Do you actually have a **feasibility study**?

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Can we deliver to the definition?

An expensive lesson: *Failing to define & execute a feasibility study that can lead to a successful project*

- We have access to *well-defined* feasibility study *requirements*
- Professional *responsibility* & *sanctions* are in place (NI 43-101)
- Project failures provide an over-priced education, *however valuable the learnings*
- What causal links in the *decision-making processes* can lead to failure of the resultant project?
- Is there a failure in the *set-up*, *management, process and review* of studies?

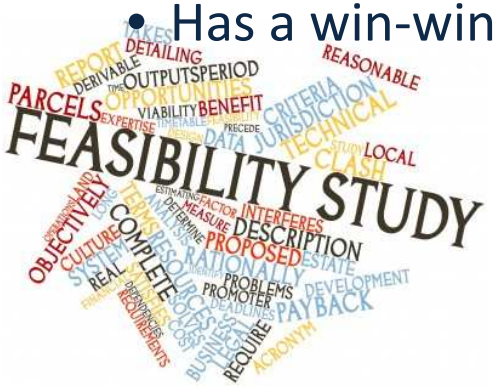
Project Failure stats:

- Megaprojects: *60% or more fail* (IPA, McKinsey)
- Failure is >25% over budget & >25% over schedule
- An outlier mining megaproject was *trending to 300% over budget*, 2 years late when the plug was pulled
- Megaproject failures *can be a company breaker* when twinned with commodity price reversals

At Issue: At project delivery stage, what linked the feasibility study to the ultimate project failure?

Project Failure: contributing *core issues* and *failure modes that impact success*

- How is *ownership of & buy-in* passed on from *feasibility phase*?
- How supportive or otherwise is the owner organisation?
- Is the owner team appointed and assembled in good time
- On what terms are *contractors engaged & contracted*?
- Which behaviours, actions (or failures to act) lead to *success or failure*?
- Is the owner's team and the contractor's *aligned for success*?
- Has a win-win opportunity and culture been created?



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Leadership: The crux of success or failure

Stewardship requires a catalogue of skills & experience and a supportive owner.

So what goes wrong with leadership in projects and why?

- Natalie Macauley analysed differentiating competencies for successful megaproject leaders in a competency model:
  - Legacy approach: Focus was largely on *past experience*
  - She recommends promoting & hiring based on *a hybrid of experience and potential*
  - She identifies leaders with the ability to manage *inherent high complexity*
  - 6 key differentiators: *Strategic mind-set*, communication in all forms, *business acumen*, balanced decision-making, *political intelligence* and change leadership.

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Case Study: A Mining Megaproject

- A bi-national megaproject, *studied for over 20 years*
- Board pressure to get early production & cut capex for approval
- Challenges to execution were:
  - Altitude of site was 4000 – 5000m in Atacama Desert; high, dry & windy
  - Mine, plant & infrastructure crossed the border, in special protocol area
  - Glaciers were a key community water source, at risk to dust and melting
  - Altitude was a threat to productivity, ~30% less oxygen -> 40% impact
  - Project was managed from 1 corporate, and 6 regional offices in 3 countries
  - Feasibility study identified further work needed for complex ore processing
  - Untrained labour, used re-skilled agricultural workers in construction

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Case Study: Feasibility Study Issues

Key choices made with significant impact on project outcome:

- Mining method: *open pit* or *underground/block-caving*
- Open pit required large *valley-fill waste dumping*
- Waste heap needed river and glacier melt-water *diversions*
- Complex metallurgy, *transitions in ore body* led to multiple processing streams – some to be designed & installed later
- *Treatment of AMD & melt-water* was required for discharge
- Insufficient water for pre-strip & mining dust management

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Case Study: Construction Issues

- Owner's team took on much of *EPCM role from contractor*
- Supply & fab of *steelwork switched from China to local supply*
- Project leadership team located off-site at coastal resort town
- Site productivity below planned 40%, *as low as 10%* of Gulf norms
- Make-up plan required 4 x increase in site labour, camp, supervision
- Tunneling progress hit hard by *bad ground, water, acid drainage*
- Over-crowding caused *excessive staff turnover*
- A *melt-water surge* on a hot day *caused water diversion failure*
- Project was *stopped & demobilised* when permit was pulled

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Case Study: Diagnosis of FS & Failure

- Mining method choice: linked to *dusting*, *glacier melt*, *flooding* of water treatment plant, *community protest* & *project shut-down*
- Base-line data for water management: Did not pick surge flows for afternoon melt-water, designed for daily peak flows
- Sourcing & logistics for materials: *Failed to address local needs*
- 7 project offices: *complex coordination, leadership & communication*
- Construction plan: *Mis-read structure, contracting & productivity*
- Bi-governmental relations: More complex than planned
- Estimating: failed to factor in complexity, productivity, schedule

Summary: Poor FS decisions & planning - major causes of failure

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Common Errors in Feasibility Assessment

Messing up *Risk & Uncertainty* as applied in Studies

- Project Capex, IRR, Accuracy & Contingency – *often **not** rigorous*
- Combine uncertainties loosely into *reaching a 10-15% contingency*
- Schedule uncertainty *not rigorously assessed*, nor impact on cost
- As a result, too many *actual project outcomes **fall outside the predicted bell curve***
- With better mathematical rigour, *potential cost & schedule risk outcomes* would be better understood and a potential bad result is *more predictable*

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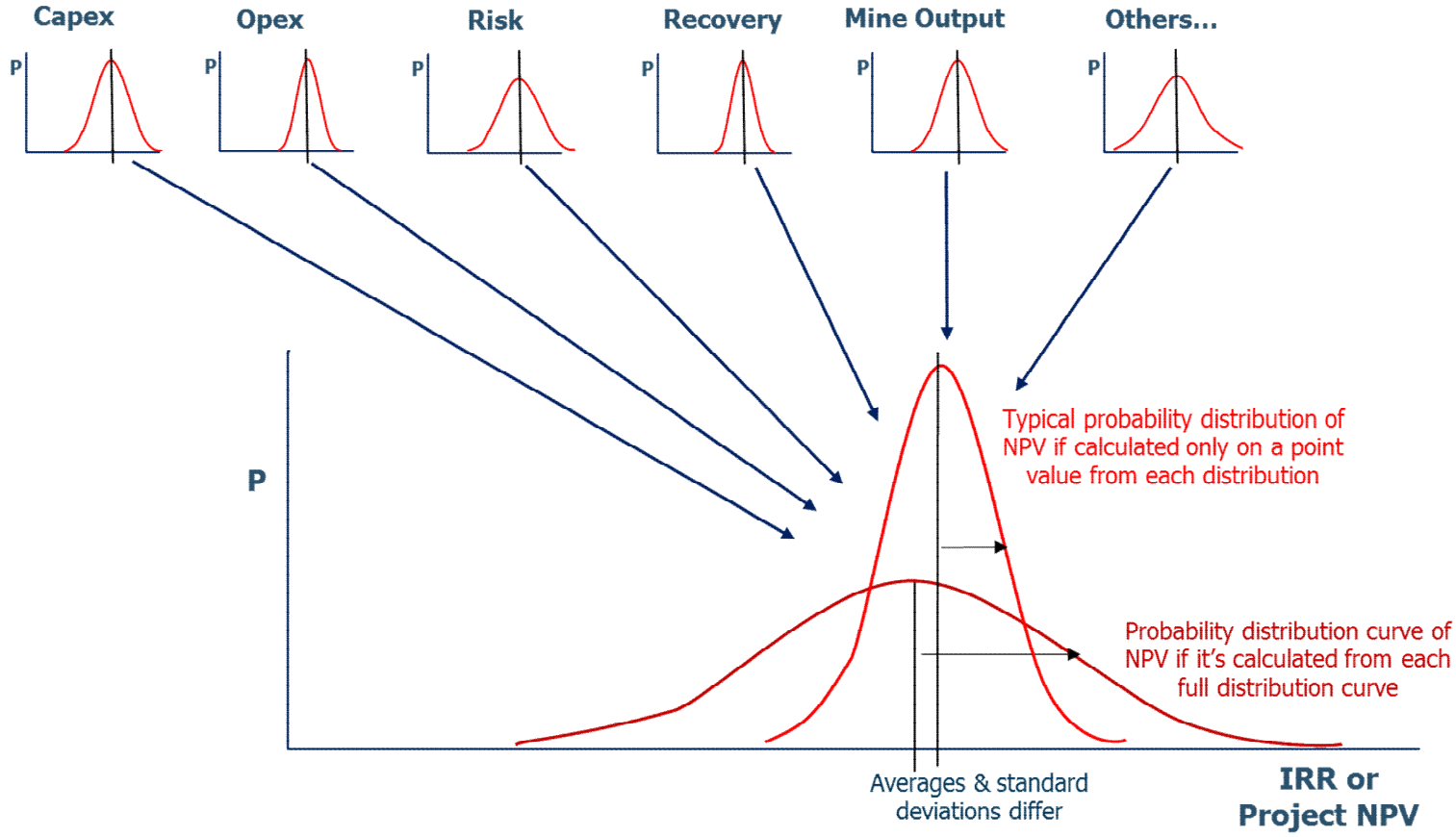
Common Errors in Feasibility Assessment

Methods of combining risks and uncertainties can lead to completely different views of overall project uncertainty



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Making key FS Decisions & Changes of Plan

- Risk caused by early adoption of a project plan and *sticking by it* instead of *re-working it to a better plan*
- Hubbard argues that one can make good interim decisions early, with less information, and *change plan accordingly*
- A case for cycling through many ideas & configurations early on with *small conceptual teams* before deploying the full FS teams to do the detail
- We should stop and re-think projects, even at the point of FID, that *do not meet investment criteria and strategy* any more

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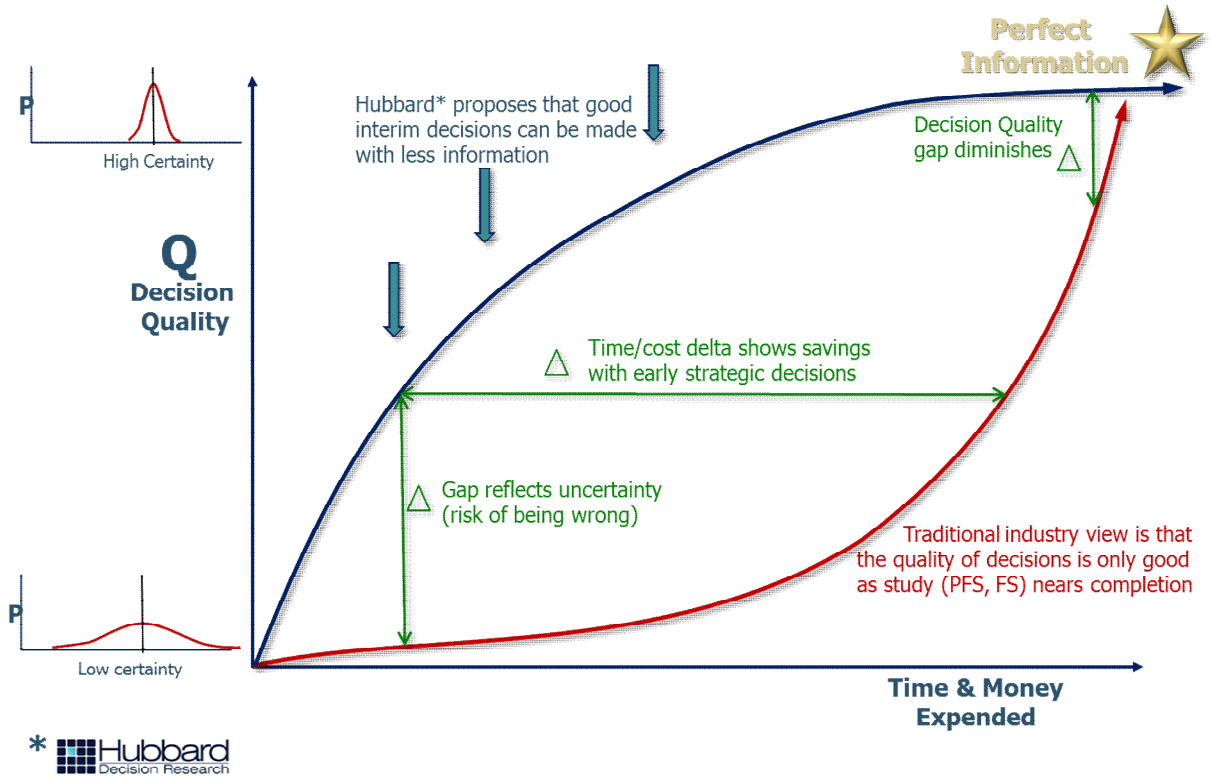
Making key FS Decisions & Changes of Plan



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Last Words…

- IPA: “Very few megaprojects fail because of problems that *originate* in execution”
- The feasibility study process needs to start with a *clear concept*, built on *well-tested resource data,* by a team that’s *capable and empowered* to find and decide on the best solutions to meet its strategy.

Questions?

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