sources alongside those listed in Step 1 above:

1. Analyst reports via Thomson One
2. Company websites and annual reports
3. Press announcements via Factiva and company websites

Disclaimer: These projects and their details have been prepared on a best-effort basis and do not represent an exhaustive list of the information. While the findings are based on publicly available data, the performance of individual companies and projects is not discussed or disclosed. Any broader industry commentary is based on general industry observations and not on the views of any single organization.



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