



TRANSFORMING THE CAPEX PROJECT LIFECYCLE WITH RISK ASSESSMENT

by Dr. Patterson, PMP

Introduction

Much has been written in recent years about the benefits of conducting a project risk assessment, particularly in the form of a third-party facilitated risk workshop.

Today risk workshops are commonplace for major capital investment projects, especially in the energy sector, and are conducted by both owner organizations and the engineering contractors that actually execute the work.

Typically, these workshops are executed just prior to what is known as sanction, or Financial Investment Decision (FID). FID is the point in the project lifecycle that stakeholder(s) give the official 'yes' to the funding of the project and green light more detailed design and execution planning. The risk workshop is validation of the project's economics and ensures that risk exposure is quantified before the project invests in capital expenditure.

Now project teams are starting to realize the benefit of risk workshops can extend to stages of the project life cycle well before project sanction.

Phases & Gates

Projects are often summarized into two parts: planning and execution. Arguably, the planning phase is by far the most important of these two. Get the planning right, produce a realistic, achievable plan accounting for risk and uncertainty and there should be very few surprises during execution leading to an on-time, on-budget success.

Get the plan wrong and you'll rarely achieve project success.

Consider then that in a major CAPEX project, there are actually several planning sub-phases (and gates separating these) that sequentially lead into project execution.



Typical Planning Phases and Gates for a CAPEX Project

1. Pre-FEED/Concept Select Phase

In this stage, the planning team runs alternate scenario feasibility studies including comparison analysis for competing project scenarios or execution strategies.

2. Concept Approval Gate

More of a milestone than a phase, Concept Approval is when specific project concepts receive the official 'go/no go'.

3. **FEED (Front End Engineering Design) Phase¹**

FEED or Concept Development focuses on adding details to the chosen scenario from Concept Select. To help build a sanction estimate, the project team solicits high level contractor bids.

4. **Sanction/FID Gate**

More of a milestone than a phase, Sanction is the official 'go/no go' investment decision for a project.

5. **Detailed Design Phase**

Once approved, a project goes into a detailed design phase where both the schedule and cost estimate is fleshed out with enough detail to manage and control execution.

6. **Construction Readiness Review Gate**

This phase ensures project is fully ready prior to 'big dollar' expenditure.

7. **Execution Phase**

As expected, the actual execution/construction of the project starts here.

Additional benefits of a sanction review are:

- understanding timing and costs of mitigations
- key decision making points and sign-offs for triggering mitigations
- understanding identified opportunities

One of the challenges experienced on projects leading up to sanction is the large volume of concurrent work causing the risk workshop to be executed at the last minute or 'squeezed in' to accommodate a rapidly approaching sanction date. If risk assessment is implemented in the preceding planning stages, this pinch point could easily be avoided.

Historically, most projects have been either cost driven or schedule driven. The new reality is that many projects are being driven now by cash flow constraints. The timing of capital spending has become equally critical as the final cost.

Level of Detail

Each of the described planning phases typically works within a given level of detail for both cost and schedule. For example, at the Concept Select phase, it is common to have say a 50 activity high-level plan with only a factored cost estimate based on previous projects.

¹ Historically, risk assessment workshops are carried out as part of a stage gate process during FEED leading up to sanction. One of the criteria for achieving sanction is demonstrating that the project has a sound understanding of forecasted duration and cost investment *and* an acceptable amount of confidence in the potential range of these estimates.

Each planning phase results in a more detailed deliverable leading to a subsequent planning phase. Phases are separated by what are formally known as stage-gates. Most organizations follow standard stage-gate processes to ensure control through these phases. Each stage gate carries both ‘must meet’ criteria and ‘should meet’ criteria.

The table below outlines the level of detail for each of the defined planning phases.

| Description | Pre-FEED/ Concept Select | Concept Approval Gate | FEED | Sanction Gate | Detailed Design |
|----------------------------|----------------------------------|---|---------------------------------|---|--|
| Phase/Gate | Phase | Gate | Phase | Gate | Phase |
| Schedule Level | Level 1 | Level 2 | Level 2 | Level 3 | Level 3 |
| Cost Estimate | Class 5 | Class 4 | Class 4 | Class 3 | Class 3 |
| Outcome/Deliverable | Level 2, Class 4 proposals | Approved Level 2 schedule, Class 4 estimate | Level 3, Class 3 proposal | Approved Level 3 schedule/ Class 3 cost basis | Level 4 resource loaded schedule, Class 2 estimates |

The table below shows an example of categorizations for cost and schedule levels of detail.

| Schedule Level | Level 1 | Level 2 | Level 3 | Level 4 |
|----------------------------|--|---|---|------------------------------------|
| Schedule detail | Approx. 50 activities | Approx. 200 activities | 1000+ activities | Resource loaded |
| Cost Level | Class 5 | Class 4 | Class 3 | Class 2 |
| Cost Detail | Factored estimate from other projects/benchmarks | Factored with project specific factors | More detailed material take offs (MTO's) | Detailed contractor estimate |

More and more projects are now mandating risk assessments as ‘must meet’ criteria not just for sanction, but for preceding and subsequent stage gates as well.

So, should you wait to conduct a risk assessment until you have several thousand activities defined for a project? The short answer is no, there is huge value in conducting a risk assessment much earlier on in the project. Conducting a risk assessment at strategic points in the project through various phases positively influences critical decisions for proceeding with the project, chosen technologies, costs for mitigations, or possibly looking at other projects within the portfolio based on the organizational appetite for managing risk.

Risk Assessment at the Pre-FEED/Concept Select Phase

The objective of a Concept Select phase is to determine the most suitable and beneficial project candidate to move forward with. Examples include choosing between a pipeline or an onshore facility or a spar facility versus a semi-submersible platform. In both cases, different executions and deliverables satisfying the same project requirements.

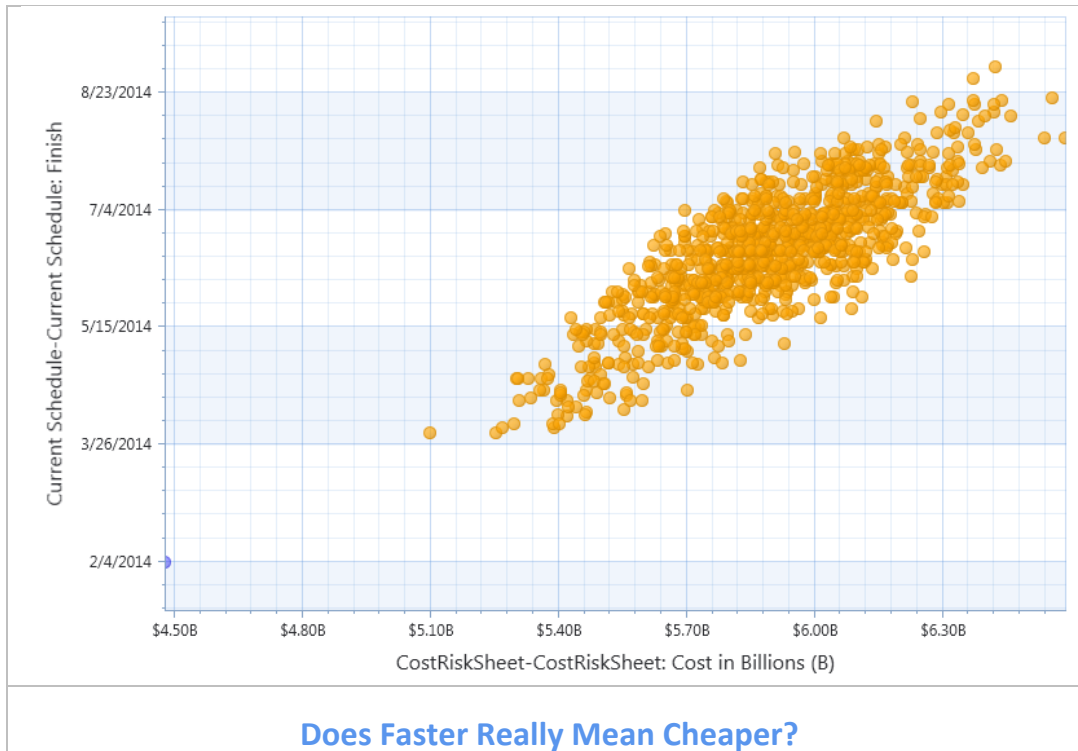
Recently, an owner organization conducted a risk assessment on two competing project concepts. On paper, concept A was cheaper than concept B, but was longer in project duration. Concept A requires less CAPEX investment, but a delayed operational revenue generation. Because the project was more time-sensitive than CAPEX-sensitive, concept B was the preferred option going into the risk assessment because the project asset would be online six months earlier than concept A's.

The results from the cost/schedule risk analysis showed a different picture. For concept B, the model showed that there was a very high probability of requiring additional work during the hook up and commissioning phase once the platform arrived at its offshore location due to high risk surrounding the fabrication of the platform in Singapore.

Why did this make concept B take longer? Surely this segment of work was simply being re-sequenced to later in the project without impacting the finish date?

Unfortunately for the project, this wasn't the case. The additional in-field work had a productivity rate of roughly a third of work in the fabrication yard. Not only was the work getting re-sequenced, it was getting elongated as well. This resulted in concept B, the more expensive option, also being more likely to take longer.

Without conducting a risk workshop, this insight wouldn't have been possible.



Key Benefits at Pre-Feed/Concept Select

- **Cost/schedule benefit analysis**
How sensitive are your alternate concepts to cost/schedule risk? Is the cheapest, fastest really so?
- **Decision support**
Objective and defensible data demonstrating why the less-than-obvious concept is sometimes the better recommendation. The exercise can also drive consideration of additional alternate scenarios.
- **Early development of a project risk register**
The project goes into FEED with an established risk register with which the selected concept can be further detailed and planned.
- **Team buy-in and awareness**
Even prior to FEED, the team is already bought in on why the concept was selected and the risks associated with it.
- **Demonstration of team's capabilities**
Provides confidence that the team is looking at all potential impacts (positive and negative) that could affect the project through each phase.

Risk Assessment at the FEED Phase

As already described, FEED leads to sanction (or a decision on whether to proceed). All efforts in FEED are to establish a highly defensible business case for funding the project's detailed design and execution phase.

A risk workshop helps drive the development of a realistic schedule/cost estimate. If the schedule and cost estimate were perfectly achievable and realistic, then risk workshops wouldn't be necessary. Instead, following a risk workshop, the planning and estimating team will often adjust or re-calibrate their durations and costs based on the team's inputs in the risk workshop thereby improving the forecasts. Cost and schedule contingency requirements are then strategically built into the estimate and plan.

Mitigation planning should be a key part of a FEED risk assessment. Presenting risk exposure to a sanction board is not particularly constructive. What *is* constructive is to use the risk exposure as a basis of discussion and then determine what is involved in reducing this exposure to a more acceptable level. Using modeling and risk tools that enable you to run what if scenarios reflecting mitigation is hugely valuable because it provides a cost/benefit analysis for proposed mitigation strategies.



Key Benefits at FEED

- **Team buy-in**
A risk workshop forces the team to review and buy into the cost/schedule forecast. This leads to cost/schedule re-calibration and improvement.
- **Sanction review preparedness**
Many of the questions posed by a sanction board actually arise during a FEED risk workshop and so the workshop is in itself an excellent 'dry run' for the sanction review.

- **Mitigation ready**
Often, a sanction review board will want to understand the change in risk exposure if further investment is made in risk reduction/mitigation.
- **Risk ownership**
Risks can only be reduced or mitigated if they are assigned. Part of the risk review process leading up to sanction is to assign risks and mitigations. These then become part of your project plan.

Risk Assessment at the Detailed Design Phase

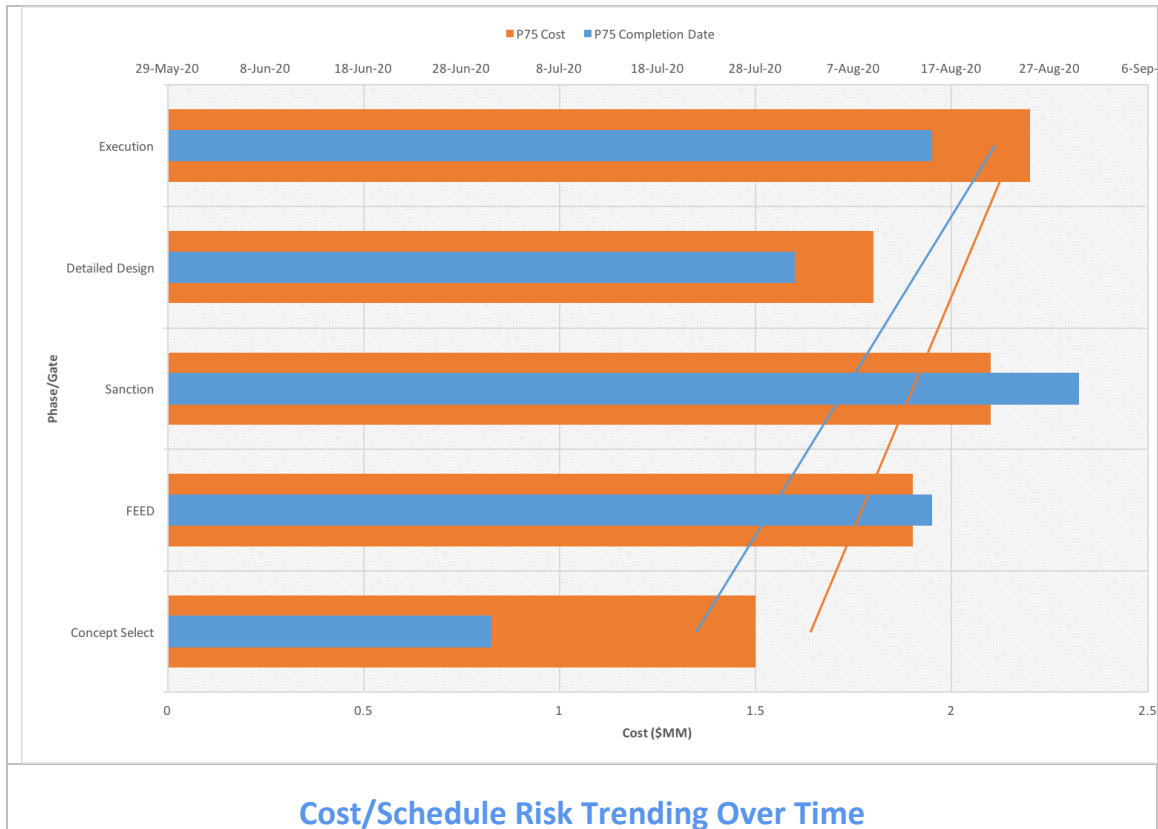
Once the project is sanctioned, focus turns towards creating a more detailed schedule and cost estimate that is then used as the basis of control and performance measurement during execution. Certain scope packages of your project may actually start execution during this phase.

One very interesting aspect of risk assessments is one of the deliverables from the process—a risk-adjusted forecast. For example, a P75 risk-adjusted forecast is the resultant schedule based on your P75 outcome. While you may have gained sanction approval at this P75 confidence level, you absolutely do *not* want to manage your execution to this P75 schedule. If you do, you will fail. Instead, you should continue to monitor project execution to your sanctioned determinist forecast tracking how much draw-down on your allocated contingency you are burning based on the actual versus plan discrepancies.

Recording this draw-down of contingency is an excellent method for determining how well you are managing your execution. Draw down too much and too fast and you need to look at accelerating or remediating your forecast i.e., re-planning to ensure you will still achieve your cost/schedule objectives even though you are currently behind schedule and perhaps also over budget.

This is where a Detailed Design risk workshop can prove to be hugely valuable. Detailed Design has a lot of moving parts all of which progress very quickly. Such fast pace and magnitude of change inherently drives the need for updated risk models beyond those developed for sanction.

With the combination of new, more detailed incoming plans and estimates from your awarded contractors together with perhaps some early execution works e.g., site clearances, comes the need for conducting a revised risk assessment. This is also an opportunity to assess whether your earlier planned mitigations have indeed been successful in reducing your risk exposure. If your risk model at Detailed Design shows more risk than it did going into sanction, you are losing control of your project. Use this approach for tracking trending of your project.



Key Benefits at Detailed Design

- Contingency management**
 Is the project keeping within the allocated boundaries for contingency?
- Mitigation effectiveness**
 Are your team members retiring and reducing risks as planned?
- Risk exposure trending**
 Compare your risk exposure all the way back to concept select to ensure continued reduction in risk and increase in project control.
- Manage multiple moving parts**
 Improved planning and control during a highly fluid and fast moving project phase

Conclusion

Risk assessments and risk workshops are far from being a new concept. Projects have been benefiting from understanding their risk exposure leading into sanction for many years now.

What is emerging and proving highly valuable is the repeated risk assessment of a project during the very early stages of planning at the concept select phase.

Using the results from a risk workshop to help with decision support during Concept Select all the way beyond FEED/sanction through to Detailed Design where the continued and repeated assessment of risk becomes valuable as a trending mechanism, giving insight into your control of risk further drives you towards project success.

About the Author

Dr. Dan Patterson, PMP is the founder of numerous project analytics organizations including Acumen, PMFocus and BASIS as well as the inventor of tools such as Acumen Fuse (now part of Deltek).

Today, Dan continues his passion for evolving project analytics through his organization, PMFocus. PMFocus specializes in project risk analytics conducting third party risk assessments globally, and revolutionizing the planning industry through software innovation.