



The Use and Abuse of Feasibility Studies – Has Anything Changed?

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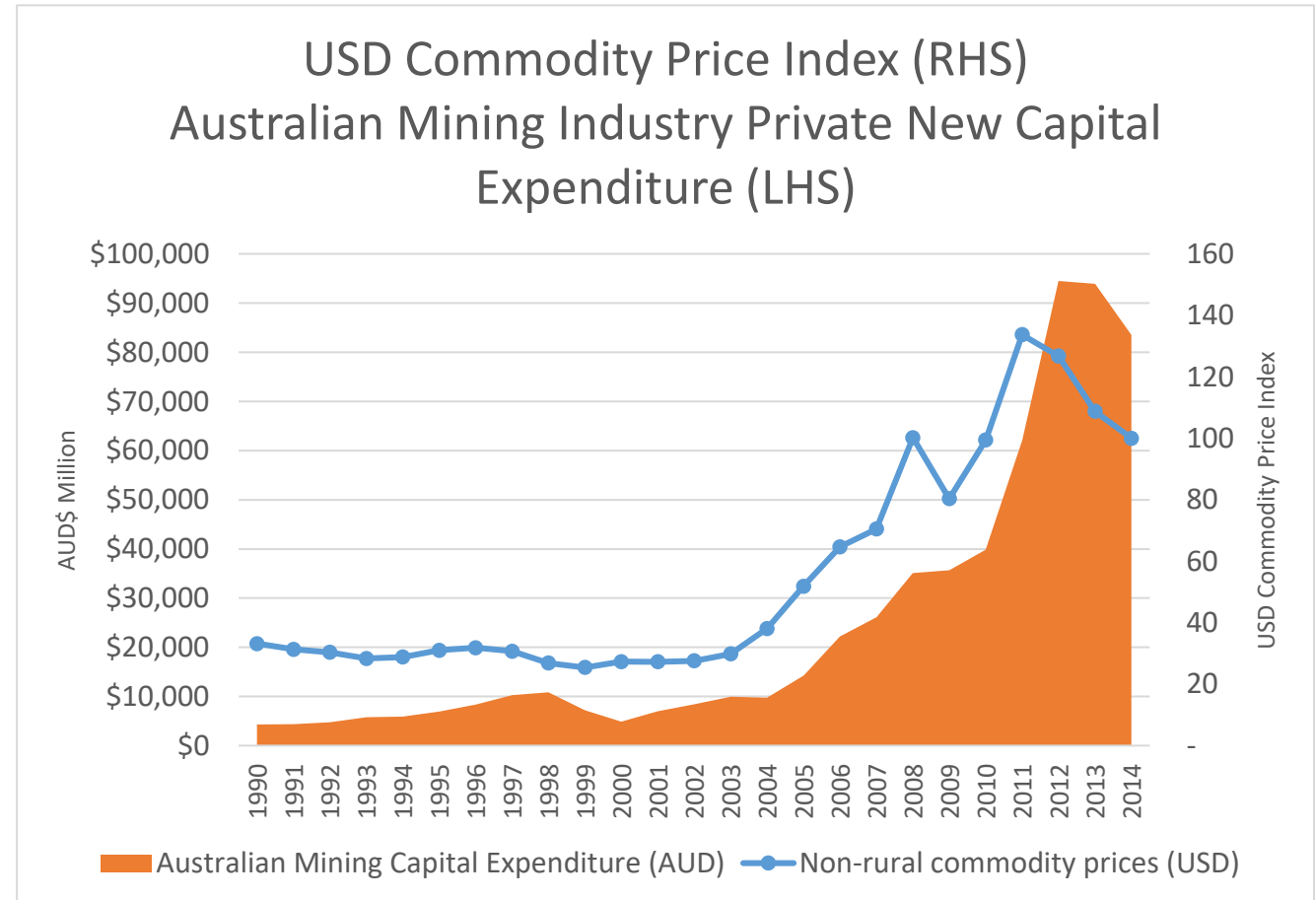


The Use and Abuse of Feasibility Studies – Has Anything Changed?

- The Use and Abuse of Feasibility Studies (Mackenzie and Cusworth, 2007)
 - Presented a framework for the conduct of resource project feasibility studies and provided guidance on minimum standards and best practice;
 - Concluded that:
 - *“In the authors’ experience, feasibility studies:*
 - *are regularly portrayed as being much more comprehensive and accurate than they are,*
 - *are often not fit for their intended purpose, and*
 - *tend to focus on technical issues at the expense of critical business and project delivery issues.*
- ***The poor track record of the industry – which indicates only half of projects meet their feasibility study expectations – demands a better approach to the feasibility study process.”***
- So, has anything changed???

Has Anything Changed?

- Yes ! – certainly from an activity perspective
 - 2006 was the start of an unprecedented surge in resource project investment triggered by surge in commodity prices
- Australian Industry response was mirrored worldwide – not just a domestic investment surge





Has the industry track record improved?

- Performance Pre-Boom – cost overruns averaged +/- 25%
 - Bertisen and Davis (2007)
 - 63 worldwide mining and smelting projects completed between 1980 and 2001.
 - Average cost overrun of 25 per cent.
 - Bullock (2011)
 - Summarised eight different independent studies conducted on 16 to 60 resource projects between 1965 and 2002
 - Weighted average cost overrun was 26 per cent.
- Caveat
 - “public domain information on project success measures is limited”



Industry performance during the boom

- Biery, Hollonds and Young (2009)
 - 56 diverse project authorised post 2002
 - Only 25 per cent were delivered both on time and on budget (within ± 10 per cent)
- EY (2015)
 - 108 recent global mining and metals capital projects
 - 69 per cent of megaprojects were facing cost overruns averaging 62%
 - Only 31 per cent delivered in line with their cost, schedule and scope commitments.
- IPA (2015)
 - 30 mining projects completed between 2006 to 2013
 - Vast majority experienced significant cost overruns offset by a few massive underruns
 - Average schedule slip of nearly 20 per cent
 - But up to 80 per cent
 - Average performance 12 months after start-up
 - 20 per cent lower output than forecast
 - 10 per cent higher operating costs than forecast



Has the industry track record improved?

- No
 - It seems that things have changed little since our 2007 paper
 - The literature review shows no improvement in the delivery of projects that meet their feasibility study expectations over the last decade.
 - If anything, these outcomes have changed for the worse.
- Caveat- Whilst an important measure of project success, factors other than Capital Costs and Schedule, often have greater impact on a project's success as an investment. Commodity prices, exchange rates, head grade, recovery rates, operating costs and ramp up timing typically have a far greater impact on the long term investment outcomes.



But why?

- Failure of resource development projects to meet their feasibility study expectations is common
 - Manifested as cost overrun, schedule slippage, production shortfalls or a combination of all three.
- Questions arising include:
 - Does the problem arise from:
 - The feasibility study prediction?
 - The execution of the project?
 - Or both?
 - Are some projects inherently more likely to meet expectations?
 - What are the characteristics of these projects?



Conclusions from other studies

- Inherent project factors such as size, location, commodity and scope have little influence on the predictability of project performance, however:
 - Complex projects tend to be somewhat less predictable than simple projects; and
 - Projects that use new or innovative technology are less predictable than projects that use mature technologies.
- External macroeconomic circumstances can have a substantial impact on the delivery of projects:
 - Projects developed during periods of high gross demand on project resources (eg qualified people, skilled labour, construction services and plant and equipment) are more likely to suffer project cost overruns and delays.
- Poorly developed feasibility studies tend to result in poor project outcomes.



Case Studies

- Case studies of recent projects have been selected which illustrate these points and the corollary that unless project expectations are established through comprehensive, detailed and integrated feasibility studies, project outcomes will not be predictable.



Selected Case Studies – Diverse Types

Project	Nature	Location	Commodity
RGP5	Brownfield	WA	Iron Ore DSO
Degrussa	Greenfield	WA	Base Metal Conc
Tropicana	Greenfield	WA	Gold
Kevitsa	Greenfield	Finland	Base Metal Conc
FMG Stg 1	Greenfield	WA	Iron Ore DSO
E&G	Brownfield	WA	Alumina
Karara	Greenfield	WA	Magnetite Conc
Rocklands	Greenfield	Qld	Base Metal Conc
Kaunisvaara	Greenfield	Sweden	Magnetite Conc
Minas Rio	Greenfield	Brazil	Hematite Conc
Sino Iron	Greenfield	WA	Magnetite Conc



Selected Case Studies – Diverse Sizes

Project	Go Ahead Given	Forecast Capital x \$1 Million	Forecast Completion
RGP5	Nov-08	A 4800	H2011
Degrussa	Mar-11	A 384	Sep-12
Tropicana	Nov-10	A 750	Nov-13
Kevitsa	Nov-09	US 400	Jul-12
FMG Stg 1	Mar-06	A 2247	Jan-08
E&G	May-08	A 1900	H1 2011
Karara	Oct-07	A 1706	Mar-10
Rocklands	Mar-11	A 250	Dec-12
Kaunisvaara	Jan-11	US 694	Mar-13
Minas Rio	Jan-07	US 3456	Dec-09
Sino Iron	Jan-07	US 2470	Jan-10



Selected Case Studies – Outcomes

Project	Actual Capital x \$1 Million	Actual Completion	Cost Overrun	Schedule Overrun	Performance achieved
RGP5	A 4800	3Q2011	0 per cent	-5 per cent	Yes
Degrussa	A 400	Sep-12	4 per cent	0 per cent	Exceeded
Tropicana	A 833	Sep-13	11 per cent	-6 per cent	Exceeded
Kevitsa	US 470	Aug-12	18 per cent	3 per cent	Exceeded
FMG Stg 1	A 2825	May-08	26 per cent	18 per cent	Yes but delayed
E&G	A 2995	1Q 2012	58 per cent	28 per cent	Yes
Karara	A 3051	Jan-13	79 per cent	113 per cent	No after 2 years
Rocklands	A 480	not completed	92 per cent	N/A	Not completed
Kaunisvaara	US 1500	Dec-13	116 per cent	35 per cent	Abandoned
Minas Rio	US 8400	Oct-14	143 per cent	242 per cent	Too early
Sino Iron	US 12000	Dec-13	386 per cent	230 per cent	No after 3 years



Selected Case Studies – Status at “Go Ahead”

Project	Category	3 phase study process	Study scope complete	Scope Frozen at Go Ahead	Permitted at Go Ahead
RGP5	Good	✓	✓	✓	✓
Degrussa	Good	✓	✓	✓	✓
Tropicana	Good	✓	✓	✓	✓
Kevitsa	Not Too Bad	✓	✓	✓	✓
FMG Stg 1	Not Too Bad	✓	✓	x	x
E&G	Not So Good	✓	✓	✓	✓
Karara	Ugly	✓	x	x	x
Rocklands	Ugly	x	x	x	x
Kaunisvaara	Ugly	✓	x	x	x
Minas Rio	Ugly	✓	x	x	x
Sino Iron	Ugly	x	x	x	x



What do these Case Studies illustrate?

- Inherent project factors have little influence
 - The projects within the 'good' category are diverse, yet the performance against expectations of the two similar greenfield copper projects (Degruusa and Rocklands) could hardly be further apart.
- Complex projects tend to be less predictable than simple projects
 - For the two brownfield projects involving the expansion of existing facilities (RGP5 and Worsley E&G) undertaken by the same owner (BHP Billiton), the more complex project (Worsley E&G) had a far worse outcome.
- External macroeconomic circumstances can have substantial influence on the delivery of projects
 - The owners of some of the projects specifically acknowledged that this was a factor in overruns (Tropicana, Worsley and Minas Rio)



What do these Case Studies illustrate?

- Poorly developed feasibility studies tend to result in poor project outcomes;
 - All of the projects that went ahead without a comprehensive phased study effort (Karara, Rocklands, Kaunisvaara, Minas Rio and Sino Iron) had ugly outcomes
- Projects whose expectations have been set after comprehensive, detailed and integrated feasibility studies and that are then delivered by experienced, integrated teams encompassing all relevant areas of project expertise are able to deliver predictable project outcomes regardless of the inherent project factors or external macroeconomic circumstances.
 - Six of the Case Studies (RGP5, Degruusa, Tropicana, Kevitsa, FMG Stage 1 and Worsley E&G) completed phased, comprehensive, detailed and integrated feasibility studies prior to commitment, yet, of these, only one (Worsley E&G) had a poor outcome.
 - Three of the remaining projects (Tropicana, Kevitsa and FMG Stage 1) suffered cost increases to varying degrees, but each was clearly identified well in advance and expectations were reset in a timely manner.



Our conclusions

- The apparent decline in project predictability seen in recent years is in part due to the **unfavourable external macroeconomic circumstances** of extraordinary demand for project definition and delivery.
- However, projects whose expectations have been set after **comprehensive, detailed and integrated feasibility studies** which are delivered by **experienced, integrated teams** encompassing all relevant areas of project expertise are able to deliver predictable project outcomes regardless of the inherent project factors or external macroeconomic circumstances.
- The impact of the uncontrollable changes in external macroeconomic circumstances will be lessened if all other aspects of a **project's planning and execution are well controlled.**



Observations and some Recommendations

- There is a consistent lack of definition of Feasibility study quality, content and accuracy.
 - Though major mining houses have well established criteria.
- There has been a consistent lack of business objectives and project delivery focus within Feasibility Studies
 - Focus on technical issues remains a common problem
- Feasibility Studies consistently have shown a lack of integration of business, sustainability, project and technical issues.
- There is a lack of definition of Feasibility Study requirements in the JORC and the NI 43-101 codes
 - Focus remains on technical issues and ore body definition in particular



Observations and some Recommendations

- The estimation, management and reporting of escalation and foreign exchange rate allowances continues to be an unresolved issue.
- Most published capital costs are in nominal dollars, yet the outcomes reported are actual costs which include the impacts of escalation and changes in exchange rates. (no wonder we have cost overruns?)
- The use of Monte Carlo range analysis to derive cost estimate and schedule accuracy levels, and in some cases contingency, are in the Authors' opinion, considered to be somewhere between unrealistic and ridiculous.
- Consistent failures to integrate cost estimates and schedules between Mining, Owner, Pre-Production, Start up and Funding costs with Process Plant and Infrastructure areas, leading to underestimation of maximum cash outflow.



Observations and some Recommendations

- The costs and time to produce a quality Feasibility Study are consistently underestimated
- The importance and the process of Pre- Feasibility Studies are not well known. Yet this is the most value adding phase of a projects development.
 - A common misconception is that a Pre-Feasibility study is just a rough preliminary feasibility study!
- Project Implementation strategies and the development of specific and credible, multi disciplined and integrated Project Implementation Plans during the Feasibility Study, are often not completed
 - This is a major flaw in development of a valid Business Investment case.