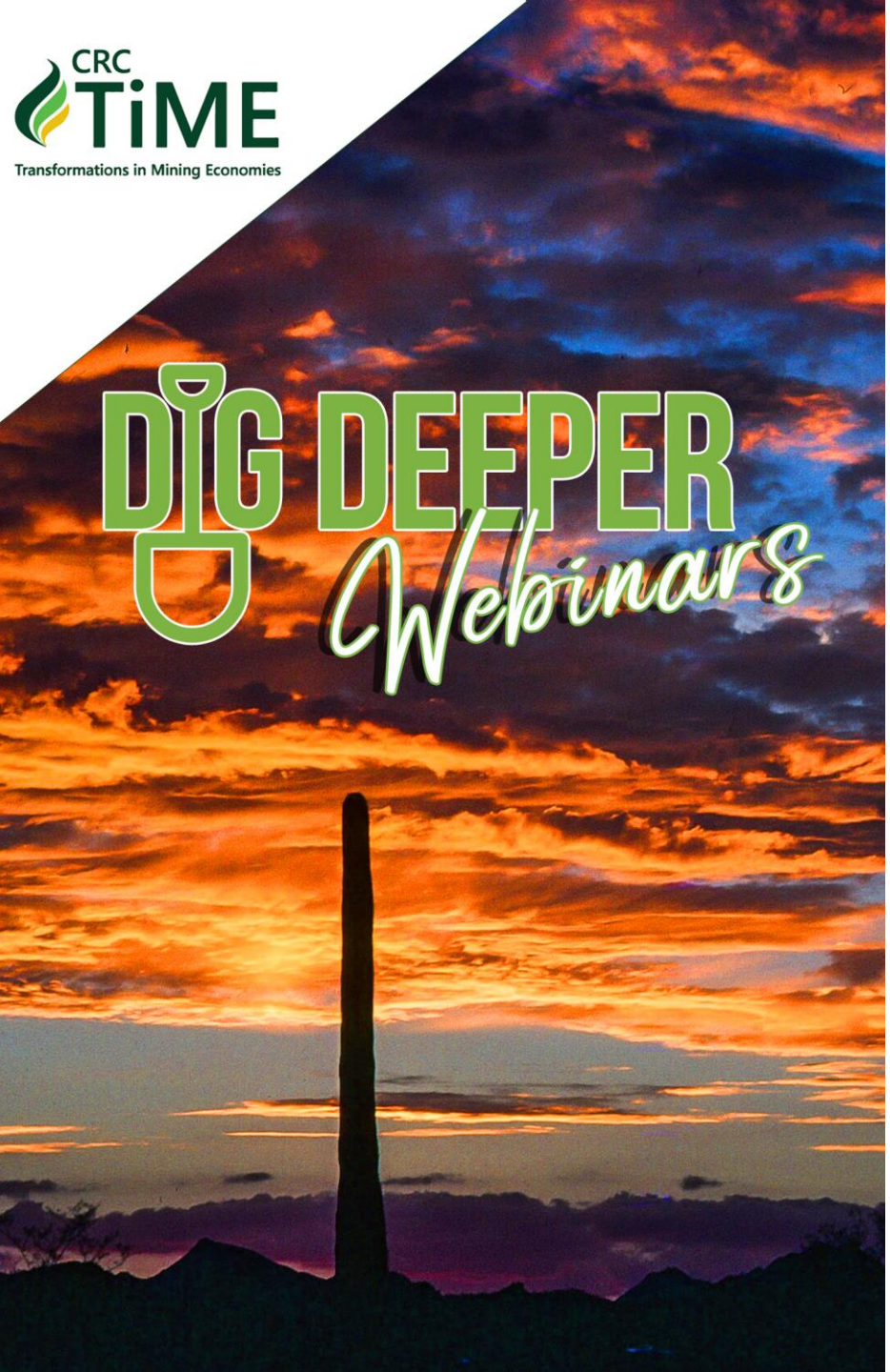


CLIMATE IMPACTS ON MINING SYSTEMS

Dr Ray Maher | Centre for Policy Futures, The University of Queensland

JUNE 2022

CRC TiME
Transformations in Mining Economies

The Team

Project Team

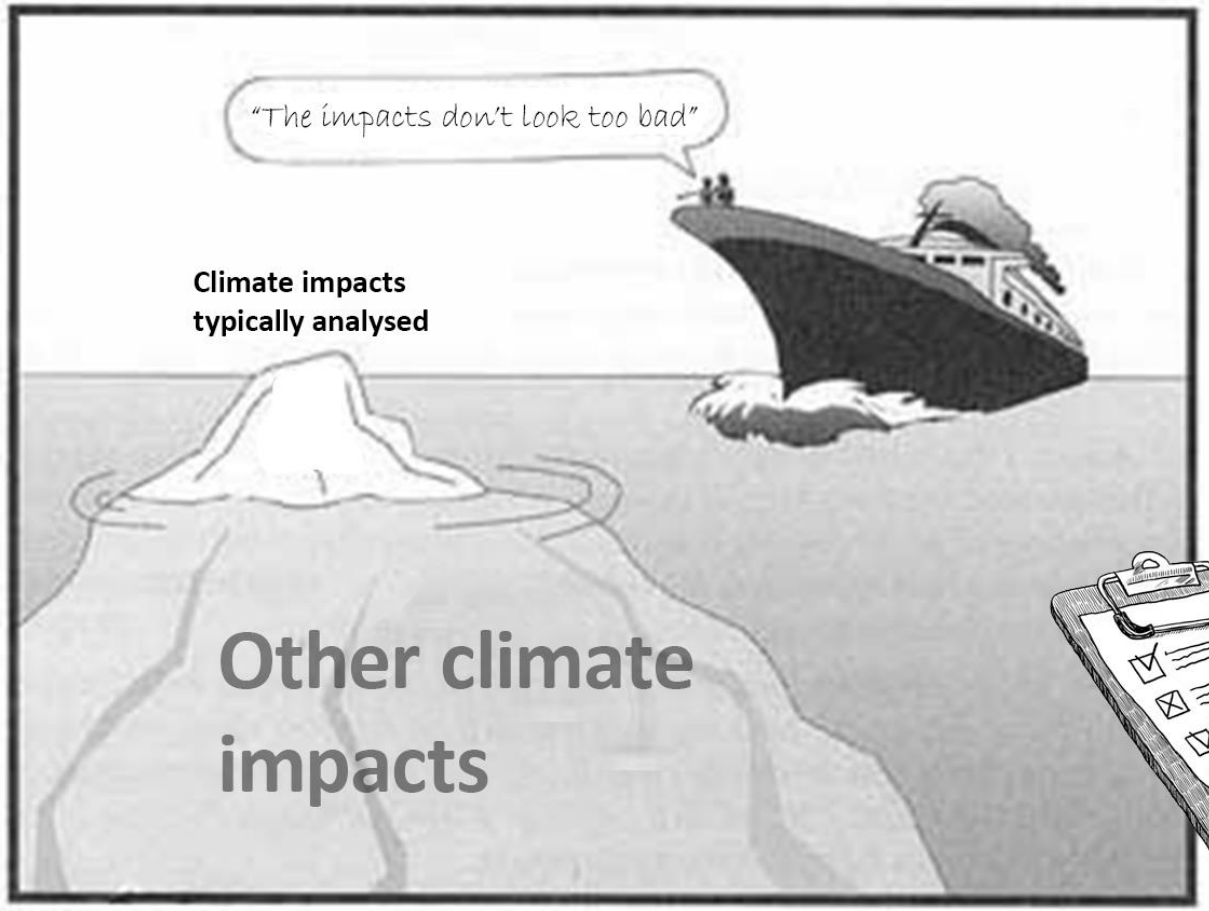
- **Dr Ray Maher**, Centre for Policy Futures, The University of Queensland
- **Ms Rachel Buchan**, Centre for Policy Futures, The University of Queensland
- **Dr Lynette Molyneaux**, Centre for Policy Futures, The University of Queensland
- **Dr Kirsten Maclean**, The Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- **Professor Anna Littleboy**, Sustainable Minerals Institute, The University of Queensland
- **Dr Martin Stringer**, Sustainable Minerals Institute, University of Queensland
- **Professor Rick Valenta**, Sustainable Minerals Institute, University of Queensland

CRC TiME Transformations in Mining Economies

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

CSIRO

The Problem:
Understanding and managing climate impacts across the mining system



Climate change is the single *largest driver of Transformations* in Mining Economies.

But…mining sector stakeholders *lack a complete framework* to identify climate impacts. What exists is limited and disconnected.

Currently, most risks and opportunities of climate change are *overlooked*, putting huge risk on organisations and communities.

A ***risky*** risk assessment

Key Findings

1) Climate Impacts on Mining Systems

- A new framework for understanding diverse climate impacts

2) Climate Risks and Opportunities across the mining system

- A synthesis of risks and opportunities for the mining system driven by climate change

3) Organisational responses to climate change

- An analysis of how organisations across the mining ecosystem publicly respond to climate change

Other research included in the report

4. Climate scenarios for the mining sector
5. Quantifying critical parameters
6. Regional mapping
7. Review of Indigenous perspectives of climate change

CRC TiME
Transformations in Mining Economies

Climate Impacts on Mining Systems

Operation
(Development and extraction)

Industry operations

Climate Impacts on Mining Systems

Current focus on *physical* impacts on mine *operation*

- **Physical impacts**

EXAMPLE CLIMATE IMPACTS:

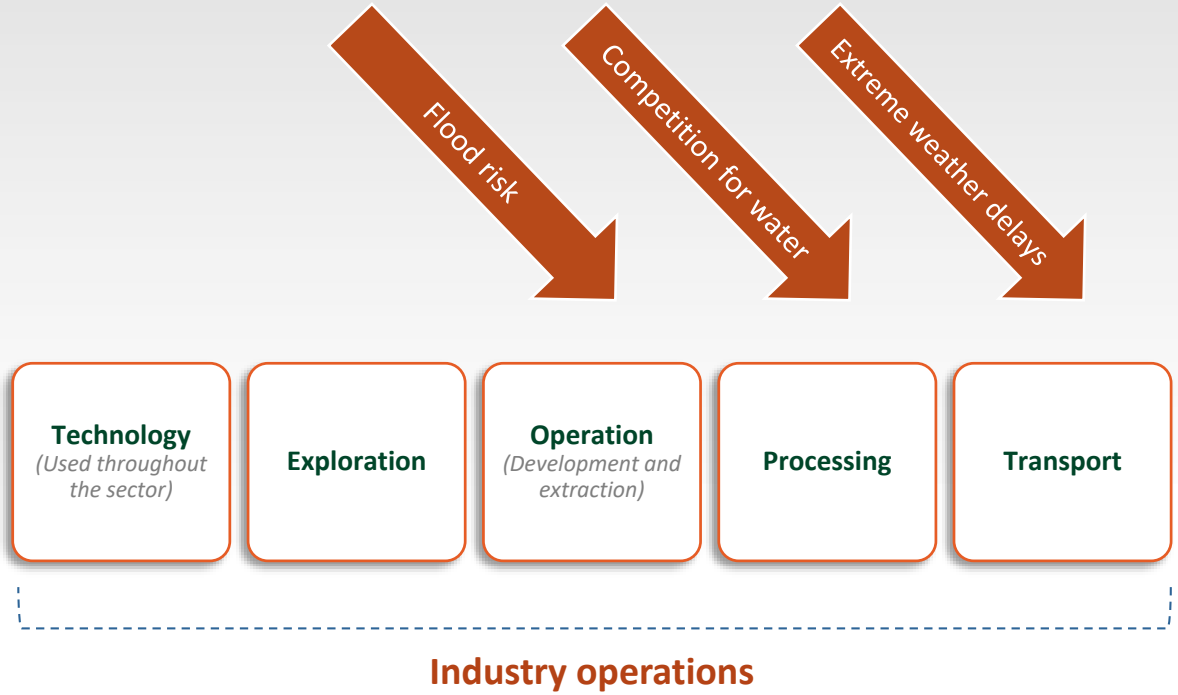
Industry operations

Climate Impacts on Mining Systems

Some examination of *physical* impacts across other *industry operations*

- **Physical impacts**

EXAMPLE CLIMATE IMPACTS:



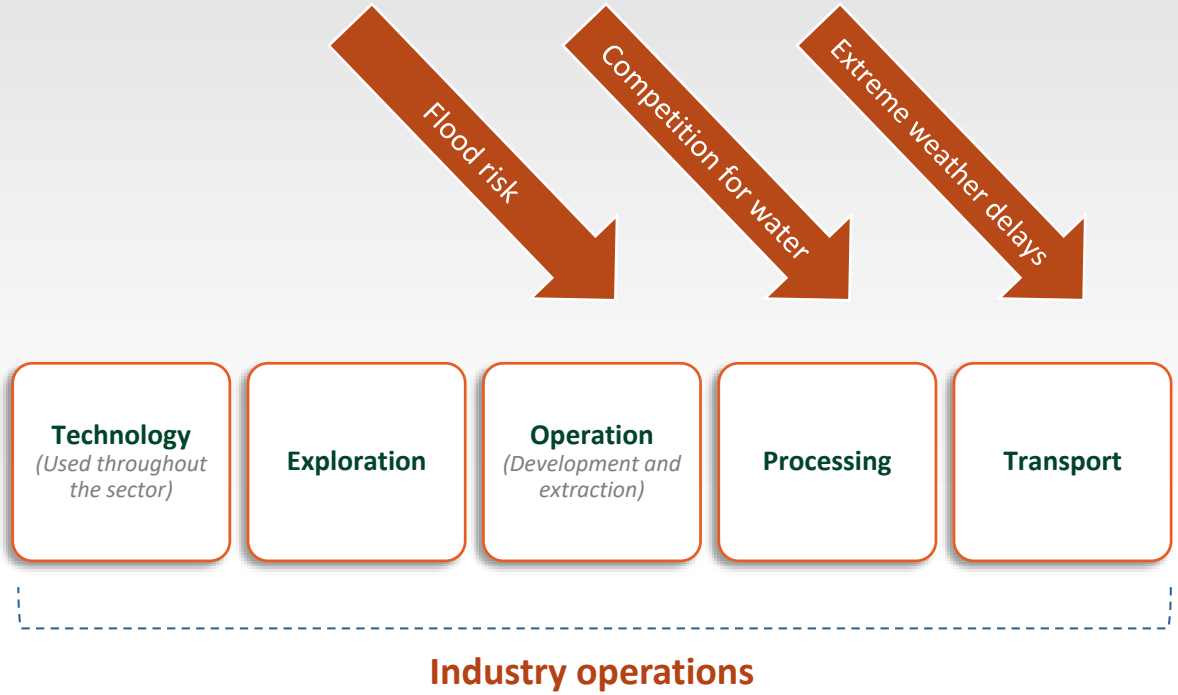
MINING SYSTEM COMPONENTS

Climate Impacts on Mining Systems

Limited integration of *financial and transition impacts* on *industry operations*

EXAMPLE CLIMATE IMPACTS:

- **Physical impacts**
- **Financial impacts**
- **Transition impacts**



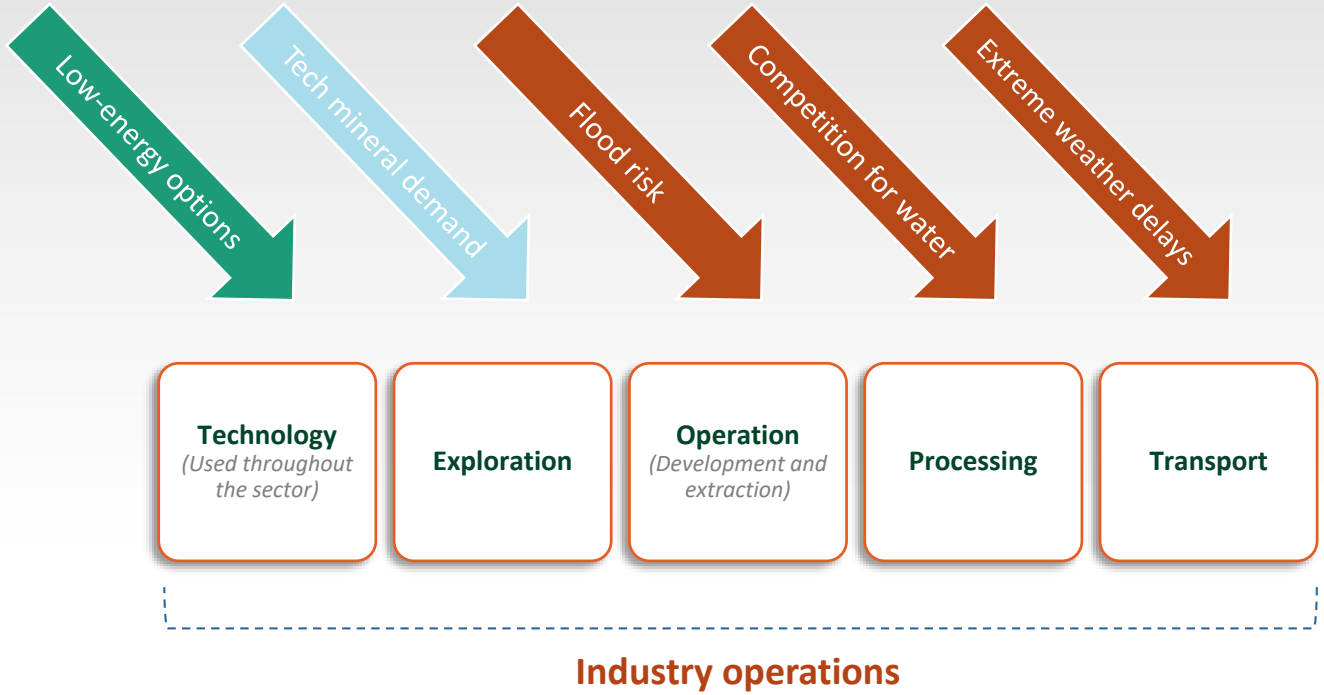
MINING SYSTEM COMPONENTS

Climate Impacts on Mining Systems

Limited integration of *financial and transition impacts* on *industry operations*

EXAMPLE CLIMATE IMPACTS:

- **Physical impacts**
- **Financial impacts**
- **Transition impacts**



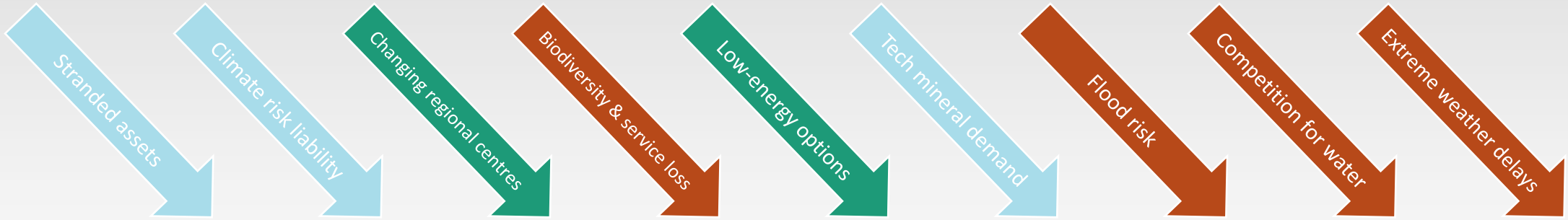
MINING SYSTEM COMPONENTS

Climate Impacts on Mining Systems

Critical gap in understanding *diverse climate impacts* across the *broader mining system*

EXAMPLE CLIMATE IMPACTS:

- **Physical impacts**
- **Financial impacts**
- **Transition impacts**



Finance (Demand, markets, and insurance)	Permissions (Policy, approvals, and social license)	People (Workforce and community)	Environment (Biodiversity, water, ecosystem services)	Technology (Used throughout the sector)	Exploration	Operation (Development and extraction)	Processing	Transport

Social-economic-environmental context

Industry operations

MINING SYSTEM COMPONENTS

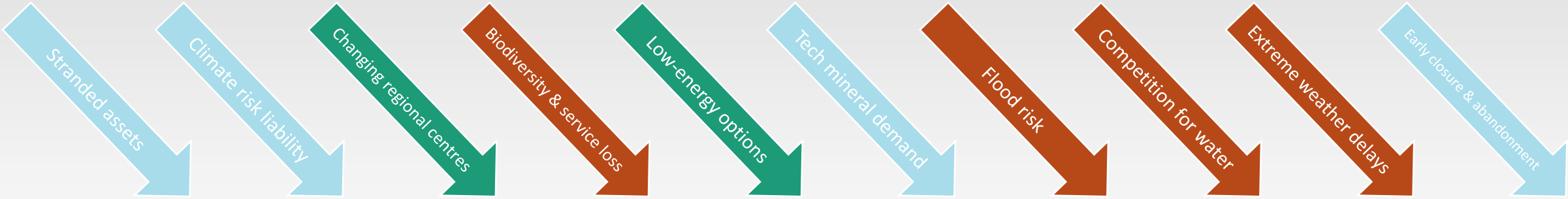
Climate Impacts on Mining Systems

Critical gap in understanding *diverse climate impacts* across the *broader mining system*

EXAMPLE CLIMATE IMPACTS:

- **Physical impacts**
- **Financial impacts**
- **Transition impacts**

…including closure



Finance *(Demand, markets, and insurance)*

Permissions *(Policy, approvals, and social license)*

People *(Workforce and community)*

Environment *(Biodiversity, water, ecosystem services)*

Technology *(Used throughout the sector)*

Exploration

Operation *(Development and extraction)*

Processing

Transport

Closure *(Rehabilitation, relinquishment, future use)*

Social-economic-environmental context

Industry operations

Post-mine futures

MINING SYSTEM COMPONENTS

Climate Risks and Opportunities across the mining system

We synthesised risks and opportunities from:

- **Review** of industry and academic literature
- **Survey** of 57 industry professionals (53% owners and exec.)
- **Two workshops** with 64 stakeholders
- **Interviews**

Types of climate impacts:

Physical (Red)

Financial (Blue)

Transition (Green)

✓ Opportunities

× Risks

Read this in our report

Mine system	Opportunities	Risks
Finance: Demand, markets, and insurance	✓ Increasing demand for low carbon metals ✓ Increased royalties from tech minerals ✓ Increased lending and investment in renewables	× Stranded private assets and insolvency × Potential carbon price cost × Reduced fossil fuels royalties × Stranded public assets, reducing funds for public services × Reduced demand and investment for fossil fuels × Reduced availability of insurance for coal
Permission: Policy, approvals	✓ Increasing ease of approvals for 'tech' minerals	× Reduced ease of approvals for fossil fuels × Civil opposition to fossil fuels × Legal liability for managing climate risks
People: Workforce and community	✓ Economic development of rural towns through low carbon industries ✓ Job growth in renewables and low-carbon industries ✓ Skill development in low-carbon industries ✓ Automation facilitating working from more hospitable locations	× Increasing costs for (re)training workforce in declining industries × Declines in rural towns founded on fossil fuel resources × Potential skill shortages following rapid transition × Increased social and economic costs to communities in transition × Reduced livability of communities in hot regions × Increased absenteeism due to health impacts × Increased heat stress on workforce
Environment: Biodiversity, water	✓ Improved air quality as fossil fuels in electricity and transport phase out	× Reduced ecosystem services as climate change reduces ecosystem health × Reduced biodiversity and increased extinctions
Technology	✓ Climate-driven technology development	× Increased damage to infrastructure due to bushfires and storms
Exploration	✓ Rapid increase of tech mineral exploration	× Sharp decline of fossil fuel exploration
Operation: Development and extraction	✓ Cheap onsite renewable energy generation	× Increased flood risk × Increased risk of tailings dam spillage during floods × Intense rainfall reducing slope stability and hence accidents in open mines
Processing	✓ Growing demand for circular economy in mining e.g. reprocessing tailings ✓ Low-energy processing technology development	× Increased competition for water from agriculture, community, and ecological demands × Reduced water quality due to increased erosion
Transport	✓ Increasing demand for low carbon transport options	× Delays in freight rail from extreme weather events × Supply chain delays and reduced site access from extreme weather
Closure: rehabilitation, and relinquishment	✓ Transition impacts eased by progressive rehabilitation and closure plans ✓ Increasing demand for carbon sinks through rehabilitation	× Heightened risk of early closure and stranded assets due to shifting demand away from fossil fuels × Heightened risk of abandoned fossil fuel mine sites × Reduced water availability impeding rehabilitation

Mining under 3 climate scenarios: 1.5°C, 2°C, 3°C

Key findings

1. Transformation of the Australian mining is inevitable: Transformation will occur either due to the transformation to a low-carbon economy to avoid high-level climate change, or because of the consequences of high levels of warming.

2. Different trajectories for 'tech' minerals and fossil fuels: Fossil fuel development is incompatible with either Paris scenario (1.5°C or 2°C). Mining and processing 'critical minerals' creates substantial opportunities for regional development and job growth.

3. Non-physical risks tend to receive less attention but have more significant consequences: Financial impacts, such as stranded assets and the shifting availability of investment, insurance, and approvals, present the most significant risks and opportunities to the Australian mining sector.

CRC TiME
Transformations in Mining Economies

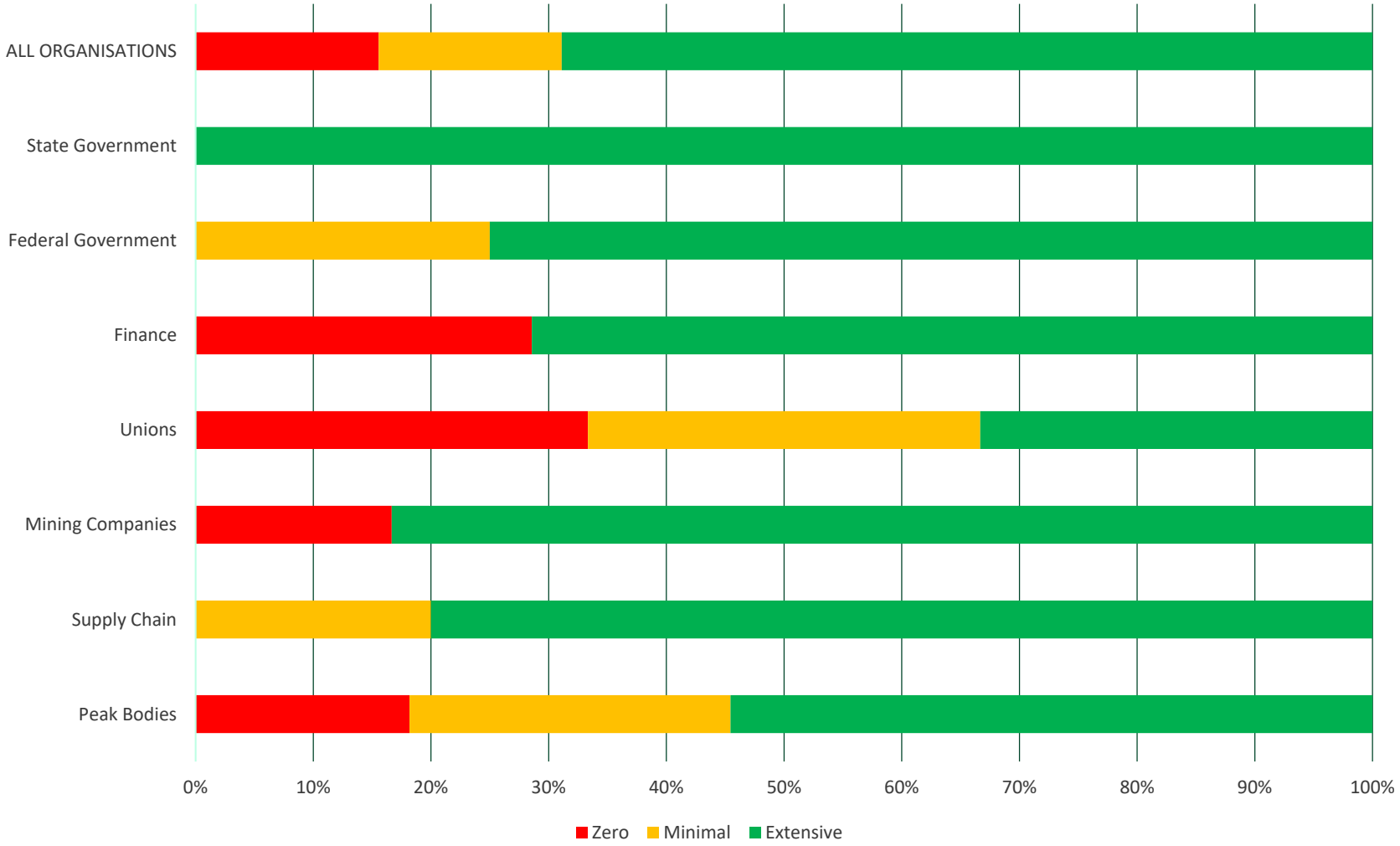
Organisational responses to climate change

Forty-five organisations across the mining ecosystem were examined for their public responses to climate change.

- Mining companies (6)
- Peak bodies (11)
- Finance (7)
- Supply chain (5)
- Australian federal agencies (4)
- Unions (6)
- State policymakers (6)

CRC TiME
Transformations in Mining Economies

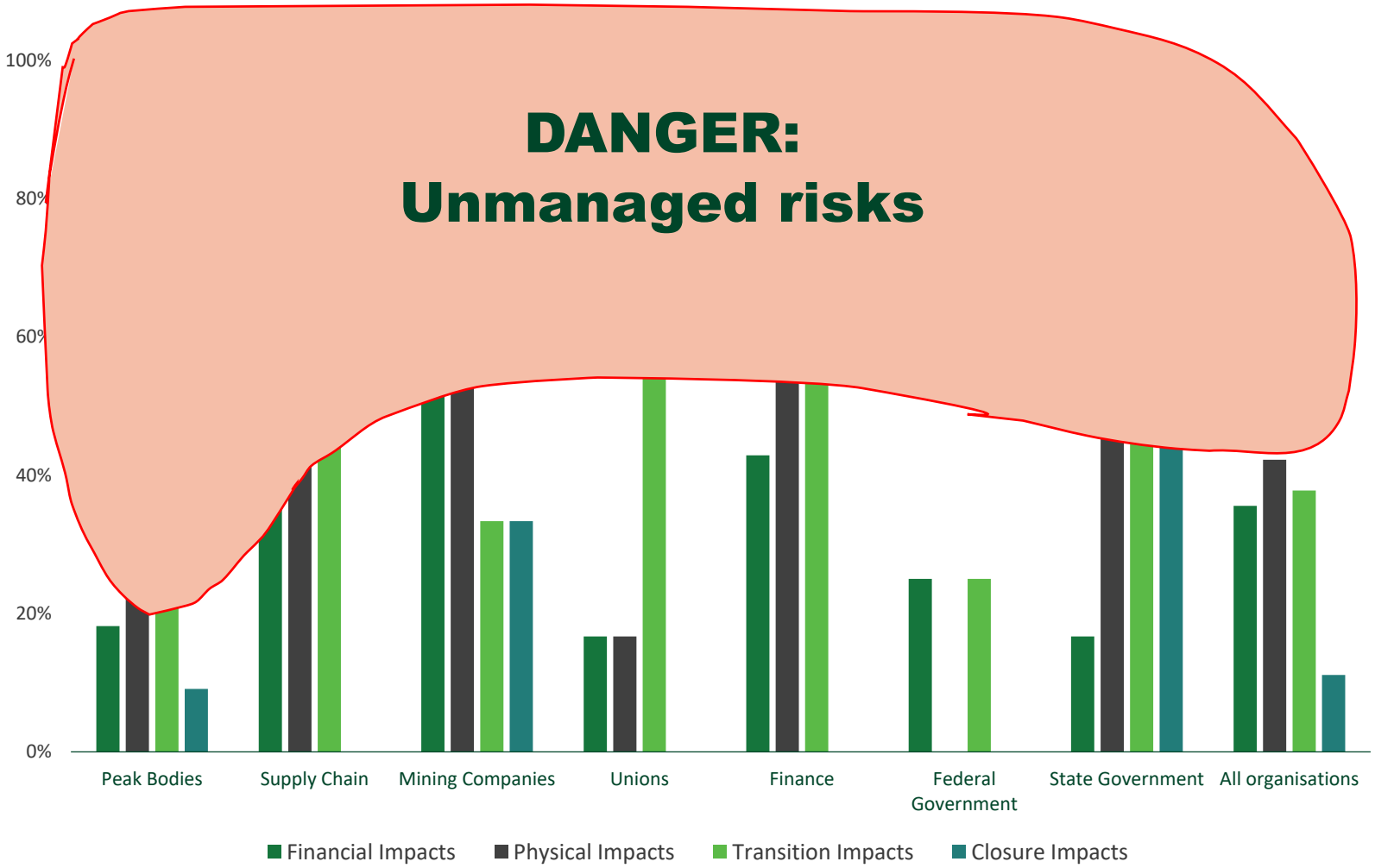
e.g. Extent of Climate Change discussion



The large majority (84%) of all organisations we examined discussed climate change issues, impacts, and/or policies in official publications.

CRC TiME
Transformations in Mining Economies

e.g. Discussion of Climate Risks

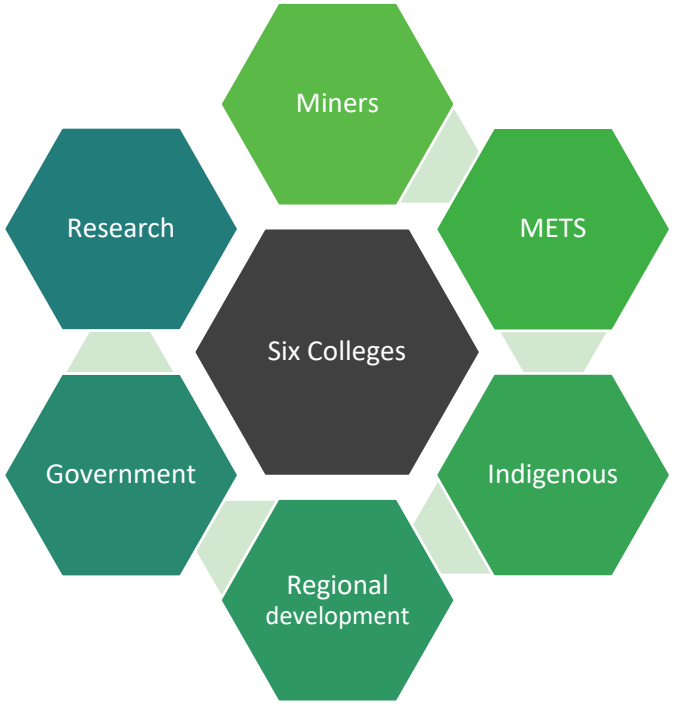


Most organisations did not discuss risks from climate change systemically.

Most types of risks were overlooked.

CRC TiME
Transformations in Mining Economies

Organisational responses to climate change



Key findings

1. Levels of agreement: Organisations' views on climate change were *generally aligned* in acknowledging climate change as a phenomenon, climate agreements, and the necessary transition to low carbon economy.

2. Limited scope of discussion: The scope of discussion of climate change impacts and actions is *significantly underplayed* and does not align with the actual risks and opportunities, nor the scale of impending transition of the mining sector.

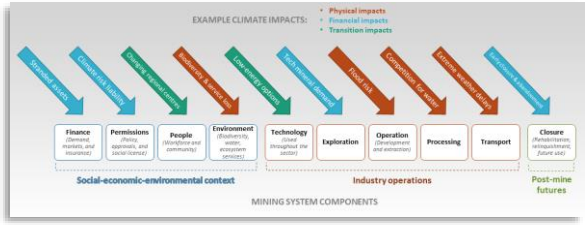
3. Discrepancy of dialogue vs action: There is a *substantial conflict* between organisations' support of climate change mitigation and their reported actions.

4. Indigenous voices are *absent* and need to be fully included in climate analysis and planning.

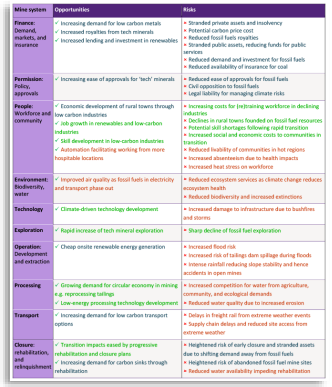
CRC TiME
Transformations in Mining Economies

How can Industry use these findings?

- Use the ***Climate Impacts on Mining Systems*** framework to inform desicions
  - We can work with you to tailor it for your organisation or community



- Incorporate thorough ***analysis of climate risks and opportunities*** throughout:
  - Strategic and financial planning
  - Policy development
  - Risk assessments



- ***Enable Indigenous perspectives*** and knowledge to inform climate change mitigation and adaptation action

…and read the report for other key findings and tools.

CRC TiME
Transformations in Mining Economies

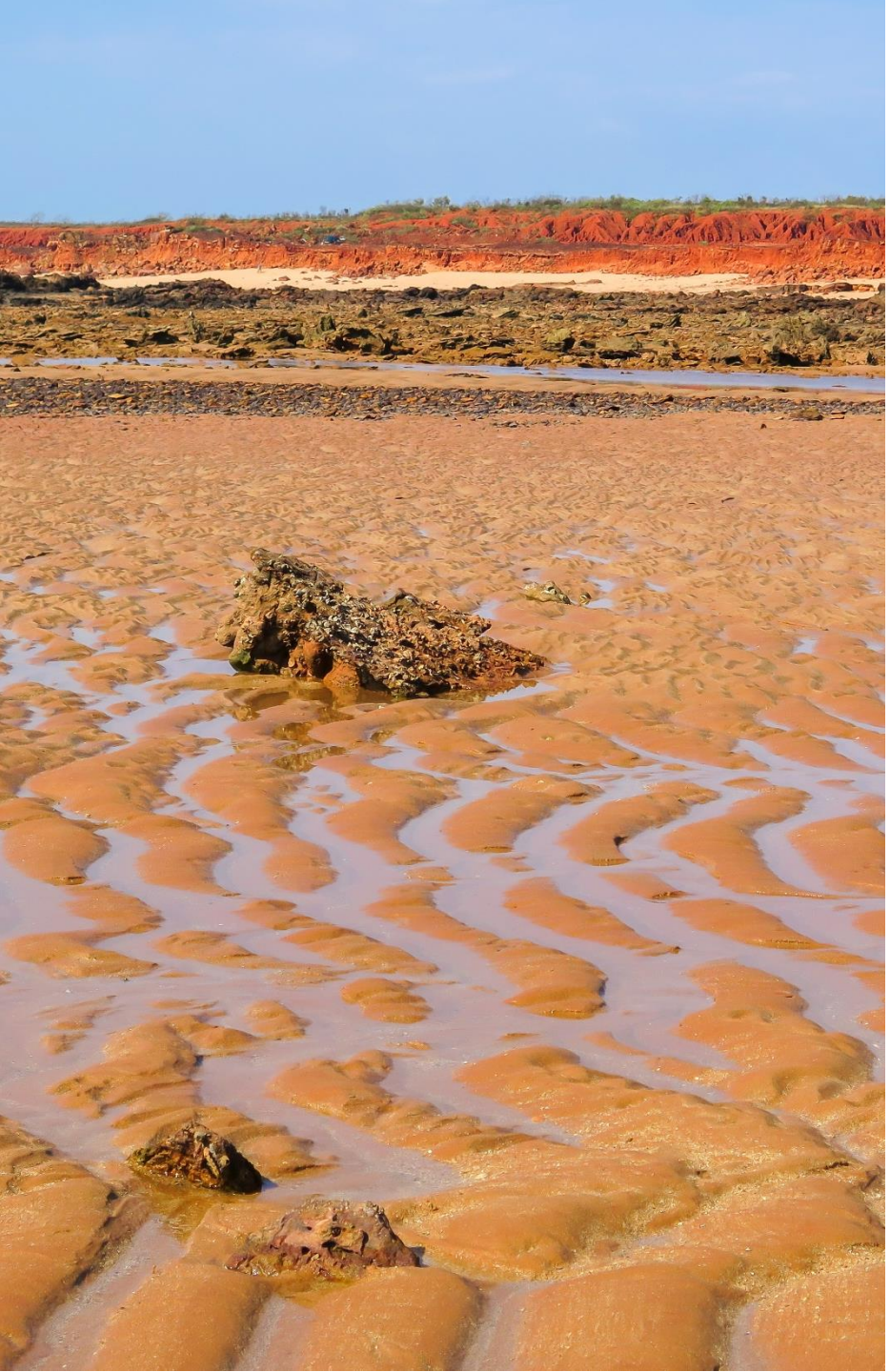
Implications

By thoroughly understanding the impacts of climate change across the whole mining ecosystem, communities, businesses, and government bodies can manage risks and seize opportunities.

This can help to:

- Build resilience in regional communities
- Avoid stranded assets and stranded communities
- Thrive among times of rapid change

CRC TiME
Transformations in Mining Economies



THANK YOU

Dr Ray Maher

r.maher@uq.edu.au

Centre for Policy Futures,
The University of Queensland

https://policy-futures.centre.uq.edu.au/

www.crctime.com.au

CRC TiME
Transformations in Mining Economies