Offshore

Mega-field developments require special tactics, risk management

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Megaprojects, those in the billion-dollar-plus class, have attracted a good deal of attention and even awe over the years. The 1970s were called the era of megaprojects, and many were associated with the development of energy resources.

The only comprehensive quantitative review of megaprojects of the '70s and early '80s concluded that very large projects, including those for energy development, routinely failed to achieve their objectives. These failures were driven primarily by too narrow a view of defining the project and, in particular, by the failure to fully understand and appreciate the interaction of megaprojects and the institutions, regulations, and customs of the host country.

There is a perception that billion-dollar and higher projects in petroleum development are not really so extraordinary and that our management processes have caught up with the complexities of very large endeavors. But is this true?

To answer that question, IPA took a systematic look at 14 elephant field developments –11 offshore – that were authorized after the publication of the prior evaluation. The sample deliberately excludes tar sands and extra heavy oil development, not because we believe these developments are really any different, but because we do not want the reader lulled into the belief that the results are somehow distorted by the inclusion of unconventional resources.

The data

The data for this study are drawn from IPA's petroleum asset development database, which includes over 700 field development projects executed by the industry over the past 20 years. Data for these projects were gathered as part of our regular evaluation process and include extensive and detailed data backed up with interviews with the project teams.

The 14 megaprojects examined here have some impressive basic statistics.

Only two of the 14 projects were primarily gas plays. The others are black oil fields, many with some associated gas and condensate. When considering the results of these projects, remember that major petroleum companies executed all with very substantial resources at their disposal. All of the projects were substantial enough to be considered significant developments by the owners.

The outcomes

There were four major outcomes:

- Cost growth, measured as the ratio of the actual costs through Phase I drilling divided by the estimate made at full-funds authorization
- Absolute cost, measured as an index of the capital cost per barrel equivalent based on the P50 reserves measured at first oil
- Schedule slip, strictly analogous to cost growth
- Absolute schedule, measured as an index of how long it took to execute the projects controlling for key characteristics.

Because the operating life of some of the assets is still quite short, we did not attempt to measure field producibility/operability in a systematic fashion.

Summary of megaprojects reviewed

Characteristic	Average	Median/range/comment
Cost	$2.7 billion	$1-6 billion total capex
Field size	815 MMboe	>200-2,000 MMbbl
Regions	6	
Operators	7	All large companies

Project characteristics that created "dogs"

Project decision or manage decision associated with failure	Stat. Prob.
The project objectives were not fully documented at authorization	0.03
An aggressive cost target was set	0.03
The project was schedule-driven with aggressive schedule	0.02
The project team was not integrated	0.01
Use of value-improving practices was low	0.008
Front-end loading (project definition) was poor	0.002

Cost growth

The 14 megaprojects averaged an astounding 46% growth from the authorization estimate, a total of $11.8 billion more than was estimated at sanction of full-funds. By contrast, the average cost growth on non-mega field developments is about 2% during the same period.

A second interesting contrast is that facilities rather than well construction are the primary source of cost growth on the megaprojects. These megaprojects are clearly not behaving like "normal" projects. The averages are misleading, however, as is often the case. Two projects actually ran under their authorization estimate, one by over 25%. Three projects came in with a reasonable 15% of their authorizations; two projects suffered between 20% and 40% cost growth; and seven projects – half the sample –experienced over 40% cost growth. We classify these seven projects as "the dogs."

Were these dogs merely optimistically estimated or did they really cost too much? The following comparison answers that question:

- The non-dog capex per barrel: $2.89
- The dogs capex per barrel: $7.31

There is no difference in average field size between the two groups. When one considers that the average cost per barrel equivalent for offshore developments is less than $2.50, these dogs, despite their enormous field size, are producing expensive oil.

Schedule and schedule slip

The average slip from authorization to first oil was 28% with a median of 13%. Six of the projects were completed reasonably close to their promised schedules – within 15% or so. Six projects slipped by 20% and more. But the most interesting contrast is with the dogs and non-dogs:

- Non-dog projects average schedule slip: 2%
- Dog project average schedule slip: 39%
- Dogs schedule index: 1.2

As was observed in the earlier evaluation of megaprojects, cost growth, high cost, and serious schedule problems are closely coupled in large projects. This is not surprising considering that one of the characteristics of mega-projects is that they have very high "carrying costs," that is, costs associated with very large mobilizations of contractors and people. When things slow down, costs increase rapidly.

Outcomes summary

Despite another 20 years of experience with large projects, you can't help but conclude that we have seen no material progress in the control of very large developments. The problematic projects here are reminiscent of many of the worst early North Sea developments. Only three of the 14 examined could be genuinely described as successful using normal success criteria of delivering as promised. More startlingly, only four of these large field developments boast costs under $3/bbl.

Half of the projects must be described as failures from both a project management and business perspective. Although the operability data are too thin to report in a systematic fashion, we do know that a few of the projects have experienced substantial facility and reservoir difficulties. In all, a rather discouraging picture has emerged.

Understanding the results

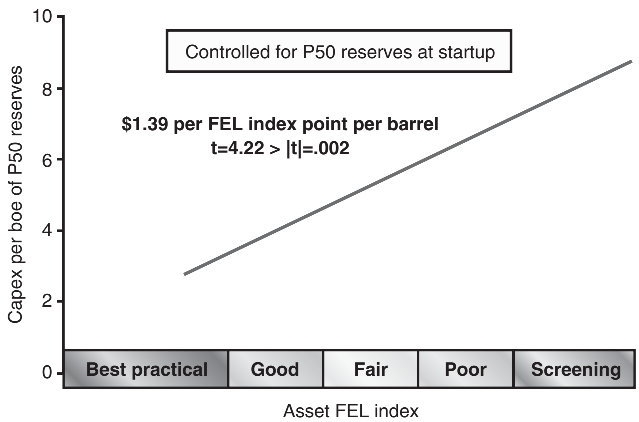
If the results of megaprojects have not changed materially, that raises the interesting question of whether the underlying causes of problems also remain similar to 20 years ago. In the earlier study, we concluded that megaprojects tended to fail when they destabilized their own project environment. The failed projects often overwhelmed the local infrastructure, created labor shortages, depleted the available capable contractors, forced regulators to deal quickly (and often ineptly) with wholly new situations, and invited political opportunism through the share volume of money suddenly available.

We firmly believe that when megaprojects create such conditions in the future, they will also tend to suffer difficult problems. In point of fact, however, these problems are less likely to occur often today than in the past because more areas have well-developed infrastructure, governments tend to be more sophisticated, and operators are more cognizant of the problems than in the past.

Unlike megaproject failures of the past, only one of the projects experienced serious regulatory problems, and even in that case, a strong argument can be made that the operator invited the problems. Only two of the 14 projects were executed in what could possibly be described as a "frontier" area, and while both were dogs, the frontier character of the area affected only one of the projects. Nor can we blame cutting edge technology for the failures. Only one of the 14 projects used substantially innovative technology and that was for purposes of "showcasing" and was not actually necessary to the field development. (That project was not one of the dogs, merely $4/boe capex.)

Another likely suspect that did not appear often was the dreaded host government, or its oil company proxy. Host government problems affected only two of the projects. In both cases, the government pushed hard for higher local content, especially job creation, and the operators failed to navigate the difficulties successfully.

Why FEL matters for mega fields



So, if the usual difficulties of the past fail to explain the high rate of disappointment in these projects, what does? The underlying source of failure in these megaprojects is simply poor business and project management. To demonstrate this point, we will compare the quality of management practices on the seven dogs with the projects that were successful or merely not abject failures.

The table lists, in order of ascending importance, six project management characteristics or decisions that helped predict whether a project would be a member of the "dog" class. The second column shows the probability that the relationship we found would occur randomly.

Two of the characteristics are decisions: to set aggressive cost targets and to prefer schedule over cost. Interestingly, aggressive cost targets were generally combined with being schedule driven in the megaproject failures. IPA defines a project as "schedule driven" only if the project team is explicitly granted authority to trade cost for schedule. The other four attributes of the failures are bread and butter bad project management.

Failure to fully document project objectives creates serious problems in generating team alignment, especially with contractors, and increases the chances that some major problems will not be anticipated. By IPA definition, a non-integrated team is one that is missing one or more critical functions on the owner team that is responsible for project development and definition (front-end loading) up to the point of the beginning of detailed design. Only one of the seven dogs was rated as having an integrated team.

The value-improving practices (VIPs) are 12 practices where IPA has established a quantitative link between the use of the practice and better project results. The use of the VIPs on the dogs was less than a quarter of the rate for the non-dog projects.

The most important single predictor of project success for any upstream project is the asset front-end loading index. This index is a weighted numerical combination of the status of deliverables that define the reservoir, the facilities, and the wells construction program for an upstream development. It turns out that the importance of front-end loading (FEL) is even larger for megaprojects than for other upstream developments.

Using all 14 projects, when we regress our asset FEL index against the cost per boe from these projects, we find that each improvement in the index is associated with a drop of $1.39/bbl of capex. The importance of FEL for cost-effectiveness will surprise few knowledgeable project managers. What may cause surprise is the fact that FEL was so poor on so many of these projects. The dog projects averaged FEL on the cusp of poor/screening. So, it leads us to yet another question: What caused the front-end work on these projects to be so poor?

Two attributes of projects fully explain poor FEL – lack of team integration and a high degree of schedule pressure. While these attributes can and do exist independently, they are also related: time pressure discourages full and effective team development while ironically making it more important. This leads us to the clear conclusion that the proximate cause of failure in mega-field development is schedule pressure.

Among the megaproject failures in our dataset, two factors underlie the drive for extremely fast schedule:

- The perceived need on the part of senior management to "make the (production) numbers"
- Fundamentally flawed commercial arrangements.

The first problem resulted from two situations:

- Internal organizational promises in which the business unit leaders made promises that could not reasonably be achieved
- Promises made by corporate management to the financial community regarding production levels that required heroic speed from large projects to achieve.

The second sort of problem occurred when concessionary deals were struck that either promised fast first oil or were structured in such a way that speed became essential to achieving a profitable result. Sometimes the concessions were too short to be profitable without breakneck project speed. Sometimes the concession structure encouraged "throwing money at the problem" by making capital appear inexpensive.

Regardless of origin, the pressure for speed on all of the disaster projects had two things in common: the source was business management, and the decisions were made without regard for asset development realities. The end results were unprofitable projects, which in all cases eroded stockholder value.

Better upstream megaproject results

The successful developments had several critical things in common. They were much better defined than the less successful projects. Of particular importance, definition was relatively uniform, covering reservoir, well construction, and facilities with good definition around regulatory requirements. The successful projects followed the operators' project work process.

With a single exception, the successful projects were not schedule-driven. This meant the projects' schedules were derivative of the data needed to proceed rather than driven by arbitrary (from the project's viewpoint) end dates.

The successful projects were generously staffed with owner personnel. The project teams also tended to include non-operating personnel as integral team members rather than passive members or auditors.

In summary, the risk position of megaproject developments is quite different from that of smaller projects. While very large fields offer enormous profit opportunities, they are, due to their sheer size and complexity, much more likely to derail than smaller projects. Further, once derailed, they are very difficult to put right.

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This leads us to suggest that companies should adopt a rather risk-averse stance toward very large field developments. This means more complete and conservative definition than a company's usual policies. It also means having cost and schedule targets that are realistic vis-à-vis the front-end loading and inherent risks.