Sizewell C Project Workshop
Summary of IPA Presentation: Understanding the Nature of Industrial Megaproject Outcomes

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IPA Megaprojects Database

IPA evaluates about 800-900 major projects for companies around the world each year with all data collected in person by IPA analysts. Between 5 and 15 percent of the benchmarked projects are megaprojects. IPA's current megaprojects database consists of 514 very large, complex projects executed worldwide. Sponsoring companies represented in the IPA megaprojects database include Integrated international oil companies, National oil companies, Nonintegrated petroleum producers, Regional refiners, Chemicals companies, Mining, minerals, and metals companies, Electric power companies, and Pipeline companies.

For the projects in IPA's database we collect information on scope, planning, and outcomes. We evaluate the quality and completeness of the business case and commercial arrangements, the competitiveness of the project at the end of scope development, the readiness of the project for sanction, and the relative success of the project after startup.

IPA develops a very complete technical, business, and people history of each project from front-end through early operation. These histories become the data that we use to find what works and what doesn't in capital projects. IPA research statistically tests relationships between practices and outcomes, controlling for project characteristics and only when a practice can be reliably seen as adding value to projects is it labeled a "best practice". Best practices, then, are not matters of opinion; they are facts based on systematic observation of many hundreds or even thousands of projects.

Megaproject Performance

Megaprojects usually disappoint their sponsors. That's just the sad fact. Even worse, when they disappoint, they almost always disappoint in a big way with large cost overruns, many months or years of delay, and, too often, poor-to-mediocre functionality. Two-thirds of megaprojects in IPA's database are assessed as Failures by these criteria.

But interestingly, when they are good (Successes), they are usually *very* good: on budget, on time, with excellent operations and highly competitive cost. There are surprisingly few mediocre megaprojects. Understanding the underlying reasons for this bi-modal distribution of outcomes is crucial to understanding these projects and how to do them better.

The divergent nature of megaprojects—very good or truly horrid—occurs because megaprojects are inherently fragile. Their fragility results from their complexity. And that complexity results from the very different kinds of work needed to make a successful project and the reality that those different kinds of work are highly interdependent. The key to every megaproject is to prepare the project so well that the number of things that can go wrong is kept to a manageable number and sort. The needed preparation is far more extensive than that for a smaller, less complex project.

IPA research on megaprojects shows that success requires braiding together three streams of work—Shaping, Basic Data Development, and Project Front-End Loading—into a manageable project.

Three Streams of Work

Technically complex (heavily engineered), large (multi-billions of dollars) projects are best conceptualized as having three major streams of work, all of which must be completed in a timely manner in coordination with the other two streams if a successful project is to result. We call these streams Shaping, Basic Data Development, and Front-End Loading.

Shaping is the process and activities associated with aligning stakeholders around the allocation of project value. A person or organization is only a stakeholder if they claim some portion of a project's value and have the ability to enforce their claim. When a stakeholder does not believe the allocation of value is fair, the enforcement of their claim creates turbulence in the project's environment. Megaprojects, which are difficult to manage under the best circumstances, quickly become unmanageable if investors are feuding, the local community is up in arms, NGOs are going to court, or regulators are unsatisfied.

All megaprojects require some amount of **Basic Data** development. The Basic Data are the foundation on which the engineering design is assembled. Some projects, such as new resource developments and projects that require new technology, have extensive Basic Data development needs. Those using standard technology with a number of established applications still have some new Basic Data requirements, but they are much less extensive. If the Basic Data are incorrect, the design is fundamentally flawed. Basic data errors are responsible for many of the megaprojects with poor functionality.

The third stream of work is the traditional project work of doing the scope development, advancing front-end engineering, and planning the execution of the project. This stream we call **Front-End Loading (FEL).** FEL is important for any project regardless of size or complexity. For megaprojects, however, Front-End Loading is absolutely essential. In our detailed databases of over 600 multibillion dollar projects, none of the poorly front-end loaded projects were successful. Although Front-End Loading is necessary, it is not sufficient.

Failures in Shaping or Basic Data development can undermine a project as thoroughly and completely as poor FEL. One of the ironies of megaprojects is that although almost all project professionals understand that excellent FEL is essential to megaproject success, only about 20 percent of megaprojects actually achieve the *Best Practical* level of work in this area.

The reason so that many megaprojects struggle to achieve a solid front-end is that FEL is dependent on the performance of the other two work streams. If the Basic Data are late or inaccurate, the FEL work is slowed and must be repeated when the correct data arrive. Shaping errors and omissions undermine the FEL process: stakeholders cannot agree on the commercial deal, which delays scope finalization, or a partner refuses to pay for FEL as a negotiating ploy, or an NGO enters the fray late and forces a late design change that undermines the work, or financial firms force a contracting strategy that will not work for the project.

The most common single Shaping error that destroys megaprojects is the setting of an unrealistic schedule. Lest one misunderstand, project teams are rarely allowed to set the schedules for megaprojects' FEL or execution. Schedules are almost always set by stakeholders, often in utter ignorance of the time that will actually be required to complete the work. The champion's need to make an announcement of the project, the time of a board of directors meeting, the perceived window for financing, or the next election, all are more likely to set the schedule for FEL and execution than the amount of time actually needed to develop the project and do the work. Aggressive schedules cause megaproject failure more often than any other proximate cause. The root cause is a failure of Shaping, which in turn is a failure of governance and leadership.

Why So Few Mediocre Megaprojects?

The complexity that characterizes megaprojects means that they are tightly woven together. The complexity facilitates cascade failures. The one thing that wasn't completed in the front-end has the ability to unwind the entire project. Due to complexity, work-arounds are very difficult.

Successful megaprojects had a set of common characteristics: no significant Basic Data errors, Shaping that was complete with an agreed upon allocation of value well before authorization, and very strong Front-End Loading performed by fully staffed sponsor teams. This enabled a plan for execution to be developed that was actually implementable by humans. The schedules were all based on the work that had to be performed and not on the calendar. The effect was not that "everything went according to plan"; EGAP never really happens on complex projects. But the problems experienced were few enough that the project teams could and did cope and keep the projects on schedule.

Although 67 percent of megaprojects in IPA's database are assessed as Failures, for projects that achieve a *Best Practical level* of Front-End Loading, the success rate grows to 64 percent. Furthermore, those projects that fully close Basic Data and Shaping issues at the right time in the project process and complete Front-End Loading to a *Best Practical* level are far more likely to be successful, achieving on the order of an 80+ percent success rate.

Nuclear Megaproject Performance

Those experienced in nuclear power have seen all manner of Basic Data, Shaping, and Front-End Loading deficiencies in their past. The industry had the misfortune in the 1970s and 1980s of implementing projects while the Basic Data were still in development, which resulted in continuous change from the regulators. Opposition to nuclear power made shaping more difficult as did the reputational effects of massive overruns suffered by so many projects. Unfortunately, many of the utilities building nuclear power plants lacked the project skills essential for FEL success. The failures are not surprising. Success will require not doing things the same old way.