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Mineral Project Development

Dr Edmund Sides
Robominers webinar, 18-February-2021

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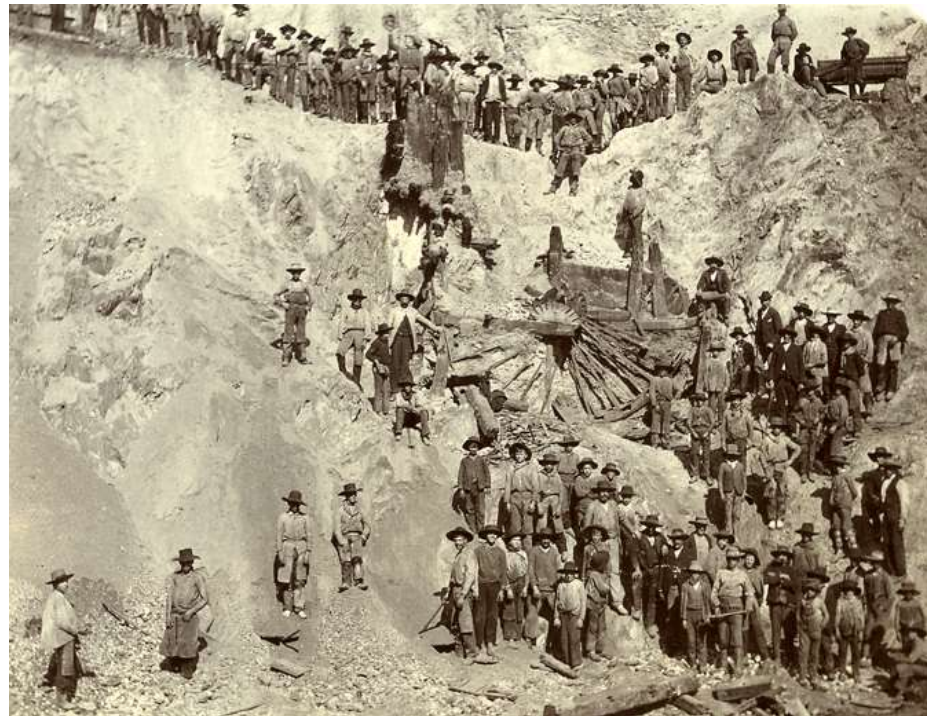
Outline of talk

- Mineral Project Development
 - Concept – Evaluation – Construction – Operation – Closure
- Talk outline
 - Introduction
 - Some Terminology
 - Developing a mining project



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Rio Tinto Mines Roman and 20th Century mining



Roman water wheel, found in South Lode, Riotinto Mines, 1919. Photo courtesy of Aquilino Delgado.
Source: <https://barryyeoman.com/2010/09/the-mines-that-built-empires/>



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Terminology



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CRIRSCO + The PERC Reporting Standard (Public Reporting by Mineral Companies)

CRIRSCO members as at September 2019



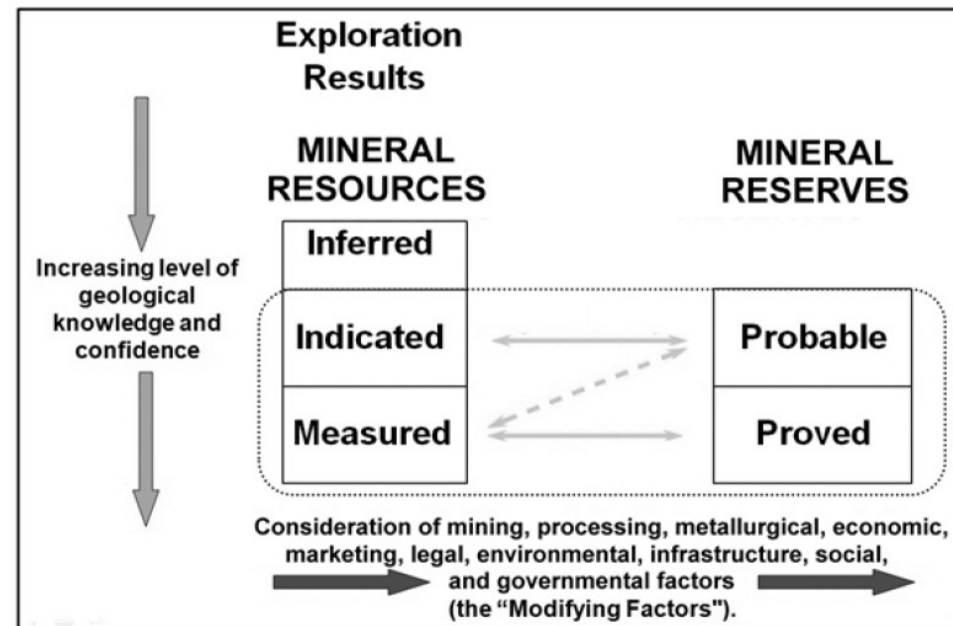
Information available at: <http://percstandard.org/> and <http://www.criirco.com/>



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CRIRSCO terminology

- Figure 1. General relationship between Exploration Results, Mineral Resources and Mineral Reserves



Note: Studies to at least a Pre-Feasibility level are required before Mineral Reserves can be reported
Based on the PERC Reporting Standard (2017): <http://percstandard.org/>



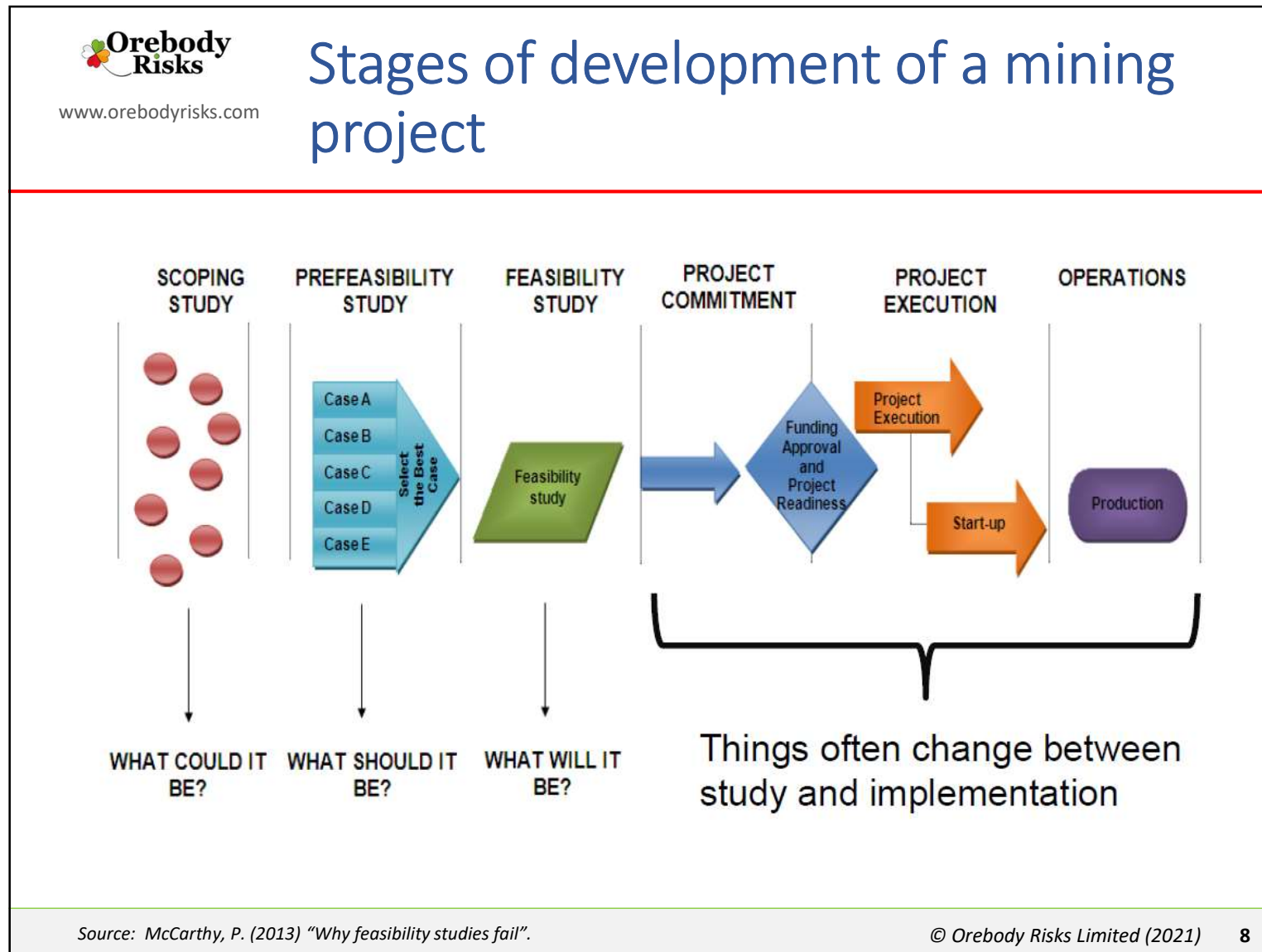
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Technical Studies (PERC/CRIRSCO)

- Scoping Study
 - *“**order of magnitude** technical and economic **study** of the potential viability of Mineral Resources.”*

- Preliminary Feasibility Study
 - *“**a comprehensive study of a range of options** for the technical and economic viability of a mineral project..”*
 - *Minimum study level required for reporting of Mineral Reserves.*

- Feasibility Study
 - *“**A comprehensive** technical and economic **study of the selected development option** for a mineral project that includes appropriately detailed assessments of applicable Modifying Factors..”*





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Project development



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Developing a mining project

- Important considerations
 - Endowment
 - Entitlement
 - Evaluation [-> Mineral Resources]
 - Engineering
 - External Factors
 - Environment, Social & Governance
 - Economic Analysis [-> Mineral Reserves]
- Key requirements/decisions
 - Permitting
 - Financing
 - Risk management



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Decision points

Stage	Typical decision required at end of Stage	Resource Status	Reserve Status
Concept & 'ground' selection	Type and extent of mineral licences to be obtained	-	
Initial assessment (exploratory investigations)	Agree cost and schedule for follow-up work on identified targets	-	
Prospect testing	Agree cost and schedule of work required to assess potentially economic mineralisation	-	
Scoping Study	Agree cost and objectives of continuing to evaluation stage	Inferred	
Pre-Feasibility Stage	Which is the optimum development scenario ? Agree cost and objectives for FS.	Indicated (+Measured)	Probable
Feasibility Stage	Have start-up and payback period risks been minimised ?	Indicated + Measured	Probable + Proved
Construction (pre-production mining)	Are schedule/design changes needed ?	Measured + Indicated	Probable + Proved
Production	Set production targets; Annual budgets.	Measured + Indicated	Probable + Proved
Closure	Agree cost and timing of closure and remediation works; plus ongoing monitoring requirements	'-	'-



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Mining factors or assumptions: Underground mine

- Selected design considerations

- Dip of orebody
- Thickness of orebody
- Nature of contacts
- Rock mass strength
- Footwall and hangingwall characteristics
- Labour costs
- Water inflows
- Mining selectivity
- Ore recovery
- Mining dilution
- Geothermal gradient
- Gas



Image Sources: <https://thebusinessstelegraph.com>; <http://miningandconstruction.com>

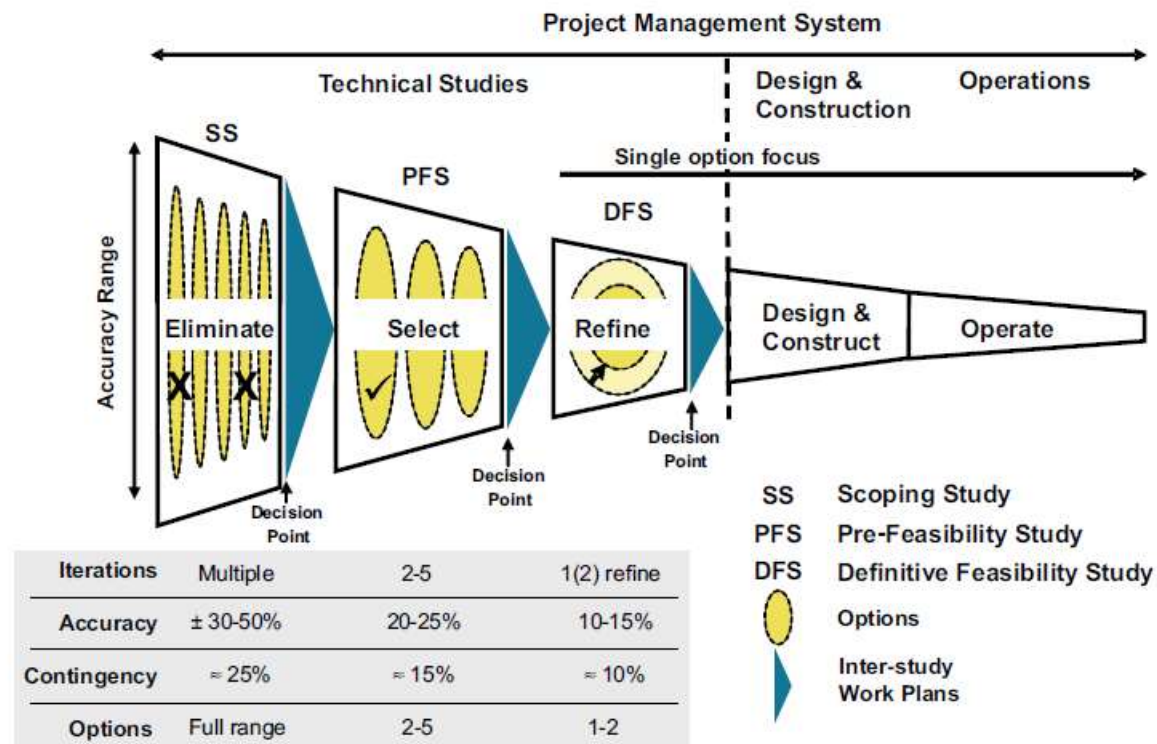
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Cost estimates at different Project Development Stages



Source: Noort and Adams (2006) "Effective Mining Project Management Systems"

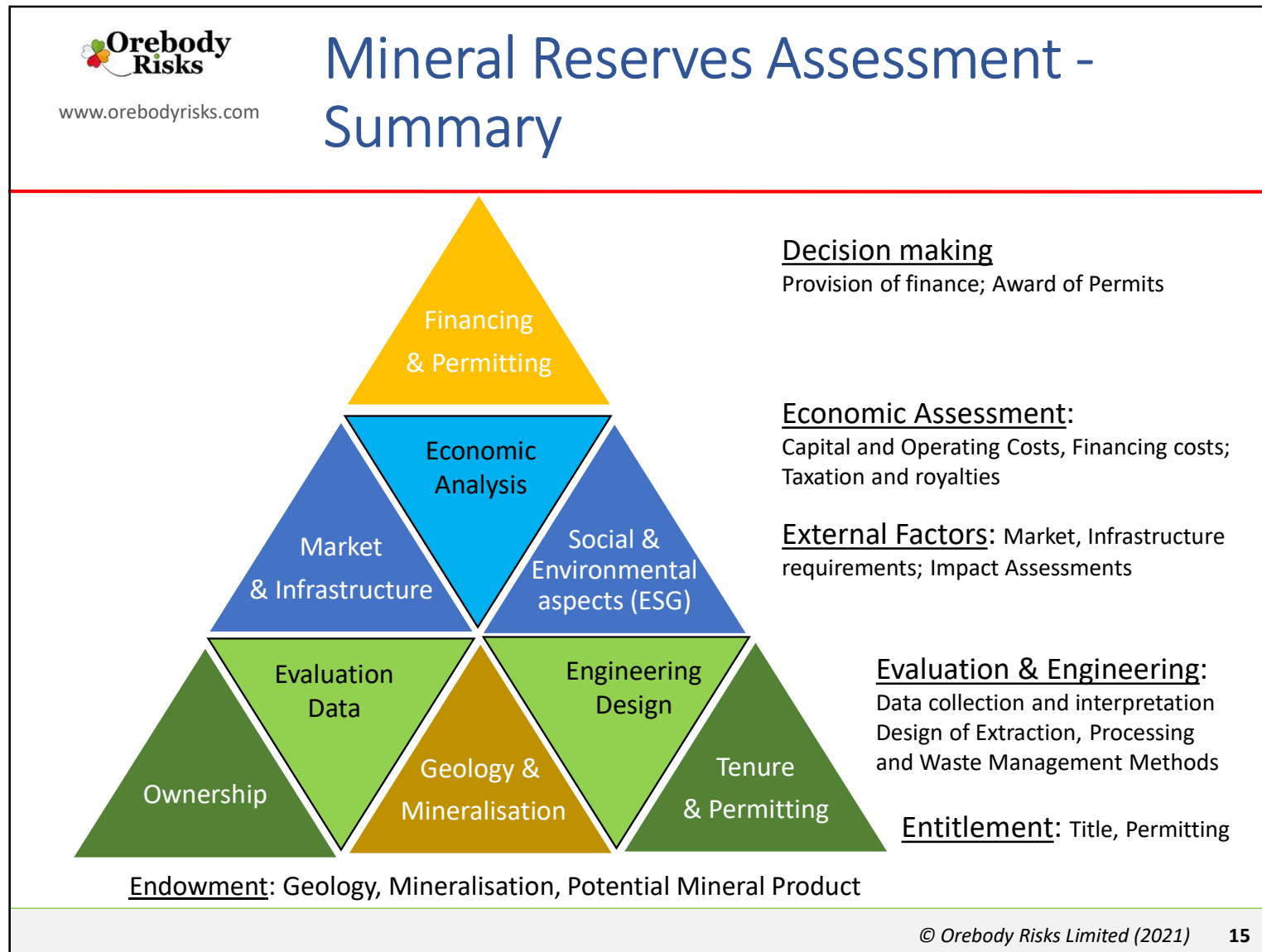
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Summary





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Questions

Contact me at: edmund.sides@orebodyrisks.com