

The Four Planes of Capital Projects

*An Integrated Approach to Capital Project
Due Diligence*

August 2009

*Management by objectives work - if you know the objectives.
Ninety percent of the time, you don't.*

Peter Drucker

THE PREDICTABILITY PREDICAMENT

The more critical the project, the more important is its predictability. Of course, the most important projects in the company's capex portfolio tend to be those that carry the most risk, due to their large size and complexity. Cost overruns and schedule delays on these "mega-projects" cannot easily be offset by better-than-expected performance on other (smaller) projects, so the expectations for predictability are even higher. The predicament, naturally, is that predictability on these projects is much harder to achieve, since they impact and are impacted by the environment in which they take place.

Who owns predictability? Every decision – maker seeks predictability in the outcome of his or her capital project investments. Management generally looks to others to be responsible for predictable project outcomes, such as their project managers and teams, or the engineering and construction contractors those teams entrust with the work. Few decision-makers see *themselves* as the primary drivers of predictable outcomes.

Perhaps they should. The decisions, strategies and plans that shape, drive and deliver a capital project are, above all else, the primary determinants of predictability and drivers of success.

CAPITAL PROJECT DECISIONS MUST CONSIDER THE ENTIRE BUSINESS MODEL

In general, the goal of a capex investment is to maintain or increase future free cash-flow. In addition to paying dividends and possibly buying back company stock, free cash-flow is used to invest in sources of future cash-flow, i.e., mergers & acquisitions (M&A), and capital projects (i.e., revenue-producing facilities). This is illustrated by Figure 1 below.

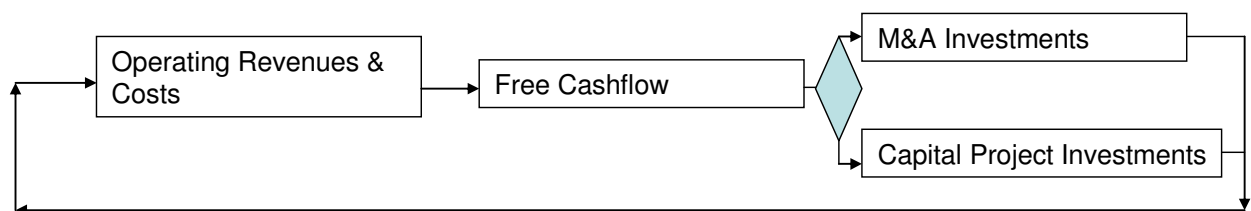


Figure 1: The business goal of investments in major capital projects is to maintain or increase future free cash-flow.

This broad business goal is eventually translated into capital projects whose strategies, plans and decisions are defined on four planes:

- The **Commercial Plane**: Describes how the capital project will produce revenue via agreements with suppliers, off-takers, et.al.

- The **Financial** Plane: Describes how the project’s capital investment will be paid for via arrangements with partners, lenders et.al.
- The **Technical** Plane: Describes the technology to be used to create the facilities required to produce the expected revenue, and the physical scope of those facilities.
- The **Execution** Plane: Describes (inter alia) the organization and contracting strategies for performing the engineering, procurement, construction, installation and startup; and the plans for managing those activities.

These four planes of a capital project investment are illustrated by Figure 2 below.

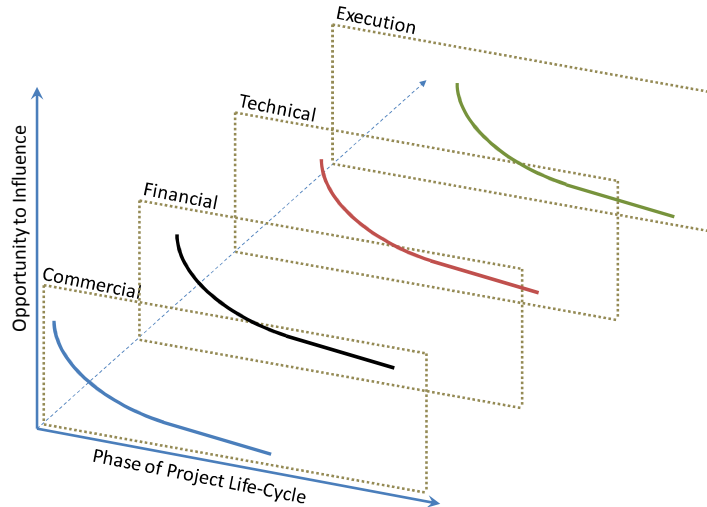


Figure 2: The Four Planes of a Capital Project Investment, Commercial, Financial, Technical, and Execution are illustrated by the influence curves above showing how management’s ability to influence the outcome diminishes with time¹. The influence curve for each plane has a unique shape with its own points of strategic inflection. Since project definition matures at a different pace on each plane, the level of influence at any given point in time will be different.

Management decisions are often taken on one plane without full consideration of the implications of those decisions on the other planes, as well as how activities and decisions on the other planes may impact the decision at hand. These decision “silos” are often a cause of lost predictability as well as inefficient use of time, effort and funding in front-end activities.

Consider a multi-billion dollar, international project in a difficult location. Clearly, each of the above planes is complex in its own right. Most organizations involved in such projects involve an array of specialists – both internal and external – to help define, negotiate and document all the required elements. As the project progresses through the phases of early commercial development, concept definition, front-end engineering, and finally to financial close and sanction; each of these planes, of course, becomes better defined. Although complex, the challenge here is usually not one of being able to do the work on each plane (there is no shortage of experts to draw upon). The real challenge is one of integration and interface management.

Let us now explore the definition and interaction of these four planes in more specific terms, and see how a more holistic approach to decision making, considering all four planes, can be applied.

CONSIDERING THE SCOPE AND TIMING OF BUSINESS & PROJECT DECISIONS

There is a logical way to group the four planes: Commercial and Financial strategies and decisions are all part of “Business Development & Execution”, likewise, Technical and Execution strategies and decisions are all part of “Project Development & Execution.” These have Business Risks, and Project Risks, respectfully, which together, determine the predictability of the outcomes of the capital project investment. This is illustrated by Figure 3 below.

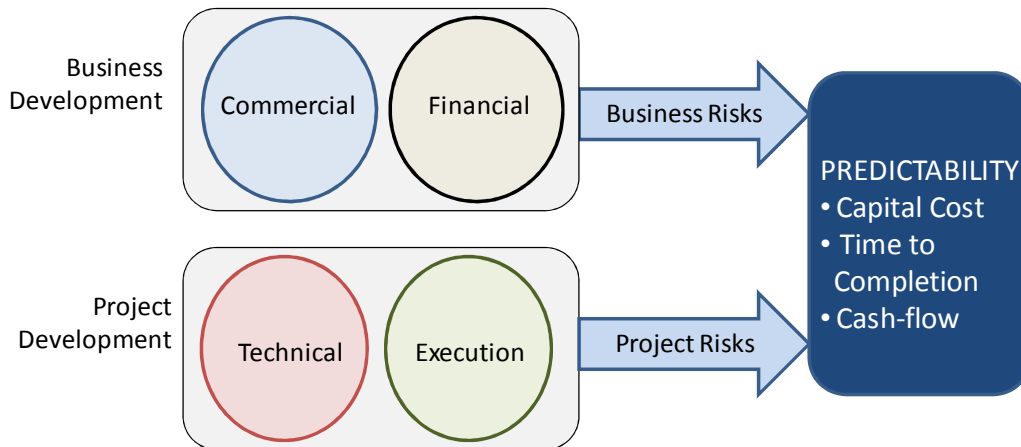


Figure 3: The Commercial and Financial Planes define the strategies and decisions describing Business Development; the Technical and Execution Planes define Project Development. Predictability is a function of both the risks to the Business Development (i.e., Business Risks), and to Project Development (i.e., Project Risks)

So the scope of decisions involving capital project investments, must consider all the relevant activities, goals, risks, and sensitivities of Business Development and Project Development, as well as the associated Business and Project Risks. Likewise, the plans along each of the four planes, which describe the activities & responsibilities necessary to develop the information needed for each decision point must consider relevant activities, decisions and requirements from other planes.

CONSIDERING AN INTEGRATED SET OF PHASES AND GATES

The disciplined use of phases and gates to describe the project life-cycle and critical decision points is a well-accepted method for inculcating the right priorities in an organization, and ensuring that decisions are based on well-developed information. In most organizations, these processes are generally applied to Project Development.

Whether or not an organization has formal processes for Business Development, the “silos” that provide the core functions for each of the Four Planes typically make alignment, coordination, and communication difficult. As a result, the people working on each plane tend to make simplifying assumptions about the strategies, decisions, and risks on other planes. Eventually, this lack of alignment shows up as major changes in direction, often resulting in significant re-direction or even as cost and schedule overruns.

Figure 2, above, illustrated the “influence curve” that described how management’s ability to influence a project’s outcome decreases with each stage in the project lifecycle. The clear implication is that early, rigorous attention to definition and decisions is critical to predictable success. Let us now consider what happens if each of these four influence curves is imposed on the others – see Figure 4 below.

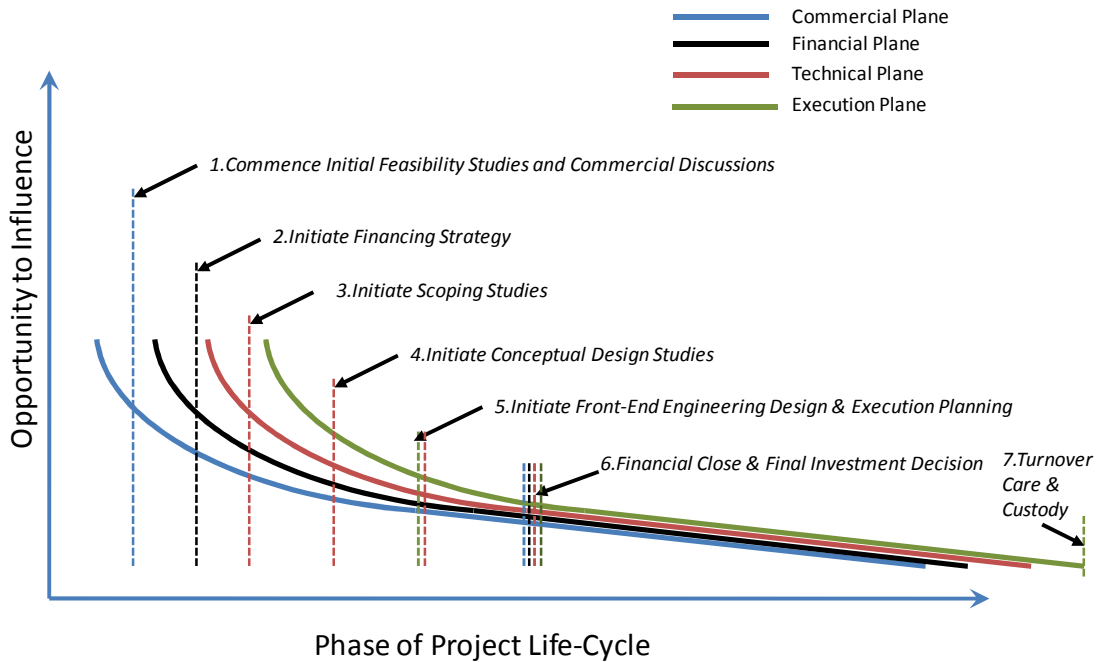


Figure 4: Key decisions on each plane must consider the current activities, past and upcoming decisions, and risks associated with the work on the other planes. The figure shows typical decision gates on each plane, and where they might intersect the work on the other planes.

For example, consider decision #4 above: *Initiate Conceptual Design Studies*. We see that this is typically an early decision gate on the Technical Plane, often marking the start of “Front-End Loading” activities that include strategic project planning such as procurement and contract strategies.

Project teams begin this work based on the results of scoping studies (on the Technology Plane). The diagram illustrates that, while the technical and execution work is still in its early stages, work on the Commercial and Financial Planes is apt to be well-developed by this time. The developments, decisions and plans on the Commercial and Financial Planes will likely have important implications for how the work on the Technical and Execution Planes proceeds ... but, in most cases, this important dialogue never takes place.

What might a high-level description of a capital project’s phases look like, if all four planes were considered? Consider Figure 5 below.

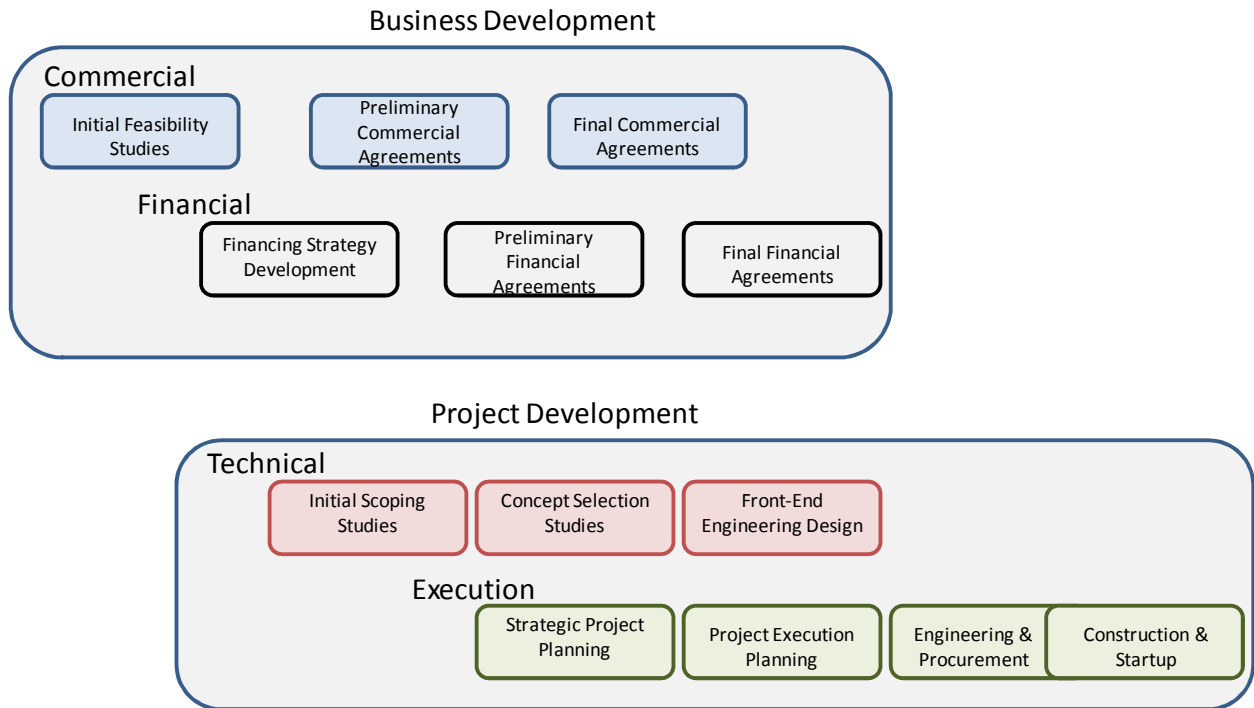


Figure 5: A high-level overview of the phases of a capital project along each of the Four Planes. The horizontal positioning of each phase provides a coarse indication of relative timing. Each phase is separated by a decision gate.

Here we see a straightforward representation of what an integrated, phased & gated business and project development process might look like. There are, of course, many dependencies between the work done in each phase on a given plane, and that done concurrently on the other planes – these are discussed further in the paragraphs below.

Now consider what happens if we combine the decision gates shown on Figure 4 with the phases on Figure 5. The traditional, facilities-centric phase-gate process now has a more holistic perspective, as do the decisions at each gate. (see Figure 6 below).

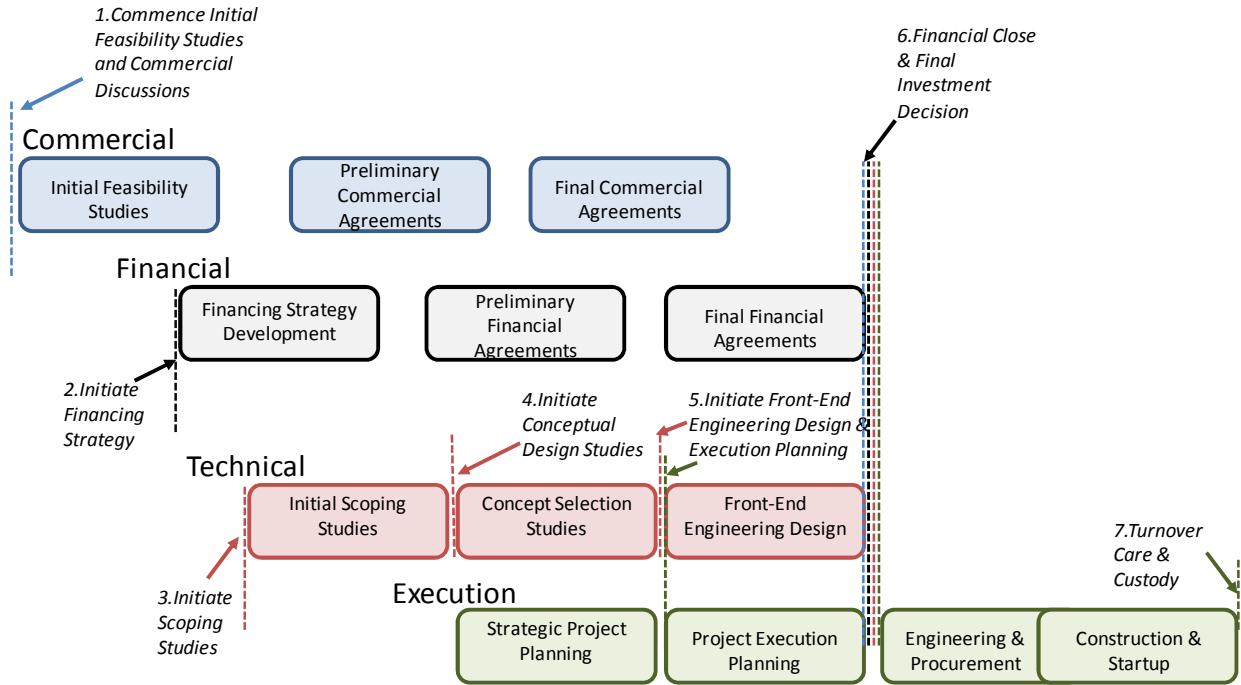


Figure 6: Illustration of an integrated phase-gate process comprising key decisions and activities on each of the Four Planes of a Capital Project Investment. Decisions at each gate consider previous and upcoming decisions and activities on the other planes. Note that all four planes converge at the Final Investment Decision & Financial Close.

It is easy to see that there are many interfaces and interactions between the activities in the four planes, since most phases overlap. Strategies, plans and decisions must consider these interfaces and interactions. Consider the example illustrated by Figures 7A and 7B below.

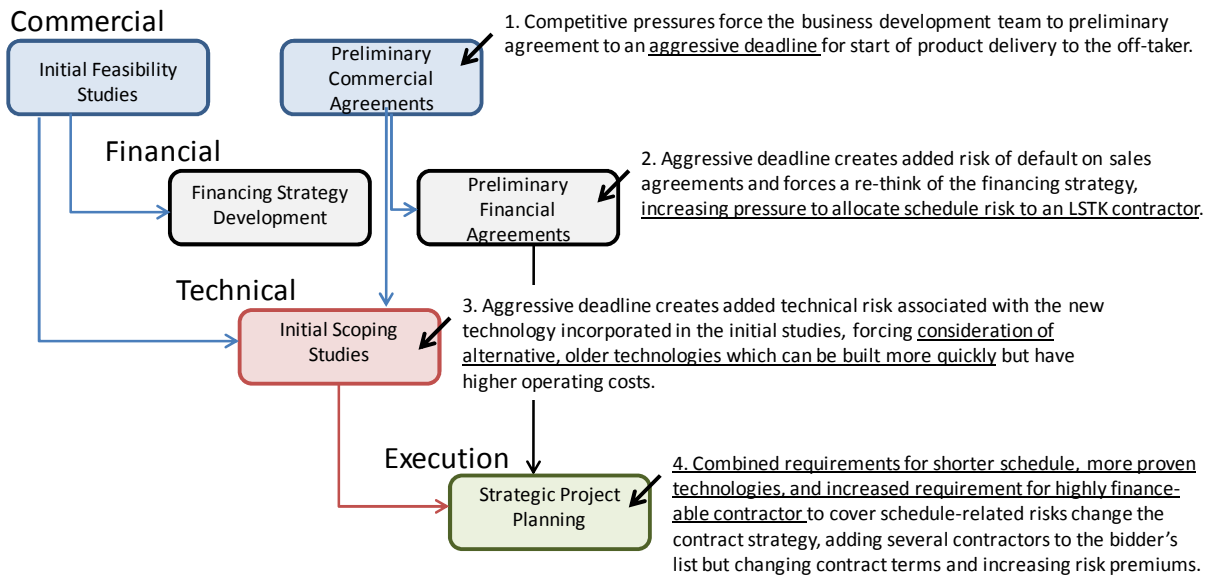


Figure 7A: Illustration of the cascading impact of a development on the Commercial Plane on the Financial, Technical and Execution Planes.

In this example, the preliminary commercial agreements changed the priorities of the financing plan, which changed the work-plans and decisions on the Technical and Execution Planes. Consider now the result of these changes, illustrated by Figure 7B below.

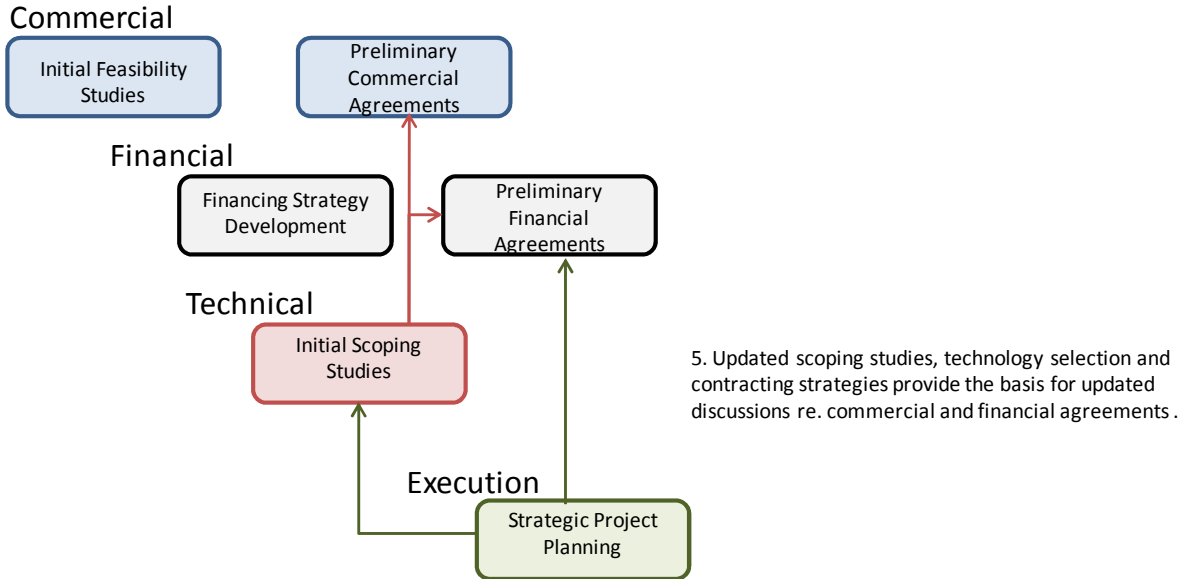


Figure 7B: Illustration of the changed work-plans and decisions on the Technical and Execution Planes, on the Preliminary Financing Plan and Commercial Agreements.

One might expect that, by timely managing these cross-functional interfaces, the company in this example avoided the costly mistake (and self-imposed risks) of making commercial commitments that it could not reasonably be expected to meet.

RISK-INFORMED DECISIONS REQUIRE CAPITAL PROJECT DUE DILIGENCE

Improving predictability is, of course, all about improving the decision-maker’s understanding of project risk. There are significant barriers to the full and unbiased communication of risk to the executive decision – maker including:

- Rational economic behavior inhibits full disclosure and communication of project risks

In his book *Megaprojects and Risk*¹, Prof. Bent Flyvbjerg examines the sources of the huge cost overruns on very large projects. His research indicates that rational economic behavior on the part of all participants drives the under-estimation of scope, difficulty, cost, time, and risk; as well as the over-estimation of the benefits the project will bring. Whether deliberate or inadvertent, this bias to optimism causes important risks to be ignored, and known risks to be underestimated. When the actual costs of the project become apparent, in most cases it is not really a “cost overrun” so much as a reflection of what the real cost was all along.

- Different risk perspectives are never reconciled

In their article *Owning the Right Risks*², (Harvard Business Review, 2008), Kevin Buehler, Andrew Freeman and Ron Hulme describe a dysfunctional decision process, typical of many large organizations, in which each decision-executive has a specific and narrow view of risks and the associated responsibilities. As a result key decisions are often taken without the integrated risk perspective that might well have altered the decision and/or the strategies taken to implement it.

Both of these barriers are really about improving the way risks are discovered, assessed and communicated. Given the structural barriers described above, it is clear that the best, (perhaps only) effective way to ensure timely, risk-informed, strategic decision-making is with a due-diligence process designed specifically for the capital project portfolio.

Figure 1 provided a simple illustration of how the preservation and growth in future free cash-flow is dependent on the wise investment of current cashflow in two ways: mergers and acquisitions (M&A) and capital projects (Capex). While the relative allocation of funds to these two types of investment varies from company to company and year to year, it is safe to say that capital project investment decisions are as important and difficult as those relating to M&A.

It is also safe to say that, when it comes to due diligence, capital project and M&A decisions are made quite differently.

Due diligence is an inherent part of the process by which M&A deals and decisions are made. Outside experts, with an independent, unbiased perspective, evaluate the opportunity in terms of risks and economic benefit. They assist in crafting and implementing commercial agreements, financial strategies and operational plans. Of course, the investment decision is greatly enhanced by this external, unbiased perspective, and often the negotiations are as well.

Now compare the M&A process with that used for capital project investment decisions. When it comes to capital projects, most organizations rely primarily on *internal* processes to drive key decisions. These processes generally take the form of breaking the “front-end” of the project into several phases which are separated by decision gates. The front end phases are followed by one or more execution phases, with the final phase being the long term operation of the facility.

These project development processes are typically designed around the Technology and Execution Planes described on Figure 2 and in the following text. They are considered best practice and credited with having improved predictability by increasing the level of project definition when the final investment decision is made. In some cases, external consultants are used to ensure all the required definition activities have been properly completed. Peer reviews may also be used to provide a “cold eyes” perspective, although those eyes typically belong to others within the same organization.

Unfortunately, even organizations who have front end loading processes, and who follow them rigorously, have issues with predictability. Rather than ask “what are we doing wrong?” one might ask instead, “what else should we be doing?” Consider this question:

Can the due diligence practices considered essential for M&A investments be adapted to capex decisions, and would doing so improve predictability?

Due diligence is generally defined as the process of evaluating a potential investment decision by investigating the financial, legal, and other material facts of the opportunity. As Geoffrey Cullinan, Jean-Marc Le Roux, and Rolf-Magnus Weddigen state in their article *The Secrets of Great Due Diligence* (Harvard Business Review, 2004) “Due diligence acts as a counterweight to the excitement that builds when managers begin to pursue a target.” Surely this is relevant to the Capex scenario as well.

Clearly, a Capital Project Due Diligence Process must address all four Planes of the Capital Project Investment: Commercial, Financial, Technical, and Execution.

CAPITAL PROJECT DUE DILIGENCE DETERMINES BANKABILITY

Capital Project Due Diligence does not duplicate the due diligence activities surround the commercial and financial transactions, its focus is entirely on the risks and predictability of the capital cost, time to first production, and the required cash-flow.

As illustrated by Figures 4, 6 and 7, the activities on each plane are impacted by the other planes, and therefore an integrated approach to planning and decision – making is required. Similarly, Figure 3 illustrates how business and project risks combine to drive predictability.

Consider Figure 8 below.

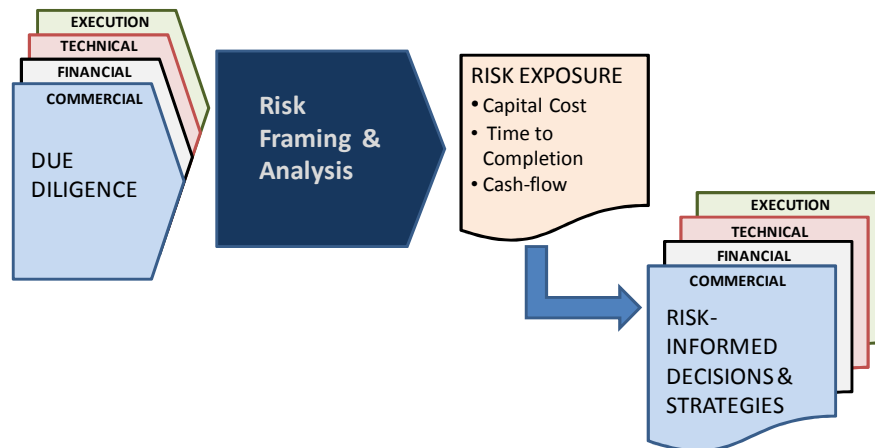


Figure 8: Capital Project Due Diligence Process. A due diligence review is required prior to the decision at each gate. The due diligence review provides an independent review of the status, progress, plans, issues and risks on each project plane, then integrates these into the overall assessment of project risk exposure. These results drive risk-informed decisions and plans on each plane.

The importance of considering the combined risks on all four project planes has been recognized by some major owner organizations who have introduced the standard of *bankability* as part of the project funding approval process. Before the final investment decision is made, a proposed project must demonstrate that its predictability of success is such that a lender and/or passive investor would be willing to finance it. Experience suggests that the standard of bankability is very useful for ensuring that all the risks on each plane have been evaluated. It also provides a means to align the operator, investors, lenders, and other stakeholders on a shared view of risks and the appropriate risk-informed project strategies.

The bankability of a proposed project as illustrated by Figure 9 below.

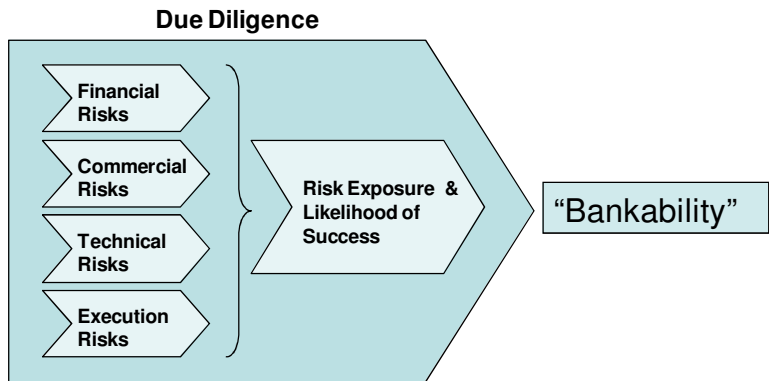


Figure 9: The “Bankability” of a proposed capital project considers the risks from each of the four Capital Project Planes, and integrates these to determine the overall likelihood of success. Even if the project will not require non-recourse financing, the investment decision is evaluated as if it did.

Summary

The quest for predictability of capital project outcomes has been long and largely frustrating. Over the past 20 years, leading owner organizations have invested significant levels of effort to implement work processes to improve the front-end definition of their projects. Clearly, this has improved the accuracy of project plans, cost estimates, and decisions. Equally clearly, it has not been enough, as many of these same organizations now question why they still experience massive overruns and delays on their most critical projects.

The idea driving the implementation of phased and gated processes for front end loading is that predictability is improved by better decision-making at each gate. That is still true today; in fact, given the exponential growth in project size, complexity and risk it is even more so. The challenge today is to determine what must be done to further improve the decision process.

Leading owner organizations today are finding that a more holistic approach that integrates the Four Planes of Capital Projects: Commercial, Financial, Technical, and Execution; provides a considerable improvement in their ability to recognize the aggregate exposure from project risks. The discipline, fact-finding, and unbiased perspectives associated with due diligence for M&A investments are equally important for capital projects. A structured approach to Capital Project Due Diligence provides owners, investors, and lenders with the assurance that all project risks are in front of them when critical decisions are to be made.



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