

Industry Agenda

Oilfield Services: Unlocking the Full Potential

Prepared in collaboration with A.T. Kearney

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Foreword

The Oilfield Services and Equipment (OFSE) industry has come a long way from its origins in the 1980s. The industry's growth has regularly outpaced the increase in oil production, and OFSE companies now constitute an essential element in the oil and gas value chain, accounting for \$531 billion of the \$764 billion in total upstream spending over the past year. OFSE companies have invested continuously in research and development (R&D) and technology, and have become essential outsourcing partners to the international oil companies (IOCs); currently, they also directly service national oil companies (NOCs) and are starting to become equity partners in some assets.

The demand for oil is still high and rising, underpinned by solid growth in populations and economies worldwide. However, the supply side has increasing constraints: the time of "easy" oil is gone and existing basins are depleting, so the size and complexity of projects is increasing overall. Additionally, a shortage of skilled professionals is having adverse effects on delivering new projects and managing existing reservoirs. In the face of these challenges, industry performance has deteriorated significantly. More than 60% of large projects are over budget and 70% are behind schedule; costs are escalating and capital expenditure is rising constantly – with severe impacts on profits. In the past, the industry was saved by high oil prices but, according to the forecasts, prices are due to remain flat or decline. Hence the current cost squeeze will become even more severe. Efficiency improvements and capital project performance are therefore crucial and are demanded by shareholders.

To advance to the next level of efficiency, OFSE companies must transform their way of doing business. Instead of developing new designs for new oilfields as in the past, engineers could apply standardization more broadly and reuse existing designs more often, thus lowering overall costs. Companies should also review specifications and balance the drive to overlap safety factors and neglect the economics.

As a whole, the industry needs to improve its project management practices and leverage technology and innovation even more systematically, which will require an increase in R&D expenditure. In addition, the industry should learn from the experiences of other engineering and capital-intensive sectors: the mining sector, for instance, is facing similar skills gaps and automation challenges, whereas the chemicals sector is being recognized as one of the most capital-efficient sectors. New contracting models would also facilitate the required step change in the performance of capital projects. Current procurement practices at NOCs/IOCs tend to focus too sharply on the lowest capital cost; they should instead place more emphasis on entire life-cycle costs and value creation.

The World Economic Forum's Oilfield Services: Unlocking the Full Potential Initiative is a cross-industry reflection on the multitude of challenges that the sector is facing. While its origins can be traced back to the roundtable on "The Changing Energy Landscape" in Calgary 2012, followed by the inaugural session on "New Frameworks for the Oilfield Services Industry" at the World Economic Forum Annual Meeting 2013 in Davos-Klosters, the actual mandate to launch a fast-track initiative was obtained at the "New Models in Oilfield Services" session at the World Economic Forum Annual Meeting 2014. Among the multitude of challenges that have been repeatedly identified, it is noteworthy to mention the increasing project complexity with escalating costs and extremely fast-paced project schedules, and considerably stricter requirements on local content, environmental standards and community engagement needs. To secure and advance the industry role in the value chain, OFSE companies must upgrade to the next level of operational excellence, pioneer new contracting models and collaborate more with one another, as well as with the NOCs, the IOCs and local governments.

While these challenges are becoming even more prevalent, not many palatable studies are being led by industry leaders and experts. Thus, the initiative aims to involve key players from the whole value chain to conduct analyses, diagnose and identify areas for coordinated cooperation, including surveying and mapping the challenges in project delivery; identifying root causes of performance deviation; and recommending areas of cooperation. For each of these areas, the report illustrates a number of perceived pathologies that the industry as a whole should be aware of and should seriously consider for their capital project strategies. Furthermore, the report presents a practical framework to understand and respond to the root causes of deviation from planned performance in capital projects. This framework includes four logical building blocks: (i) external challenges (regulatory and human capital); (ii) project challenges (project management practices, governance models, contractual and risk ownership models); (iii) planning challenges (budgeting, forecasting, design and engineering); and (iv) execution challenges (procurement, supply chain, technological).

Although a difference in perception exists between surveyed leaders, services companies believe that budgeting and forecasting are the key phases to master in capital projects, while producers would rather place such emphasis on the design and engineering phases. When the whole sample of surveyed respondents is aggregated and ranked in terms of challenge frequency and impact, it is possible to elicit five key challenges: unrealistic budget and schedule, project understaffing, limited level of standardization, insufficiently qualified labour, project management and management of change.

This report is a direct result of an engagement process with leaders from the private sector and civil society, particularly the infrastructure & urban development (engineering & construction) and the oil & gas industries. In this regard, we would like to thank and acknowledge the World Economic Forum Partner companies that served on the Steering Board: Amec Foster Wheeler, WS Atkins, Consolidated Contractors Company (CCC), EnQuest, Fluor Corporation, Maire Tecnimont, Pemex, Petrofac, Samsung Engineering, SapuraKencana, Saudi Aramco, Schlumberger and Weatherford.

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We would like to give special acknowledgement to Ayman Asfari (Group Chief Executive, Petrofac) and Samir Brikho (Chief Executive Officer, Amec Foster Wheeler) for their relentless interest and commitment to serve as champions of the Initiative since its inception and to provide strategic guidance to building a new Community of OFSE partners at the World Economic Forum.

The experience, perspective and guidance of all the people and organizations mentioned above contributed substantially to a number of remarkable discussions that took place between the kick-off of the initiative at the World Economic Forum Annual Meeting 2014 and the workshop held right after the World Economic Forum Industry Strategy Meeting in New York City in October 2014.

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Introduction

End of easy oil brings unprecedented challenges.

Texas created 49% of all new jobs in the United States between July 2009 and June of 2011, and an overwhelming share were linked directly or indirectly to the oil and natural gas boom.¹ Oil and gas capital projects have been engines of regional economic growth raising standards of living for developing and developed countries. History has also repeatedly shown that oil prices have an incredibly far reaching impact on the global economy and vice versa. On average, every 1% increase in global GDP requires an 854kboed increase in oil demand. The importance of the oil industry in fueling and improving the standards of living is without question, the economics of achieving production growth via efficient execution of capital projects has now become the critical question.

The US Energy Information Administration (EIA) estimates that by 2035 there will be a nearly 50% increase in global energy demand as compared to 2007 levels. Since major conventional resources or “easy oil” are already being tapped, volume increases will have to come from “unconventional” resources such as shale gas. The cost of supplying oil and gas will jump due to less accessible geology and new technologies required for extraction. The proportion of conventional projects and costlier unconventional capital expenditures is now evenly split, which helped fuel an increase in capital expenditures from \$568 billion in 2008 to \$825 billion in 2013. This trend is not expected to end anytime soon, with capital investment growth rates projected to continue at roughly 5% a year.¹

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The oil & gas industry faces new challenges triggered by unconventional resources and highly complex megaprojects.

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The “Eureka!” days of easy oil are gone. Existing basins are being depleted. Accessing arctic and remote regions, deeper water, unconventional reservoirs including oil sands, heavy oil and source rock resources, and politically unstable regions is now a necessity. The result is an increase in not just the size of capital projects but also the underlying complexity.

We observe oil companies investing in a fewer number of larger capital projects. Current industry observations show that of the projects with total project life-cycle costs of more than \$1 billion, about 75% are behind schedule and over 60% are over budget.² The oil and gas industry has a proud tradition of rising to meet both technical and non-technical challenges. John D. Rockefeller built a 4,000-mile oil pipeline in response to railroad barons trying to extort higher freight rates from him. However, the industry still has a way to go in terms of repositing current challenges.

The upstream oil and gas industry is deeply concerned with the negative impact current capital project performance will have on the industry as a whole – and rightly so. Russell Ackoff said: “Successful problem solving requires finding the right solution to the right problem. We fail more often because we solve the wrong problem than because we get the wrong solution to the right problem.” With this logic in mind, this report will identify root causes of oil and gas capital projects failing to achieve performance targets and go on to address possible solutions.



Challenges and Root Causes of Capital Projects under-performance

“The industry still uses the standard response to manage today’s complex capital projects.”

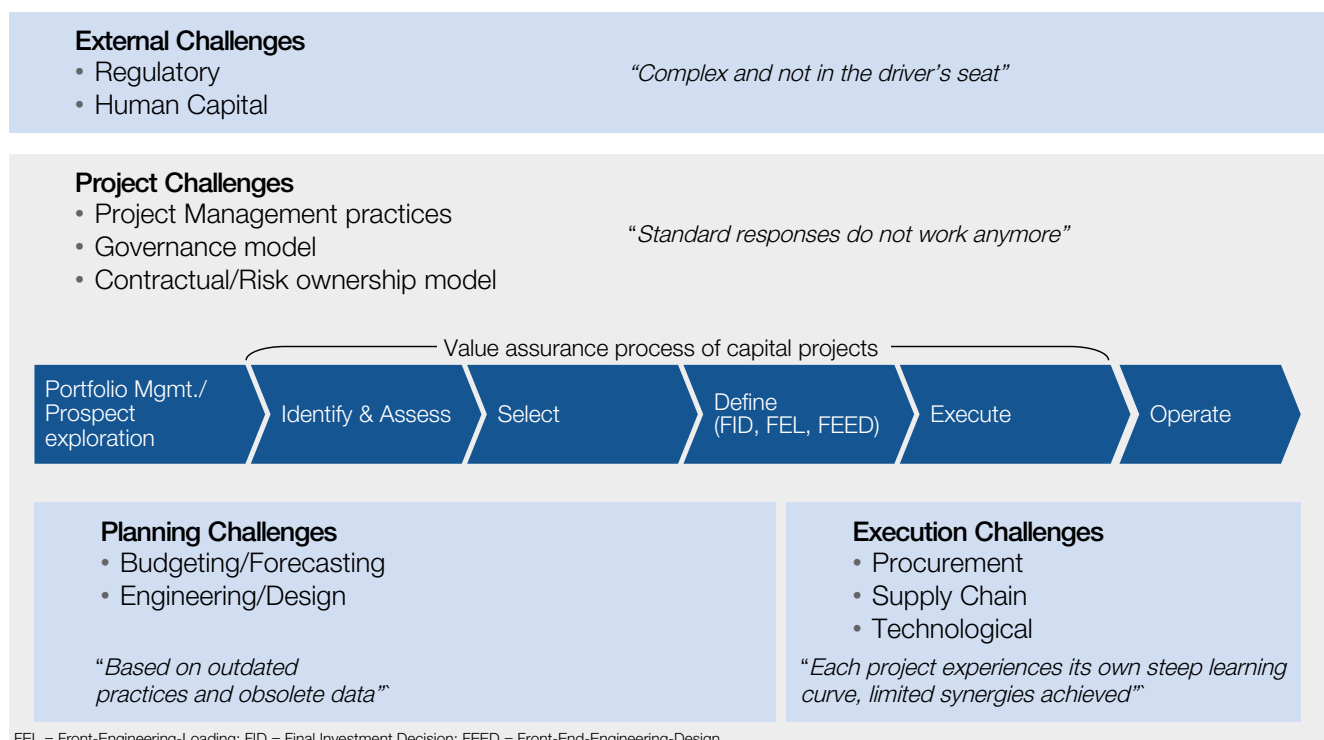
The World Economic Forum has developed a framework for mapping capital project challenges and root causes. The framework is based on the historical performance of oil and gas upstream megaprojects which are projects of over \$1 billion in annual budget, over the time period from 2003 to 2013. Interviews exploring potential root-cause drivers were conducted with over 50 seasoned executives and practitioners, from the standpoint of both project owners and service providers. The analysis provides a holistic view on where and when various large capital projects go wrong.

Challenges and root causes emerge in four categories along a capital project’s value assurance process:

- **External Challenges** – *complex and not in the driver’s seat* – mainly consists of regulatory and human capital issues

- **Project Challenges** – *standard responses do not work anymore* – dominated by project management practices, governance model, and contractual and risk ownership model issues
- **Planning Challenges** – *plans are based on outdated practices and obsolete data* – covers budget, forecasting, engineering and design issues
- **Execution Challenges** – *each project experiences has its own steep learning curve and few synergies realized* – focused on procurement, supply chain and technology implementation issues

Figure 1: Framework for Root Causes of Capital Project Deviation from Planned Performance



Source: World Economic Forum, A.T. Kearney

When analysing a number of specific examples, the highest priority issues identified were working towards unrealistic budgets and schedules (*planning challenge*), insufficient qualified labour in local markets (*external challenge*), inadequate change control and management (*project challenge*), and scarcity of service provider capacity (*execution challenge*).

Other challenges that were noted to have a large impact and occur frequently are insufficient supply of necessary equipment (*execution challenge*), ineffective risk identification and mitigation (*project challenge*), change order over-reliance with a magnitude of 20% of budget (*planning challenge*), and slow and ineffective stage-gate approvals³ (*project challenges*).

Oil & Gas Capital Projects – External Challenges

“The oil & gas industry is not in the driver’s seat for the complex external challenges.”

A steep increase in capital projects over the last decade is creating a tight labour market, in which each region experiences specific skills shortages and challenges.

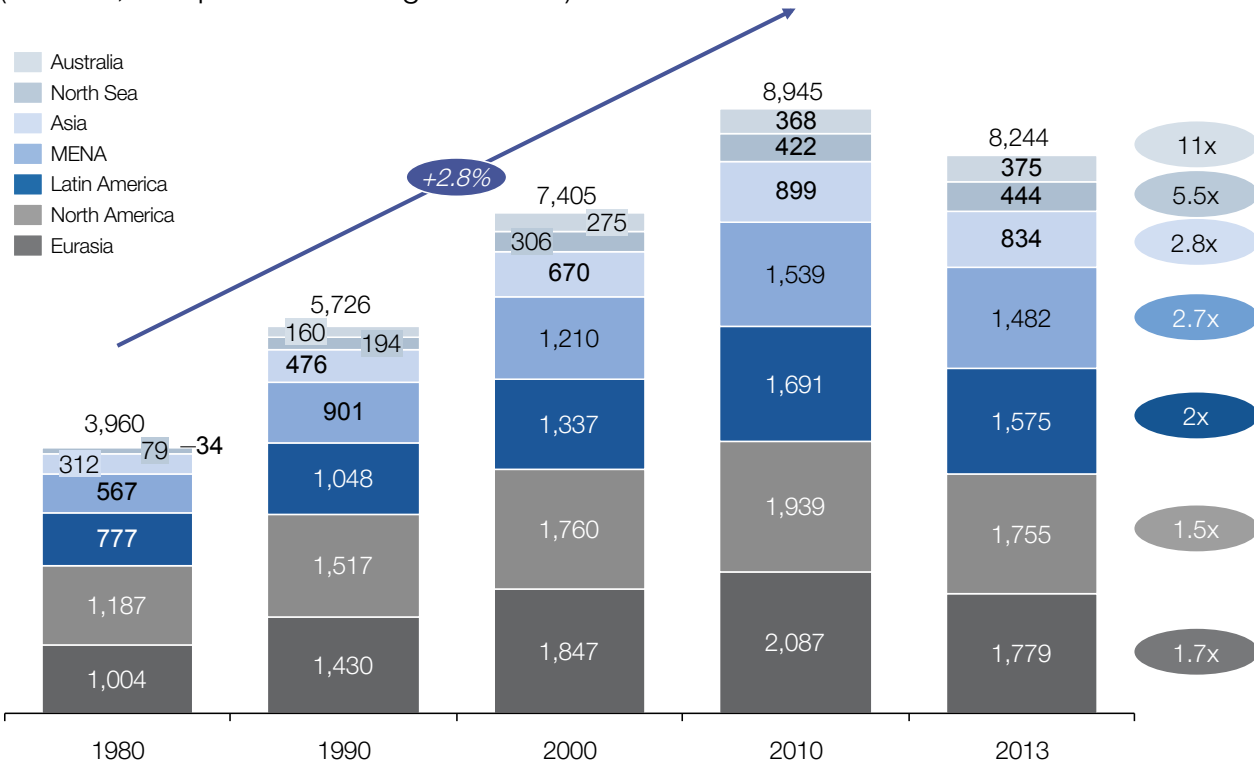


Steep increases in capital projects over the last decade are creating tight labour markets.



Figure 2: Increase in Capital Projects per Region, 1980-2013

(number, compound annual growth rate)



Source: World Economic Forum, A.T. Kearney

In mature markets, such as North America and the North Sea region, there is already infrastructure, universities and training centres, for training a specialist workforce in place as well as a supply of skilled local workers. Still, these markets are experiencing a talent crunch for specialty engineers, construction and supervision staff. This issue has numerous causes. Many experienced workers are approaching retirement; likewise there is a missing generation of specialists due to under investment and insufficient recruitment between 1990 and 2000. Skilled workers are also wooed to less-developed regions by above market wages. Finally, many bright young things with engineering degrees are instead heading off to Silicon Valley or Wall Street.

Talent availability can be further constrained by regulations imposing restrictions on the number of skilled resources able to migrate – although the impact varies considerably by location.

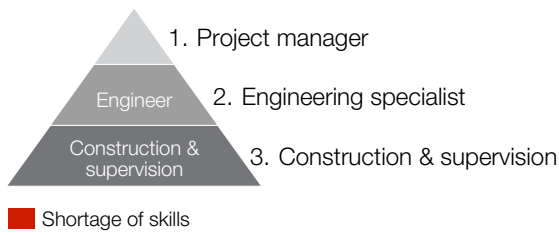
For example, Australia requires that for every one foreign worker imported, three local jobs must be created.

In developing markets, such as Latin America, the Middle East, and Asia, there is infrastructure to develop the local workforce, but the pool of skilled local workers is insufficient to support the local market. These markets are experiencing a shortage of top project managers, as well as a shortage of specialist engineers. Traditionally, developing markets have allowed skilled labour from other regions to immigrate to fill the human capital gap.

In new markets, such as West Africa and Eurasia, there are shortages of skilled labour across all levels and specialties, mainly due to the immature stage of their training infrastructure, and employment and knowledge transfer demands by local governments.

Figure 3: Skills Shortages according to the Type of Local Market⁴

Specific skills shortage:



1. Project manager with strong engineering expertise, project management, leadership and communications skills
2. Engineering specialist such as technical safety, metallurgy and process control
3. Qualified construction and supervision staff shortage due to shift in career preference towards roles in other industries and an aversion towards remote/difficult locations



Traditional Markets

Limited availability of construction and supervision staff

Developing Markets

Limited availability of top project management expertise

New Markets

Skills shortages across all levels of capital projects organizations

Source: World Economic Forum, A.T. Kearney

Due to the number and changing nature of capital projects, regulatory bodies are stretched beyond their capabilities and capacity. The North Sea region has seen over a 400% in the number of capital projects in the past 30 years. Lengthy approvals and processing times are common, as most regulatory bodies are managing an increasing number of operators, projects, and contractors with the same or fewer resources as 30 years ago.

“
Regulatory bodies are stretched beyond their capabilities and struggling to support industry.
 ”

Regulatory bodies play a much larger role than most people realize. Regulations around environment protection and operating requirements have shaped the industry over the past decades. Going forward, governments will also have to demonstrate flexibility in terms of new approaches to ensure supply of qualified labour. Regulators seek to ensure a competitive environment to drive innovation and ensure good wages. However, they also play a role in controlling that there are not an excess of players that would stress the supply of equipment, skill workers, etc. to the breaking point.



Oil & Gas Capital Projects – Project Challenges

The nature of oil & gas capital projects has changed; standard practices do not work anymore.

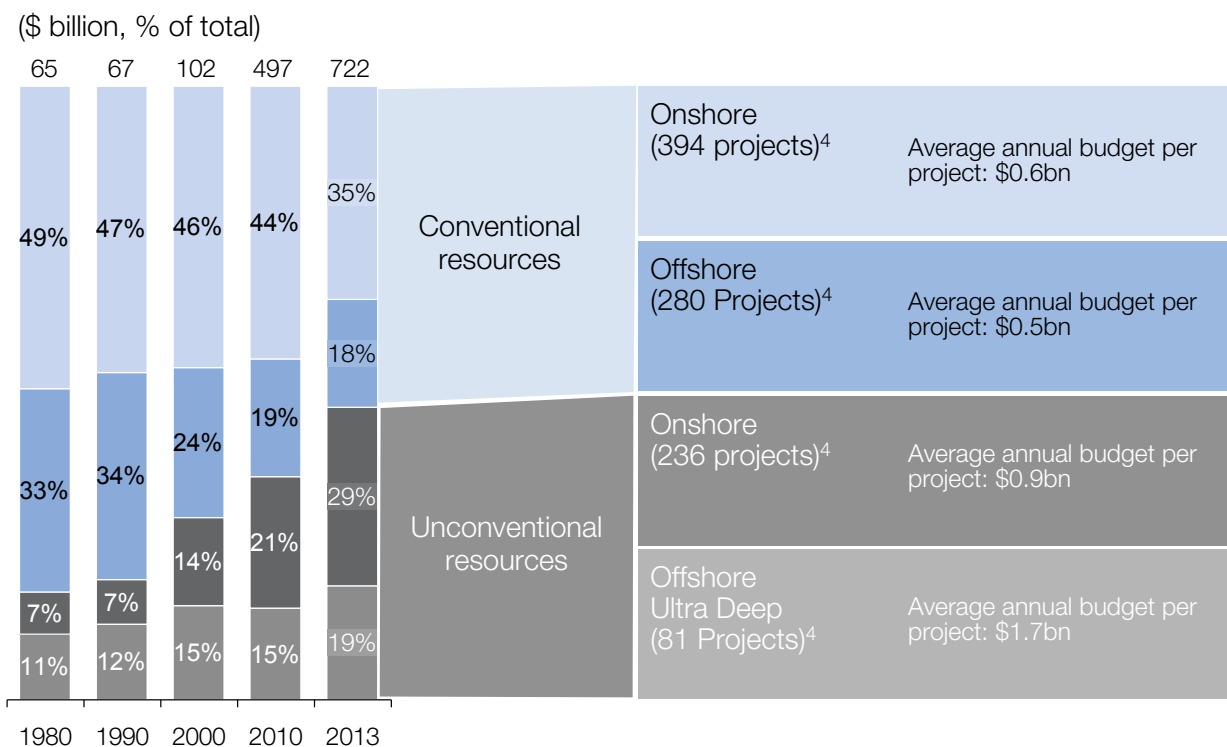
The oil and gas industry has experienced a revolution of sorts over the past decade. Capital expenditure in 2013 was seven times as large as in 2000. Concurrently, the capital expenditure profile changed significantly – unconventional and deep offshore exploration projects now account for roughly 50% of all upstream capital expenditure as compared to less than 30% in 2000.⁵

“

The shift towards unconventional, deep offshore and remote locations means that high complexity, high uncertainty and fast pace are now standard characteristics of large capital.

”

Figure 4: Historical Upstream Capital Expenditure by Project Category, 1980-2013



Source: World Economic Forum, A.T. Kearney

Misalignment of shifting capital project requirements and existing methods is a major root cause of poor project performance. Geology, personal safety standards, operating risk, and political stability for capital projects have changed significantly. But methodologies, processes, regulations and stakeholder relationships have not kept pace. Capital projects have become increasingly complex, requiring more advanced technology and operating in challenging locations. However, the methods used to manage the projects have change little in the last decade. While the industry is facing new risks and unknowns, risk ownership models remain unchanged – either project owners or contractors bear the full ownership of risks. The explicit negotiation of risk ownership remains a best practice, but successfully completing risk ownership negotiations create the sense that risk is “reduced” when in fact it’s often simply “allocated”.

Project management requires an overhaul to enable more autonomous and fast decision making by project managers and refocus on upfront stakeholder management. Overall, the “oil ecosystem” needs to shift its focus from schedule and cost control towards value creation and delivery. Project

governance models based on “stages and gates” along the value assurance process need more rigor and standardization, while being tailored to fit the specific risk and scale of the capital project. Capital projects are frequently pushed along to the next stage, even though not all deliverables have been realized. Furthermore, gate approvals can take over sixty days due to inefficient governance processes, particularly when national oil companies involve government control bodies. Roles, responsibilities, and the composition of project related steering committees are not clear or obvious. For example, it is critical to have the presence of someone with significant financial authority. Finally, project controlling and reporting is often opaque. It is characterized by minimal transparency and moving baselines due to soft sanctioning, ineffective reporting metrics and dashboards, as well as an improper definition of the project control function.

Oil & Gas Capital Projects – Planning Challenges

Planning and budgeting are based on outdated practices and obsolete data.

The industry’s focus on meeting economic and schedule targets has impacted the ability to properly budget and engineer large capital projects. Stakeholders often face conflicts of interest and perverse incentives, as realistic budgets render projects “economically unviable.”

Budgeting and engineering are driven by predetermined financial targets rather than by the actual requirements of the project. Driven by the perception that “it’s been done before, so it can be done faster and cheaper”, a number of projects are considered “cookie cutter” and are tapped for a “fast track.” The result is that standard pace projects are facing extinction. Interviewed subject-matter experts conveyed that project target budgets often determine engineering design, rather than the other way around. Similarly, project managers predetermined milestones dictate the time available for engineering activities rather than knowledge and an understanding of the project’s actual workload requirements.



The industry’s focus on achieving predetermined economic and schedule targets has impacted the ability to properly budget and engineer large capital projects.

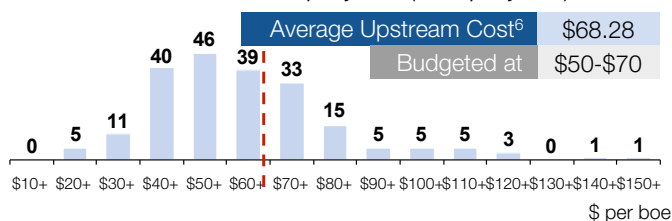


The tendering process is heavily biased towards financial parameters. Today’s tendering processes lean heavily towards financial metrics. Important technical parameters such as quality, health, safety, and environmental impact are harder to weigh and can often receive limited attention during tendering processes. As a result, contractors tend to be driven by cost in their tendering. Schedule delays are often a result of cost-oriented decisions. Higher priority is placed on contractor profits than on project quality, as suppliers will heavily rely on change orders to achieve profit margins.

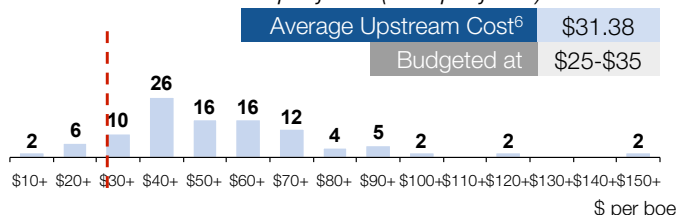
Figure 5: Final Investment Decision Budget vs Average Upstream Cost by Project Category and Region^{6,7}

North America⁶

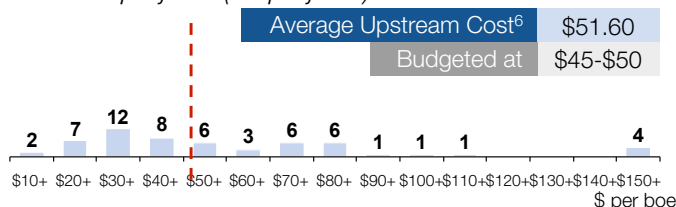
Onshore unconventional projects (236 projects)



Onshore conventional projects (103 projects)

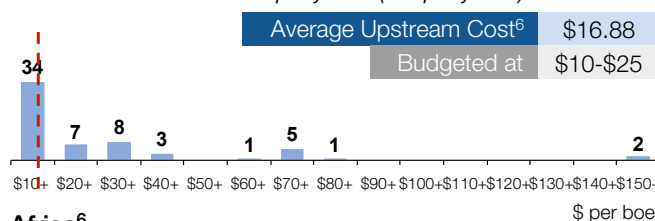


Offshore projects (57 projects)



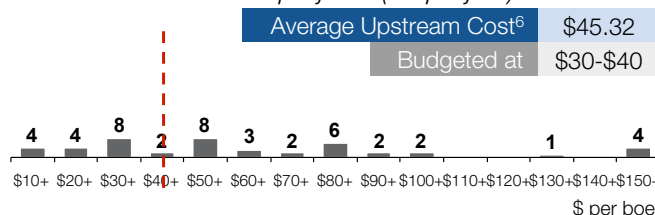
Middle East⁶

Onshore conventional projects (61 projects)

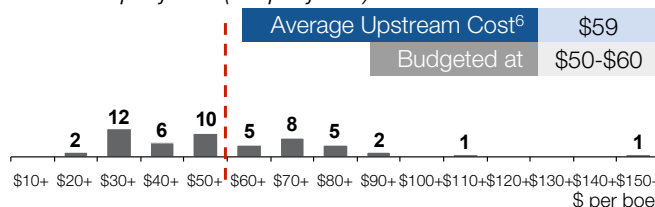


Africa⁶

Onshore conventional projects (46 project)



Offshore projects (52 projects)



Source: World Economic Forum, A.T. Kearney

In the early 1990s, NASA launched an initiative called, Better, Faster, Cheaper. The NASA workforce was cut by a third and more costly experienced managers and engineers took advantage of early retirement. NASA moved from a multiple vendor model to a single vendor model to eliminate overlap, thinning the system of checks and balances. In 2003, the space shuttle Columbia disintegrated as it re-entered the atmosphere, resulting in the deaths of the entire crew. The

cause of the catastrophe was found to be that a piece of foam had fallen off the external tank.⁹ But the deeper cause was failure to recognize the irreconcilable tension between Better, Faster, Cheaper. Today, you never hear mention of Better, Faster, Cheaper without it being followed by the quip, “pick two”.⁸ Oil and gas companies must decide which two to choose.

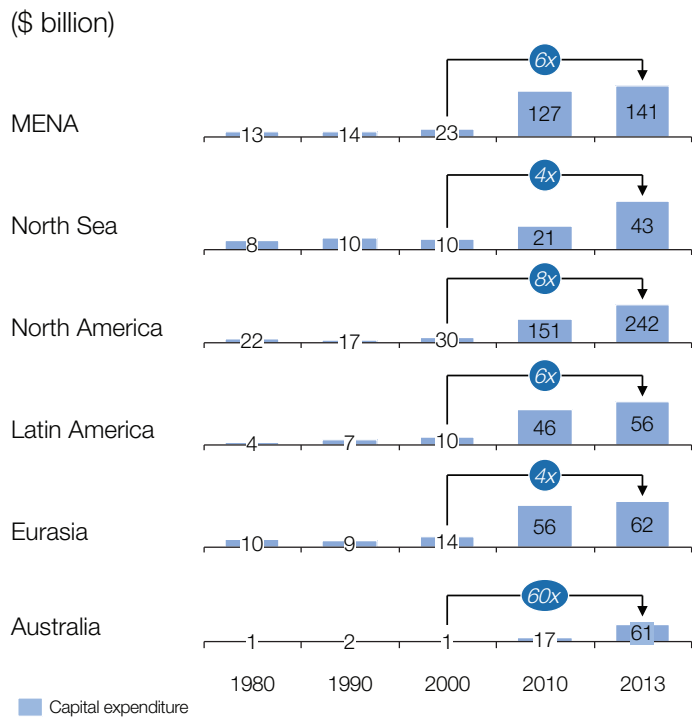
Oil & Gas Capital Projects – Execution Challenges

“Limited synergies are achieved during the execution phase.”

Although execution challenges are broad in nature, the challenge with the greatest impact originates with the procurement function. The sharp increase in capital expenditures over the last decade has put pressure on both regional and global supply chains, causing price increases and backlogs in the delivery of services and equipment.

Sharp capital spending increases within and across regions underpin the pressure put on global supply chains. Often a limited amount of equipment, human capital, and other items are needed by various projects concurrently. The most significant example is in Australia where projected liquefied natural gas project costs increased sixtyfold from \$1 billion in 2000 to \$61 billion in 2013.

Figure 6: Increase in Capital Expenditure by Region, 1980-2013



Source: World Economic Forum, A.T. Kearney

“**The sharp increase in capital expenditure during the last decade has put pressure on both regional and global supply chains, causing price increases and backlogs in the delivery of services and equipment.**”



Supply and demand planning of oilfield services and equipment requires careful consideration and must be based on an accurate understanding of purchaser needs. However, the oil and gas industry is notorious for its low level of supplier involvement at the early stages of capital projects. This results in service providers cautiously and slowly responding to the sharp demand increases from customers.

A widely acknowledged move towards specialization across upstream organizations resulted in core technical capabilities migrating to and being held almost exclusively by oilfield services suppliers. Although the procurement of oilfield services and equipment is strategic for capital project delivery, contractor relationships are largely treated as transactional. The project owners focus on reducing costs rather than on securing supply. That results in oilfield services companies abstaining from increasing capacity due to squeezed margins and uncertainty over future demand for their products and services.

Constrained supply chains around the globe are also linked to contractual models between upstream companies and their providers, which do not help cultivate the development of long-term strategic relationships. Two contractual models, widely known as “lump sum” and “reimbursable rates”, dominate the landscape. However, neither form in its current state supports a long-term strategic relationship. Each contracting model assigns the full allocation of risk to one party or the other rather than enabling a balanced allocation according to the circumstances surrounding the project.



Figure 7: Characteristics of the Dominant Contracting Models in the Oil & Gas Industry

Dimension	Reimbursable rates	Lump sum
Attractiveness	<ul style="list-style-type: none"> Preferred by contractors due to low associated risk 	<ul style="list-style-type: none"> Preferred by project owners due to cost control and risk transfer
Behaviours	<ul style="list-style-type: none"> “Foster gold plated solutions” Operators spend most efforts on contractor management for cost control 	<ul style="list-style-type: none"> Fosters cost-driven decision-making rather than value creation Focuses on compliance to initial specifications Change orders are means to achieve contractor profitability
Main risk holder	Operator	Contractor

Source: World Economic Forum, A.T. Kearney

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The lack of involvement of suppliers early on has resulted in service providers only cautiously ramping up own resources.

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Finally, barriers to strategic partnerships exist once a relationship is established. Most traditional supplier performance evaluation processes focus on the short term and do not consider long term parameters. While cost, time, and quality are typically touched upon, dimensions to foster a sustainable, longer-term relationship, such as value creation in the form of expertise and the development of innovation, are very rarely included, measured, or promoted.

Potential Solutions and Areas for multistakeholder Collaboration

Capital project challenges are mostly intertwined.

When envisioning solutions, one must acknowledge that today's challenges are all interconnected. Human capital scarcity, transactional relationships between stakeholders, and incoherent value assurance processes are outcomes of an industry experiencing dramatic growth. However, without the means to coordinate efforts for the benefit of all stakeholders, it is a zero-sum game.

Adapting to the new nature of capital projects. Just as the automotive industry reinvented itself in the 1960s and 1970s, the oil and gas industry requires a new operating model to successfully deliver capital projects. A key starting point is opening mindsets to testing out different contractual models to foster long-term strategic relationships. Effective contracting models are those in which project owners and suppliers agree projects on a common vision from the very early stages, and work closely to create value in the form of improved cost, quality, and overall satisfaction. The development of expertise, security of supply and demand, and balanced risk ownership associated with capital project execution are also critical components.

The envisioned contractual model would have a lifespan reaching beyond the execution of a single project. The mindset behind it would be one of reaping benefits in the medium to long term rather than just "now." Examples of such contractual models exist in the industry today in the form of master relationship agreements. However they are limited by the scope, degree of information exchange, and level of commitment between the parties.

Standard design platforms as enablers of collaboration. A collaborative approach requires a common language to successfully deliver benefits. Industry leaders already acknowledge the need for cross-industry standardization of engineering practices and design guidelines. However, to date no successful examples are in the public domain. In the automotive industry, standard design platforms for common equipment or modules are established to lower costs and improve success rates. To achieve standardization, the industry could establish a governing body to identify the initial subjects to standardize and to lead the development and later establishment of such standards. Alternatively, it could delegate the task to an existing industry body.

Catering for human capital needs of a growing high-tech industry. The oil and gas industry is and will continue to be one of the main sources of employment in the regions where it operates. In recognition of this fact, almost all respected organizations currently engage with and support local universities or establish their own training and development centres to provide a steady influx of new talent. However, the industry needs to look beyond current practices. Creating the

public perception that oil and gas is a cutting edge, high-tech, and environmentally friendly industry is crucial to attract talent. Opportunities exist to do so through early engagement in honest dialogue with relevant stakeholders, such as environmental groups, universities and local governments.

In addition, the industry must focus on how to better prepare for the new challenges as well as how to better leverage existing expertise. Multistakeholder collaboration can deliver important benefits when it comes to efficient resource utilization, particularly given the unsteady nature of the workload in the industry. Sharing a skilled technical resource pool across partner organizations under well-thought out agreements can enable not only access to needed skills for current requirements but also the creation of specialized centres of excellence equipped to prepare professionals for the future demands. Such an initiative would only be possible with stakeholders permitted to exchange information and the standardization of engineering practices. While there is nothing of such a scale, there is anecdotal evidence that oil and gas companies can work cooperatively.



Conclusion

There can only be a collaborative solution.

Today's challenges are interwoven and the outcome of an industry experiencing dramatic growth without the means to coordinate efforts. The complex and multistakeholder nature of today's challenges and those of the future signify the need for a different approach, if a solution is to be reached. If the industry can respond to once again deliver outstanding capital projects reliably the value creation opportunity is dramatic over the next 10 years and beyond – projects are only getting more difficult, so a response is required sooner rather than later.

Moving forward, the industry landscape will remain challenging. The global demand for energy continues to drive capital expenditure increases across the globe, highlighting the need to coordinate efforts to effectively tackle human capital and tight supply-chain challenges. Concurrently, the exploration of evermore challenging resources will continue, underpinning the need to adapt the management, planning, and execution of capital projects to its new complex and uncertain reality.

The first challenge is to align oil and gas stakeholders on which issues demand the highest priority. Conquering these challenges and issues requires an aligned response from all stakeholders. However, the views differ on where the priorities reside. Evidence from the World Economic Forum's survey on

capital projects shows that oilfield services companies see budgeting and forecasting – primarily performed in the select and define stage – as key issues to enhance the value of capital projects. However, oil and gas companies prioritize the execution phase, since that is the time during which a substantial amount of the money is spent. Bidding and contracting as well as selection and construction are seen by both parties as important, but not as the top priority.

Firstly, upstream organizations must recognize the need for open dialogue and collaboration across all parties involved in successful project delivery, as the means to tackle the industry's challenges.

Solutions to the challenges impacting the industry today also require engaging stakeholders outside the traditional supplier-customer relationship, such as regulatory agencies, universities, government, and other relevant partners.

For generations the oil and gas industry has been an outstanding example of how to “overcome challenges and adversity” for the benefit of the global economy. In a world where business models are constantly reshaped by customer demands and innovation, mastering the fundamentals of capital projects is the key to unlocking the full value of the industry.



Appendix

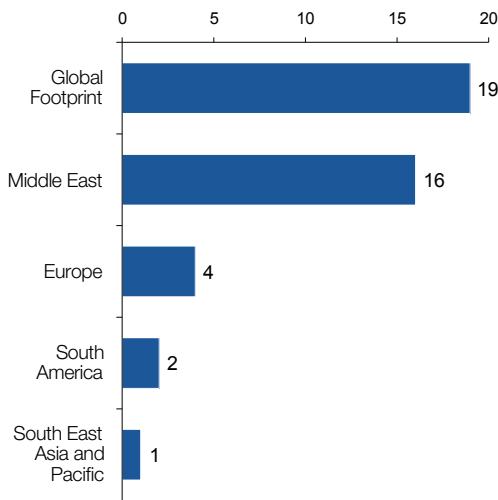
Capital Projects Survey and Results

Question 1:

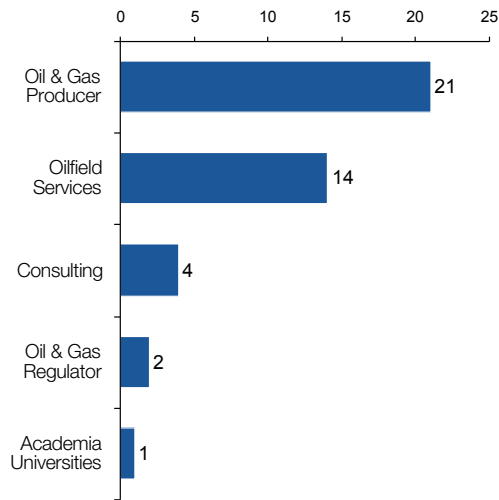
- My company's primary affiliation is part of this industry/sector.
- In which regions does your company primarily operate?

A total of 42 participants took the survey, mainly from organizations with a global footprint.

Participants by Geography



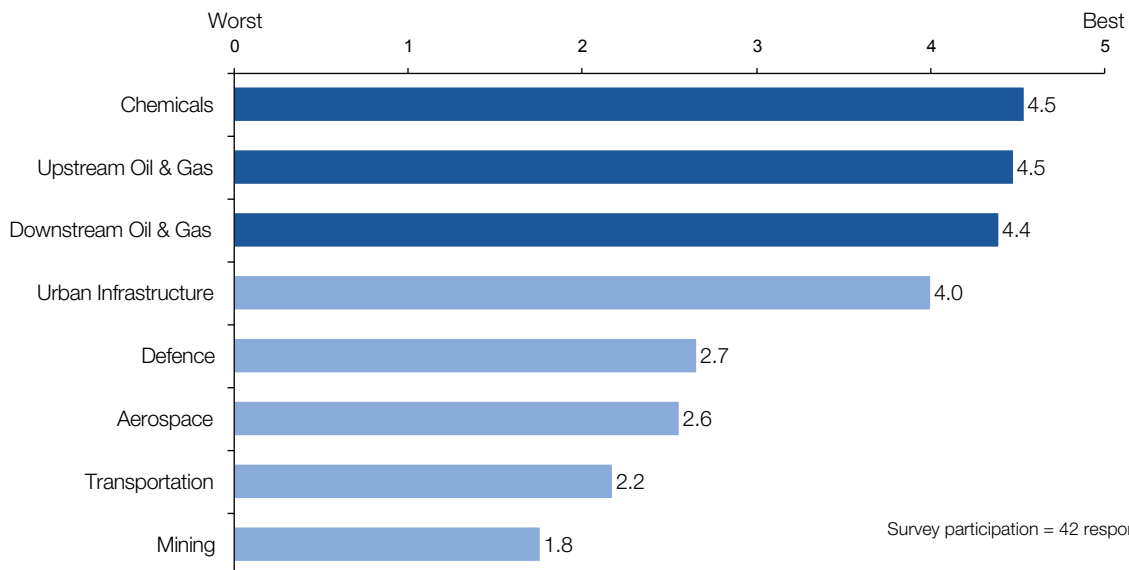
Participants' background



Question 2:

Please rank the following capital intensive industries' ability to deliver large capital projects within budget, schedule and quality.

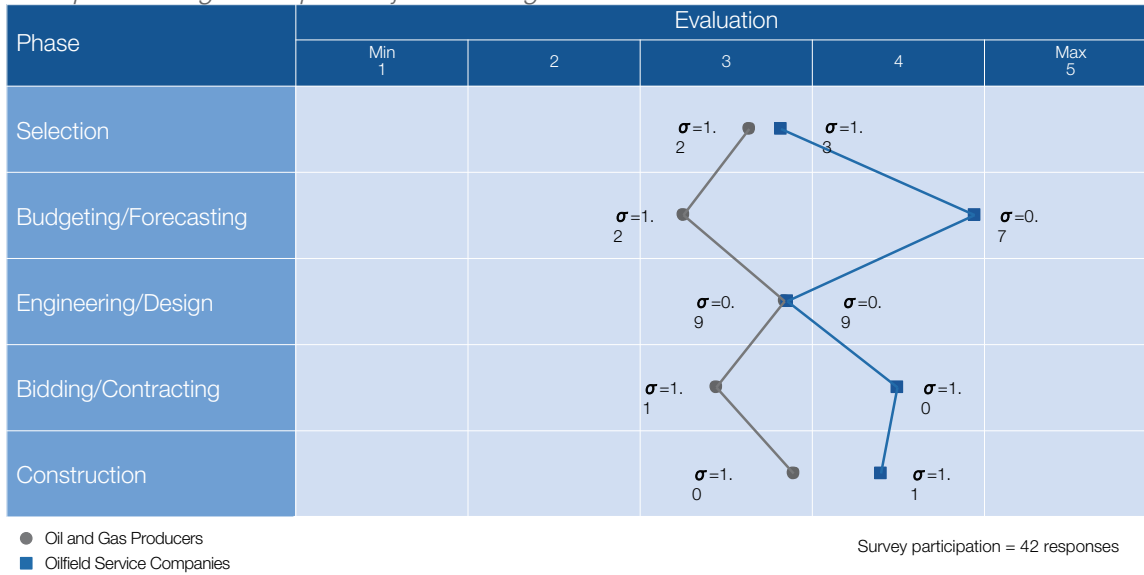
Perception of Capital Project Performance across Industries



Question 3:

Budget challenges often arise at different stages in the life cycle of a project. Please rate the following project phases according to your perception of when issues originate.

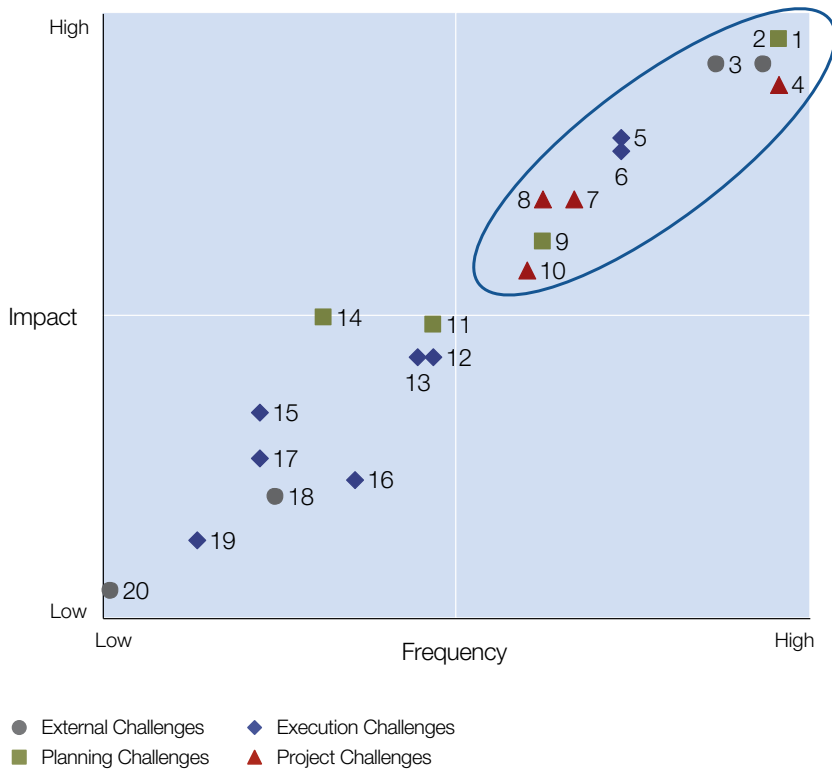
Perception of Origin of Capital Project Challenges



Question 4:

From your point of view, please indicate the likelihood and impact of the following situations occurring during projects.

Frequency vs Impact of Capital Project Challenges

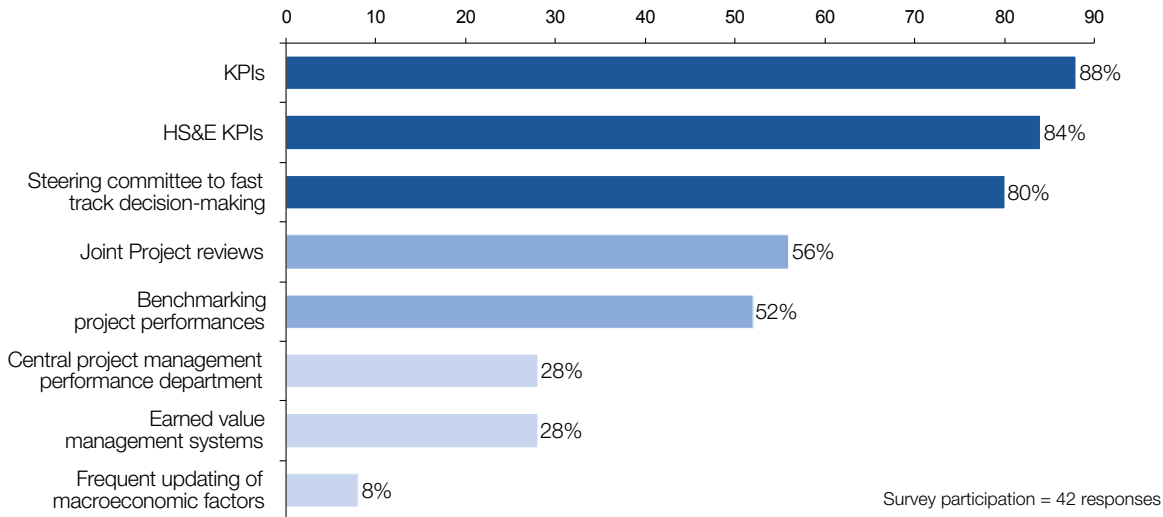


Key challenges	
1	Working towards unrealistic budget / schedule
2	Project understaffing
3	Insufficiently qualified labour
4	Project management – Management of change
5	Price increases - Competition from other projects
6	Thigh supply chain - Competition for resources from other projects
7	Risk management – Effective risk identification
8	Risk management – Effective risk mitigation
9	Change of orders represent >20% of budget
10	Slow and ineffective stage gate approvals
11	Price escalation calculated together with contingencies
12	New technologies qualification
13	Ineffective procurement
14	Contingencies exceeding 30% of FDI (Final Decision Investment) budget
15	Ineffective logistics – Incorrect or lack of materials on-site
16	Ineffective materials management
17	Logistical challenges associated with remote locations
18	Local content regulations
19	Excess inventory accounts >10% of budget
20	Environmental regulations

Question 5:

How does your company currently track the performance of capital projects? Select all applicable answers.

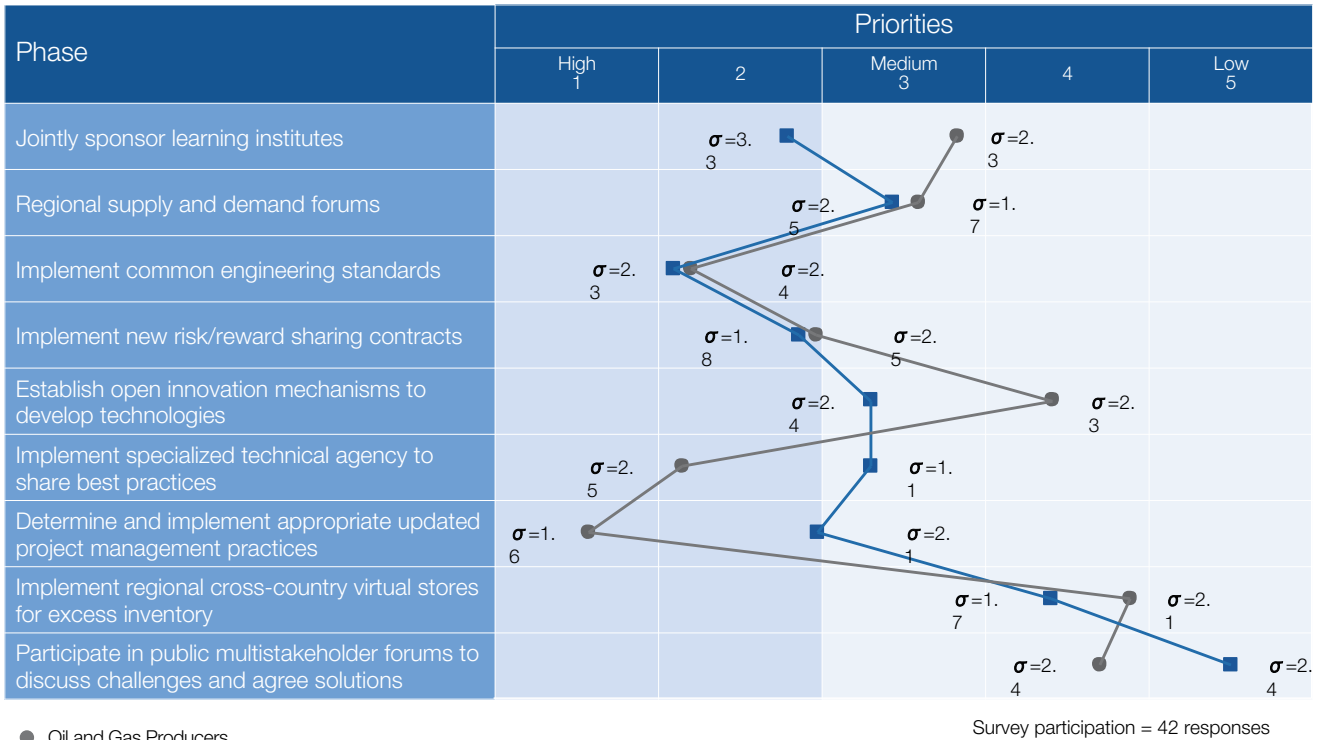
Use of Project Management Tools according to the Survey



Question 6:

How can your industry improve the performance of large capital projects? Please rank in order of importance (1 highest priority – 5 lowest priority)

Perception of Priorities to Implement Potential Solutions by Stakeholder Group



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List of Abbreviations

CAGR	Compound Annual Growth Rate
EIA	Energy Information Administration
FEED	Front End Engineering Design
FEL	Front End Loading
FID	Final Investment Decision
IOC	International Oil Company
MENA	Middle East and North Africa
NOC	National Oil Company
OFSE	Oilfield Services and Equipment
R&D	Research and Development
KPI	Key Performance Indicators
HS&E	Health, Safety and Environment

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Endnotes

¹ Blockmon, David. "Oil & Gas Boom 2014: Jobs, Economic Growth And Security." Forbes Feb. 2014.

² World Health Organization, Global and regional food consumption patterns and trends

³ US Energy Information Administration, International Energy Outlook 2013, Rystad Energy Database – Authors' analysis.

⁴ A.T. Kearney – ExCapII Survey 2012

⁵ A stage-gate process is a project management technique in which an initiative or project is divided into stages or phases, separated by gates. At each gate, the continuation of the process is decided by a manager or a steering committee. The decision is based on the information available at the time, including the business case, the risk analysis and the availability of necessary resources.

⁶ Based on interviews with leading global and regional upstream organizations.

⁷ Megaprojects with an over \$1 billion budget in execution from 2000 to 2013 – Rystad Energy Database – Authors' analysis.

⁸ Columbia, The Legacy Of "Better, Faster, Cheaper"? Raymond Anderson, Space Daily

⁹ Faster, Better, Cheaper – Choose Two: A Response to the Columbia Accident Investigation Board Report, Spencer L. Lewis, October 2, 2005

¹⁰ Capital projects in execution from 2000 to 2013.

¹¹ US Energy Information Administration – Independent Statistics and Analysis, 2007-2009.



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