Climate Adaption

Extreme Weather Events and the Mining Industry

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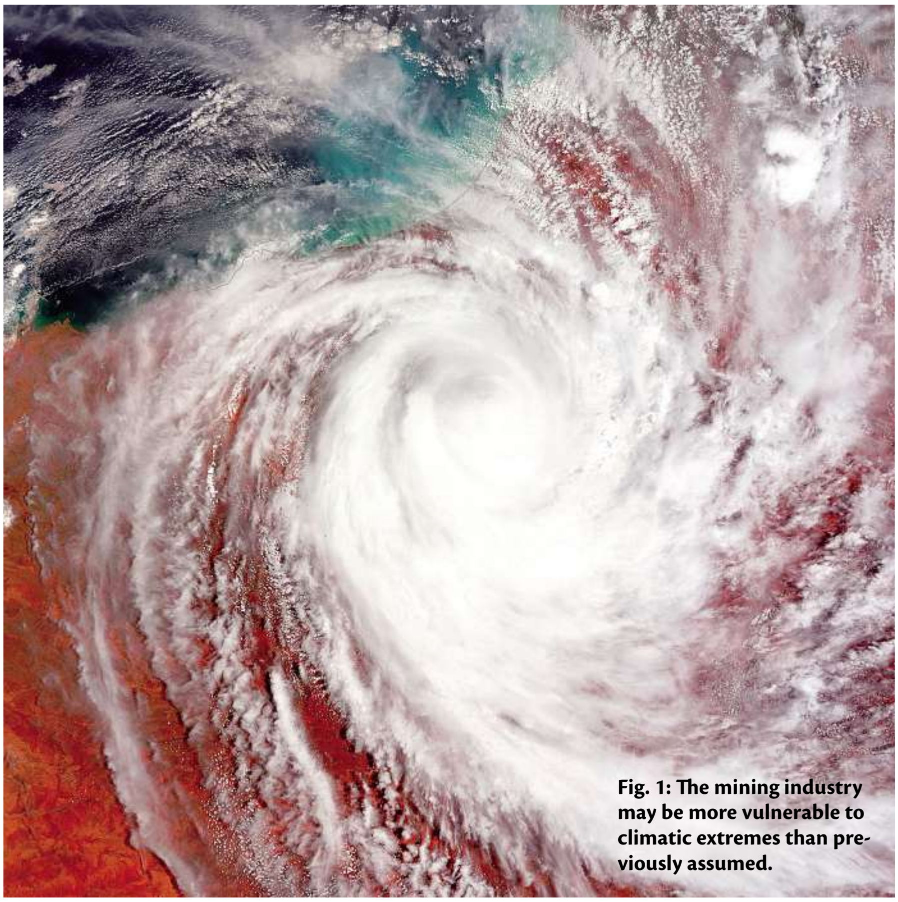

Picture: Nasa

Fig. 1: The mining industry may be more vulnerable to climatic extremes than previously assumed.

The damage caused by recent flooding across eastern Australia highlights the vulnerability of the built environment to extreme weather events. Flooding is part of the natural cycle of climate variability everywhere so the current discussion about whether the recent floods were caused by climate change unnecessarily diverts attention away from the urgent need to adapt to climate extremes.

The best available scientific information indicates that climate change may amplify some aspects of natural climate variability, resulting in the normalisation of weather events currently considered extreme. There is a growing body of empirical evidence (especially extreme temperatures, rainfall and sea levels) suggesting that climate change is already having this effect.

To date, the mining industry's focus with respect to climate change has been on the emissions mitigation and the implications of a price on carbon. Recent events highlight the flip-side of the climate debate – climate adaptation. Mining operations may be more vulnerable to climatic extremes than previously assumed. As such, the mining industry needs to consider whether current approaches to mine and infrastructure planning and design provide an adequate basis for cost effectively managing the extreme weather events that might occur in the future.

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Not at any Cost

The "defend at any cost" perspective that characterised initial post flood recovery discussion does not provide a constructive basis for making decisions about appropriate types and levels of investment to enhance climate resilience. The range of options available for increasing climate resilience include education and awareness campaigns, more comprehensive risk-based flood insurance schemes, investments in defensive infrastructure, revamped building and infrastructure design and retreat from the most risky locations. In some circumstances, the best option may even be to accept additional damage and reduced levels of service.

Either way, the adaptation options are likely to be context specific and need to be informed by judgements about what constitutes an acceptable level of risk for individuals, communities, organisations and government. It is heartening to see that as the flood recovery discussion matures a more nuanced response than "defend at any cost" is emerging.

To date, investment by government and industry in climate resilient design has been piecemeal and inconsistent. While a number of strategic studies on the possible impacts of climate change have been undertaken, mining industry recognition of climate change has not yet translated into widespread consideration of climate change in planning and projects.

	Weather forcasting	Seasonal forcasting	Inter-annual and inter-decadal variability	Long-term climate change projections
Scale	<10 days	1-18 month	Up to 20 years*	20-60 years*
Why ist tgis usefull?	Day to day planning	Mine construction and operation	Flood assessments. Mine water balances	Water security Assessments Mine rehabilitation plans
How is this assessed?	Meteorological forecasts	Forcasts using oceanic variabilty	Stochastic generation to simulate past climate behaviour	Downscaling from global climate model (GCM) simulations. Scenario testing and sensitivity analysis
Part of mine life	Operation	Procurement, construction, operation	Planning, feasibility, design	Planning, feasibility, design, decommissioning

Picture: SkM

Fig. 2: Overview of techniques for characterising climate risk at different timescales.

Planning and design are generally informed by design standards that are based on historical experience. However, our understanding of climate change suggests that history will provide an increasingly unreliable guide to future experiences of climate and weather extremes. Unfortunately, since the scientific basis for extreme weather event projection under climate change is still emerging, there is no agreed alternative to the conventional approach.

In the meantime, approaches to planning and design are required that provide a sound basis for decision making under uncertainty and enable the identification of cost effective measures to enhance resilience. Risk techniques provide a useful framework, and should draw on analyses of climate extremes and their impacts and how they might be affected by climate change.

What is Climate Risk?

Climate risk refers to the extent to which an organisation's infrastructure, operations and markets are affected by variability and long term shifts in the averages and extremes of climate. In mining operations, climate risk may be manifested in areas as diverse as:
- Threats to mine water supply security.
- Damage to mines and associated transport infrastructure from flooding, cyclones and bushfires.

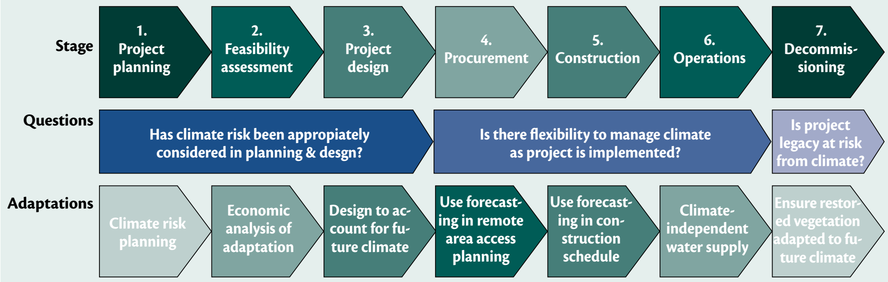

Fig. 3: Overview of SKM framework for assessing and responding to climate risk in a mine life cycle.

Picture: SkM

- Threats to port operations and infrastructure from sea level rise and storm surges.
- Overtopping of tailings dams, leading to failure and environmental contamination.
- Delays in construction of mine infrastructure or in production and shipping of product.
- Human health threats for mine staff from changes in working conditions or disease prevalence.
- Climate-related social dislocation and security concerns in communities around mining operations.
- Changes in surface water and groundwater interactions, with implications for acid mine drainage or movement of contaminants.
- Threats to vulnerable ecosystems in areas within mining operations from direct climate impacts or via climate sensitive agents, such as fire, pests, weeds or diseases.

The effects of climate risks might include: operational delays, revenue losses, increased production costs, labour shortages, environmental damage, loss of reputation and adverse mine legacies. If properly understood and managed at the right time in the mine life cycle, these risks can be accounted for in planning, investment and operational decisions.

Assessing Climate Risk

The sources of climate risk, its importance and management responses vary with the phase of a mine's life cycle. For example, when developing a construction program for a mine site or transport infrastructure it would be useful to know the projected number of rain days or the likelihood of flooding over the coming wet season.

By contrast, a long-term water supply strategy could involve establishing water security from a number of supply sources over the mine's design life. Such an analysis would need to include an evaluation of the influence of natural climate modes, as well as longer term climate change projections. Finally, a mine rehabilitation strategy is concerned with the likely climate beyond the end of the mine design life, and therefore would need to consider long-term climate change projections.

The diagram in Fig. 2 provides an overview of the techniques available for characterising climate risk at each of these time-scales.

For long-term future impact assessments (up to 20 and 20 to 60 years, Fig. 2), natural climate variability and human-induced change will need to be considered jointly to ensure various climate risks are adequately characterised. It is noted, however, that most climate change assessments are for the window from 2030 to 2070 after, with implicit assumption that natural variability will be dominant from the present to 2030, or alternatively that the impact of climate change next 20 years can be adequately characterised by extrapolation between current climate conditions and 2030 forecasts.

Climate Knowledge

The assessment of risks and opportunities associated with climate variability and change should be an integral part of all mining projects from the initial planning all the way through to mine decommissioning. This assessment could simply consist of asking some questions to assess risk and vulnerability as part of the design scoping discussion, or it could be a more specific and comprehensive plan tailored to specific aspects of a project.

The fundamental question is how does climate variability and change affect the mining project? This involves an assessment of the following aspects:

- The project's sensitivity to climate: this refers to the degree in which change in climate will affect the project. For example, what would be the effect of a 20 per cent increase in flooding from a nearby river or a decrease of inflows to mine water storage of 20 per cent?
- The project's exposure to climate: this refers to the magnitude of natural variability and/or extent of projected human-induced changes in temperature, water availability, likelihood of floods and storms, and/or sea levels.
- The capacity to adapt to change: the capacity – planned or unplanned – of the mine operator, local communities and/or natural environment to adapt to change in climate.

Project Life Cycle

An alternative framework for assessing and managing risk considers the likely climate impacts at all stages of the project life cycle, see Fig. 3. This will involve asking additional questions to what is normally considered, with the aim of embedding an appreciation of climate risk and opportunity in project vision, goals and delivery methods.

Conclusion

Climate variability and change contain risks and opportunities that will manifest at all stages of the mine life cycle, at a range of geographic locations and over a range of planning horizons. This requires a robust understanding of how the climate operates and of how this might change in the future. It also requires an understanding of design and operational flexibility to manage this risk. Although uncertainty will always be part of any assessment or risk, the tools are now available to assess and adapt to climate risk throughout the mine life cycle. ■

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