Breaking Free of the New Mine Development Catch-22

Charting a Path Forward

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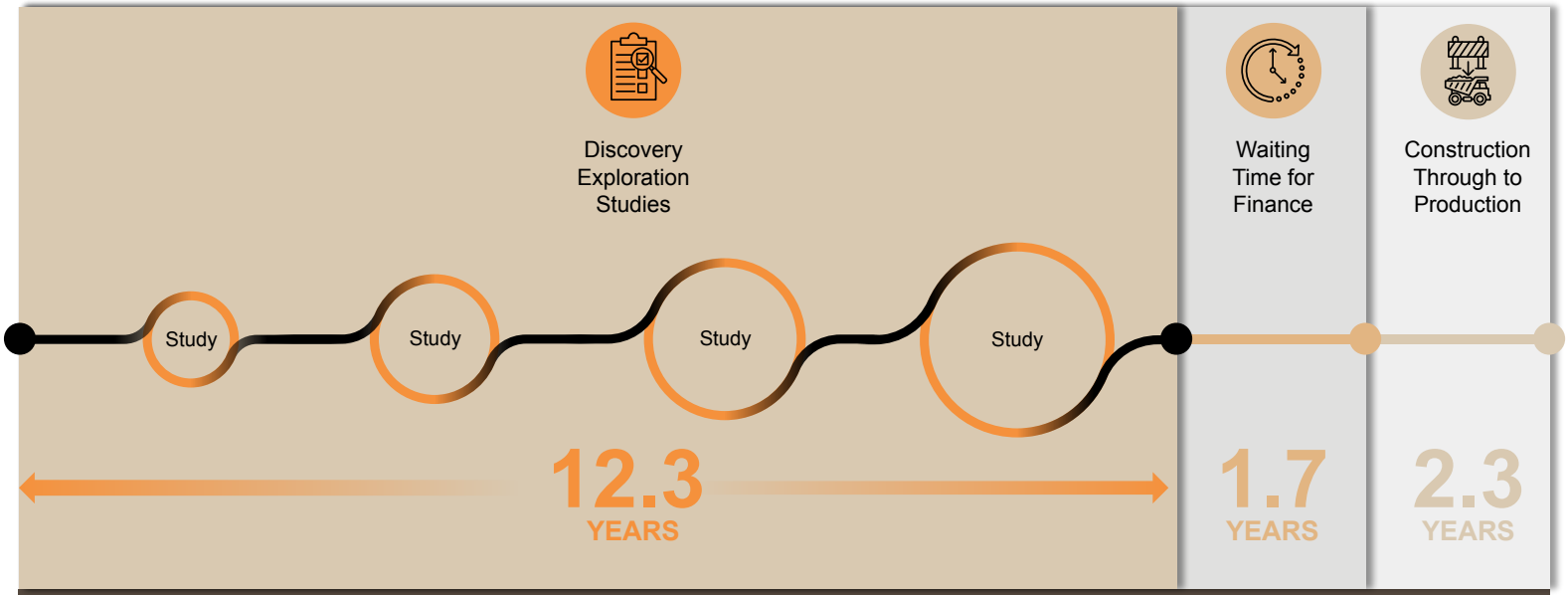
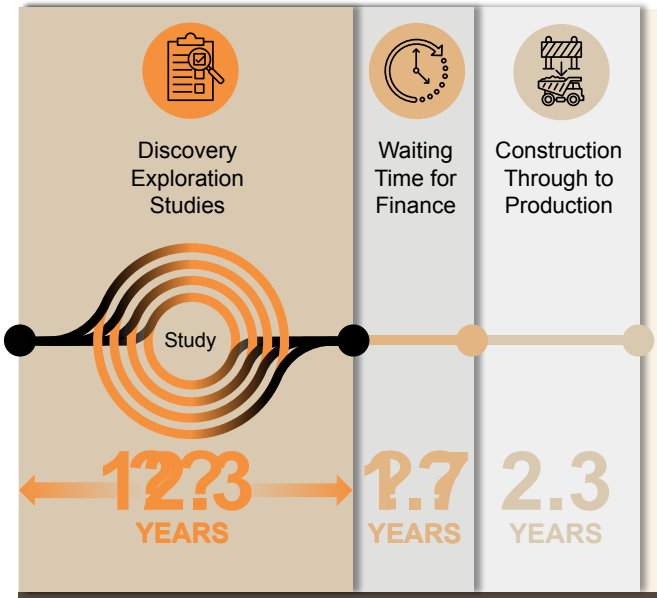
The challenge of developing new mines



New mines are crucial for a sustainable future but face challenges to develop efficiently and safely. Modern mines take >16 years from Discovery to Production, often delayed by the “Study Phase Catch-22”.

Long development timelines and specific mineral feasibility durations



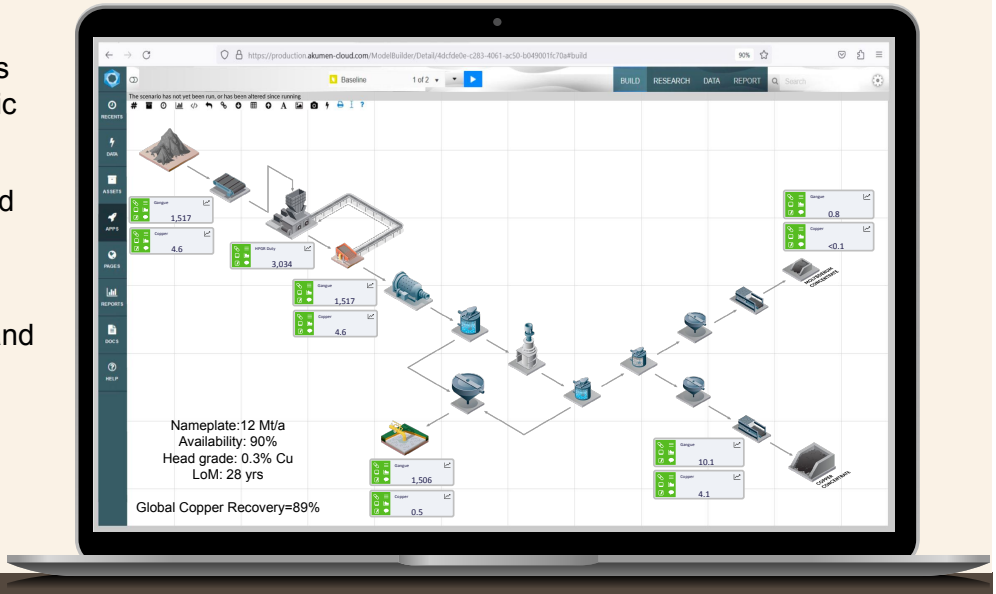
Gold, Lithium, Zinc and Nickel all have substantial feasibility times due to longer exploration and permitting.

On average, **Copper mines** have one of the longest exploration and discovery time frames, **roughly around 12.9 years**

What if we could streamline the discovery process and run multiple study scenarios simultaneously to optimise yield and operational efficiency?

Optimising mineral processing with Akumen

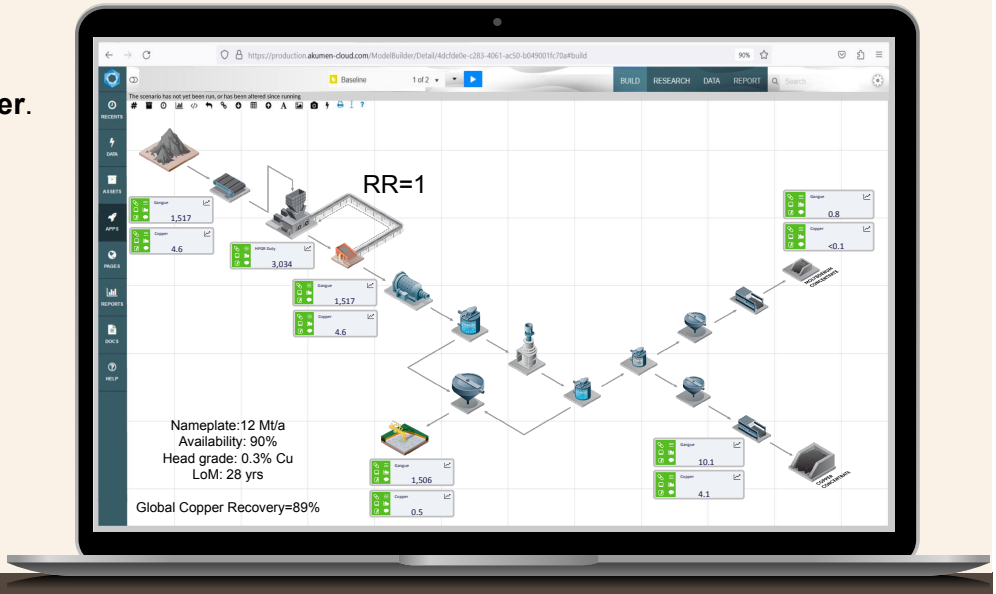
- **Two-step process**: High-level mass balance model and techno-economic model for financial metrics.
- **Dynamic driver modelling**: Tailored for each operation using standard components and process inputs.
- **Goals**: Maximise copper recovery and gangue rejection, using partition coefficients and bond work index.



Analysis: Run “what if” scenarios with Akumen to explore trade-offs.

Scenario 1 | NO Ore Sorter (Units=dmt/h)

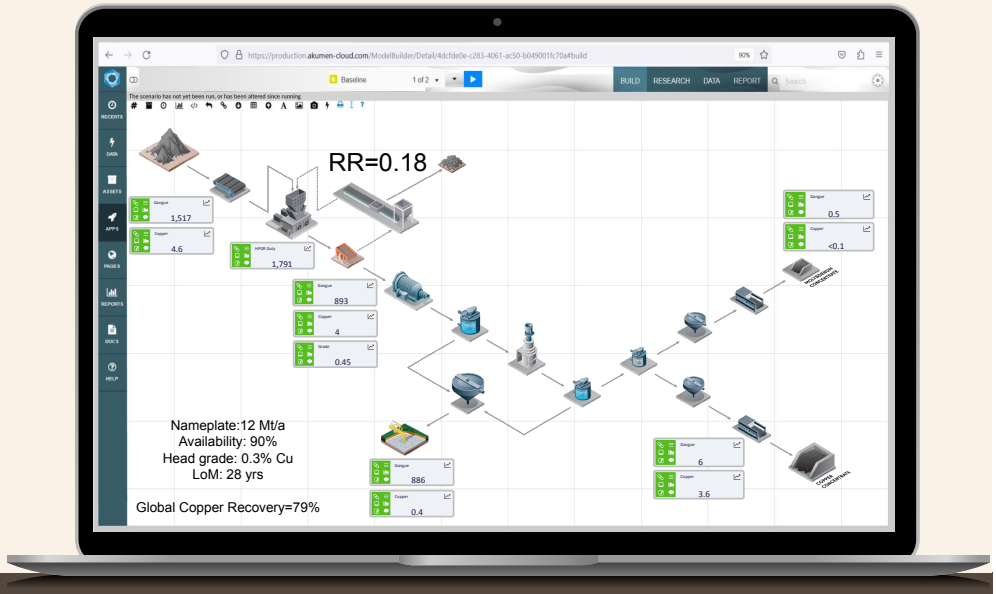
- Here we see a **Level 1 DDM** mass balance for the base case, **NO sorter**.



The recycle ratio around the HPGR is around **1** and the global recovery is **89%**

Scenario 2 | WITH Ore Sorter (Units=dmt/h)

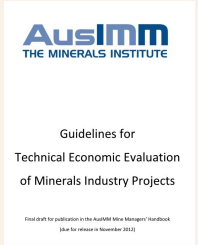
- In this **With Sorter** case we see coarse gangue being rejected from the ore sorter with some loss of copper.
- However, the size of the HPGR recirculating load is reduced by 80% which means the HPGR can be smaller.

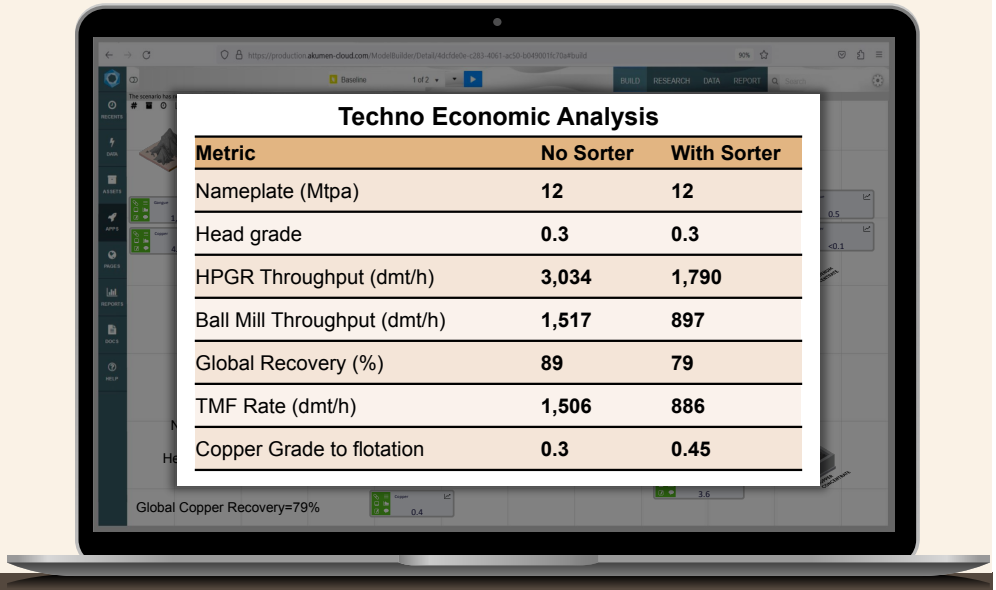


Analysis: Run “what if” scenarios with Akumen to explore trade-offs.

The techno-economic analysis Ore Sorter trade-off

- While these Level 1 models are not the final solutions in themselves, they are tools that can help guide the way through the early stages of study (scoping) ahead of the expensive detailed study and make **better decisions early in the study process**.



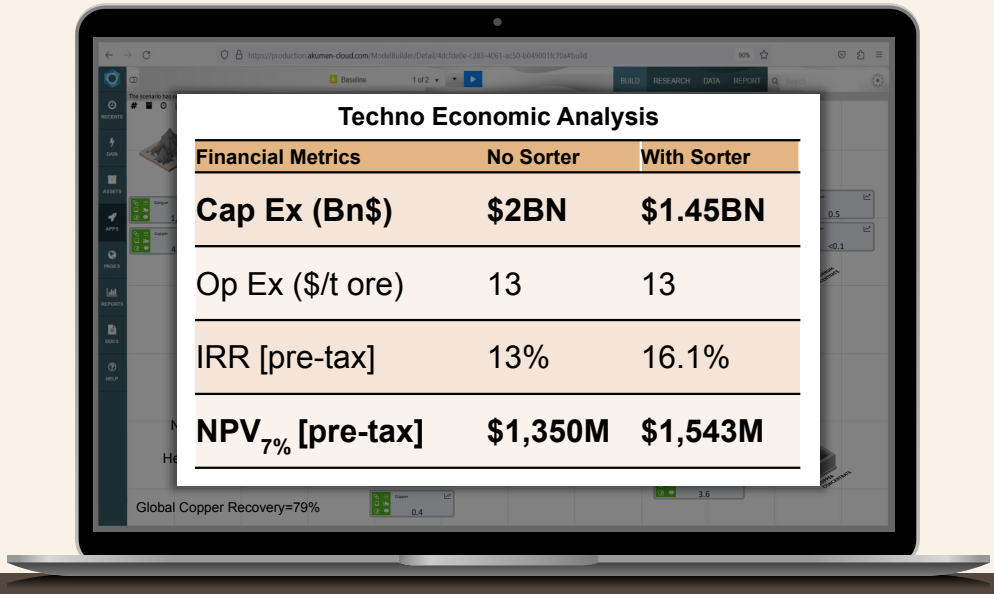


Techno Economic Analysis

Metric	No Sorter	With Sorter
Nameplate (Mtpa)	12	12
Head grade	0.3	0.3
HPGR Throughput (dmt/h)	3,034	1,790
Ball Mill Throughput (dmt/h)	1,517	897
Global Recovery (%)	89	79
TMF Rate (dmt/h)	1,506	886
Copper Grade to flotation	0.3	0.45

Lowering the capital ask like in this example can help break out of the **‘Study Phase Catch 22’**

The techno-economic analysis, Financial transparency



Techno Economic Analysis

Financial Metrics	No Sorter	With Sorter
Cap Ex (Bn$)	**$2BN**	**$1.45BN**
Op Ex ($/t ore)	13	13
IRR [pre-tax]	13%	16.1%
$NPV_{7\%}$ [pre-tax]	**$1,350M**	**$1,543M**

Lowering the capital ask like in this example can help break out of the **'Study Phase Catch 22'**

Final thoughts

- Modern mines take >16 years from Discovery to Production, often delayed by "Study Phase Catch-22"
- These new mines are crucial for a sustainable future, but face challenges to develop efficiently and safely
- By running "what if" scenarios:
  - better techno-economic trade-off decisions can be made earlier
  - decision makers and stakeholders are more engaged, leading to novel ways to **break out of the 'Study Phase Catch 22'**
  - leverage digital technologies to help solve the critical minerals shortage

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