



Resources and Sustainability

Whos in the room?

MINERAL RESOURCES FLAGSHIP



CSIRO; Who we are

People 6035

Sites 55

Flagships 9

Budget \$1B+

64% of our people hold university degrees over 2000 hold doctorates over 500 hold masters

We develop 832 postgraduate research students with our university partners



CSIRO and National Research Flagships



AGRICULTURE



BIOSECURITY



FOOD AND NUTRITION



OCEANS AND ATMOSPHERE



ENERGY



LAND AND WATER



MANUFACTURING

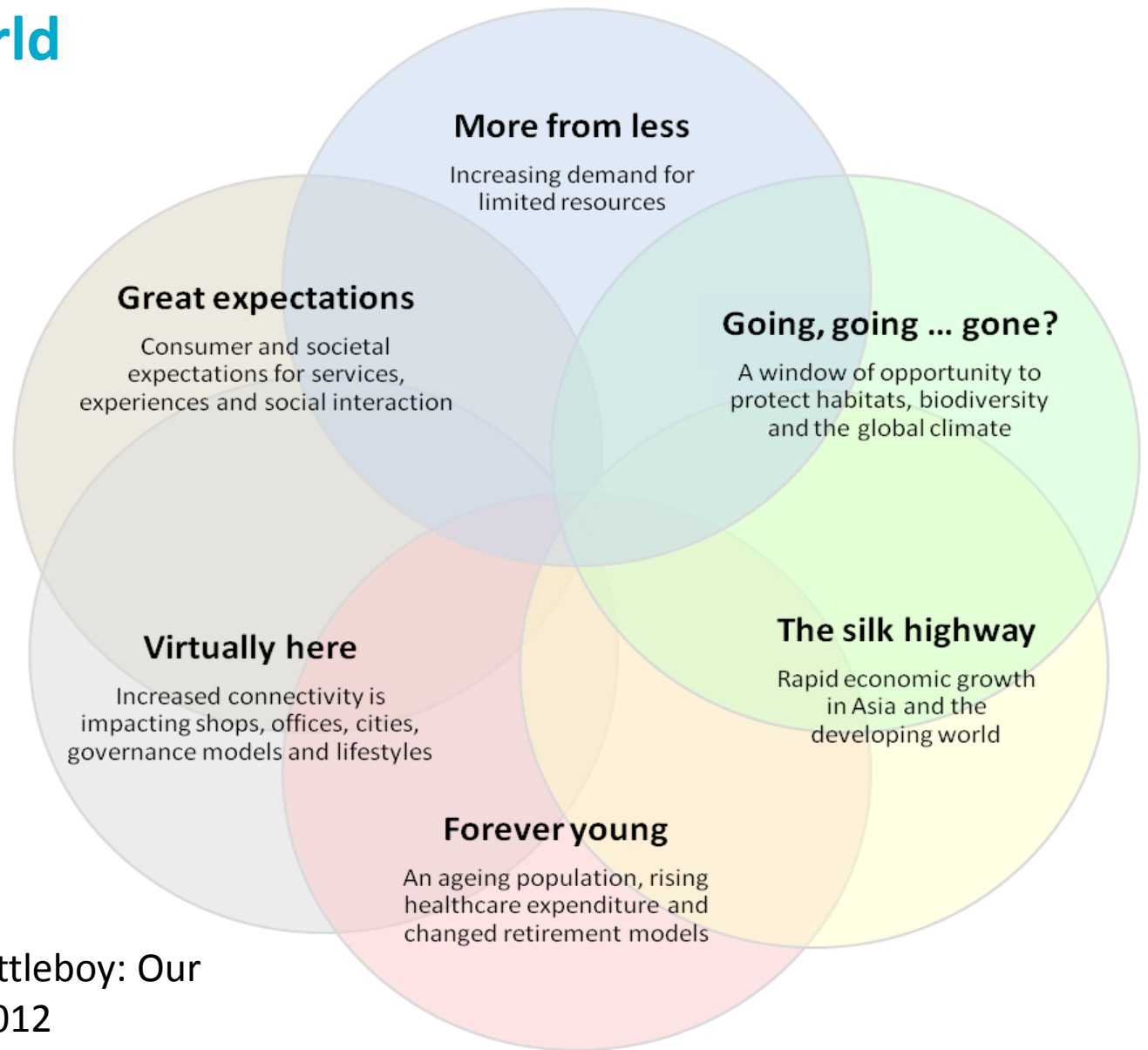


MINERAL RESOURCES



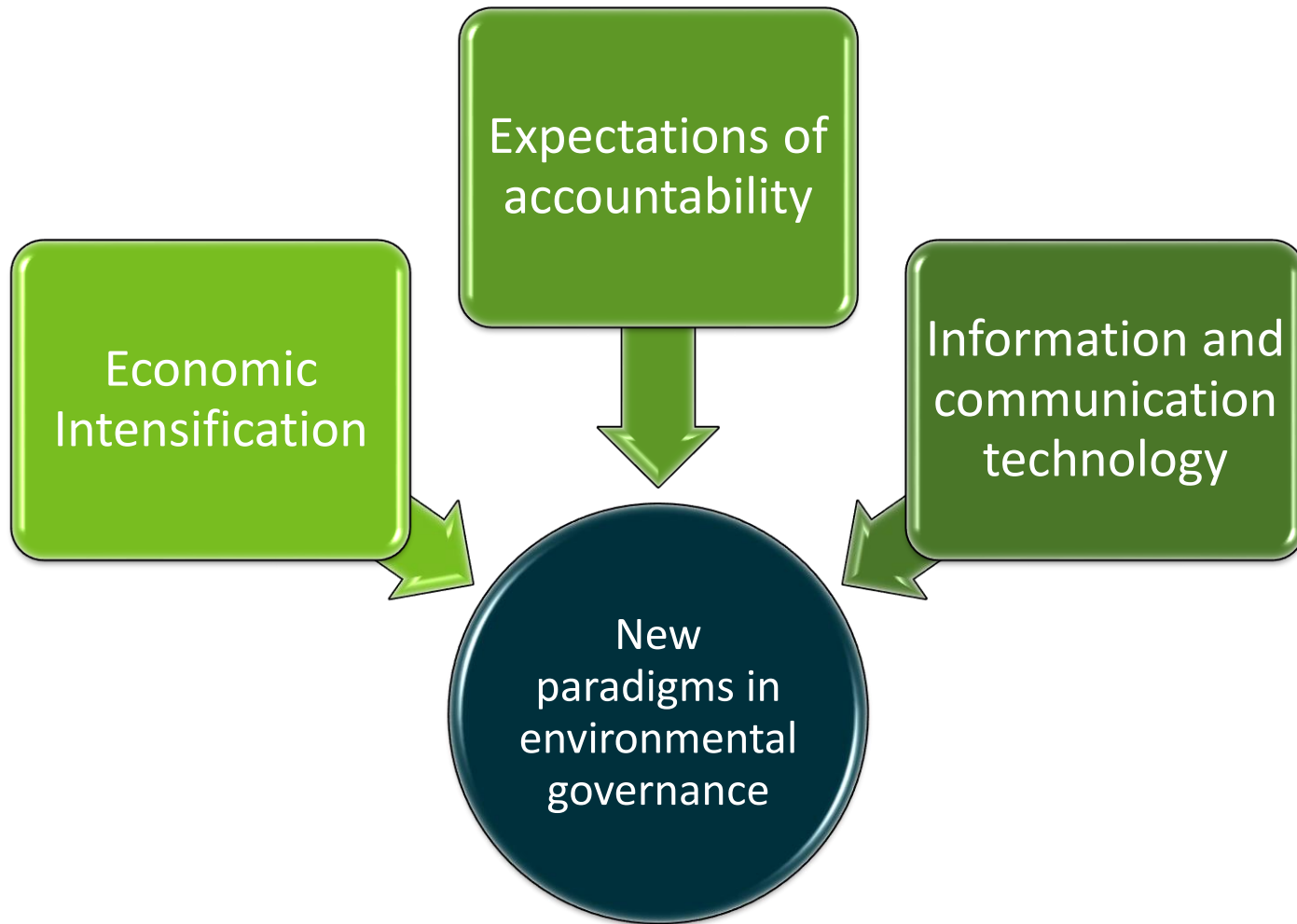
DIGITAL PRODUCTIVITY
AND SERVICES

A changing world



Hajkowicz, Cook and Littleboy: Our Future World, CSIRO 2012

This presentation

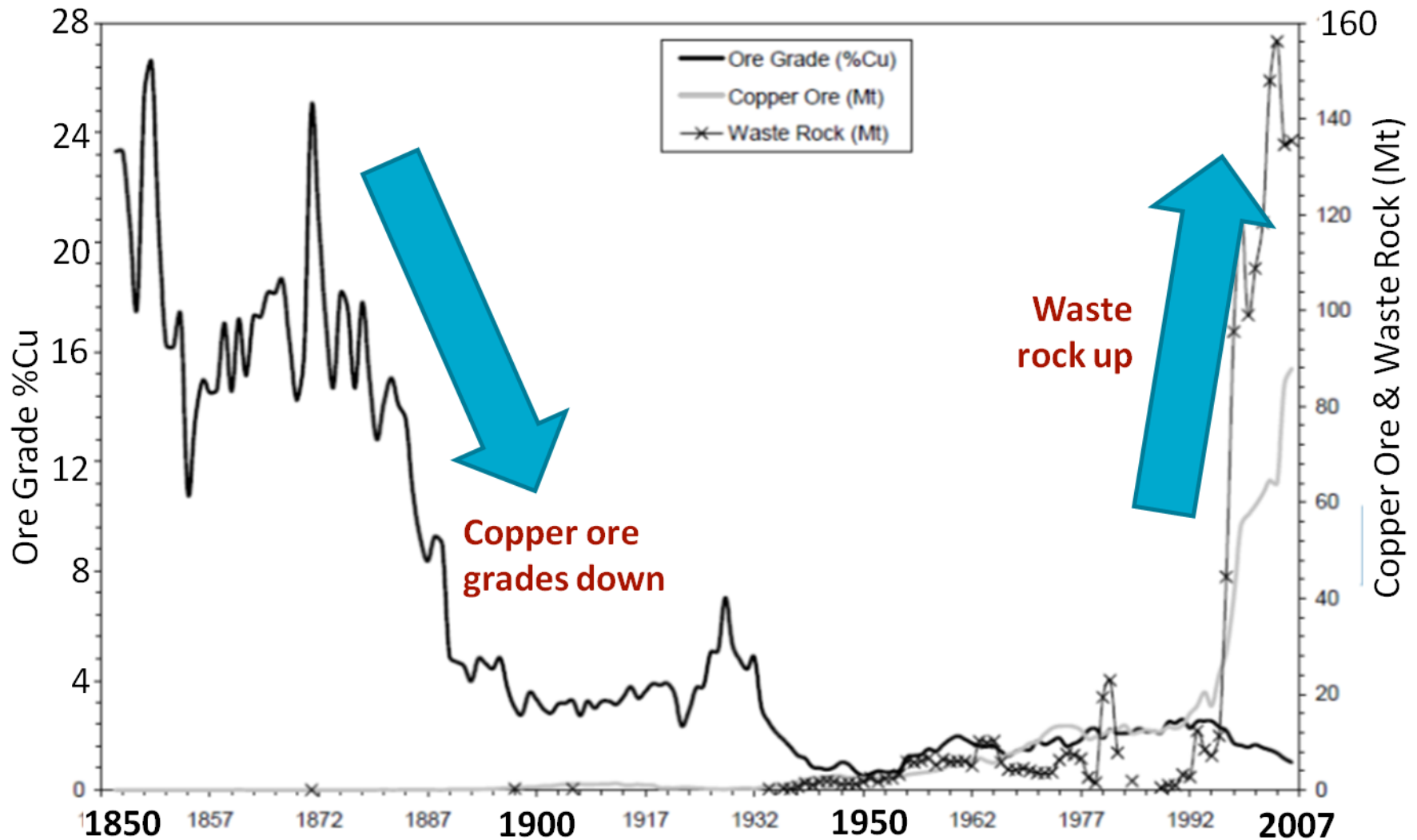


Fundamental economic shifts in the resources sector

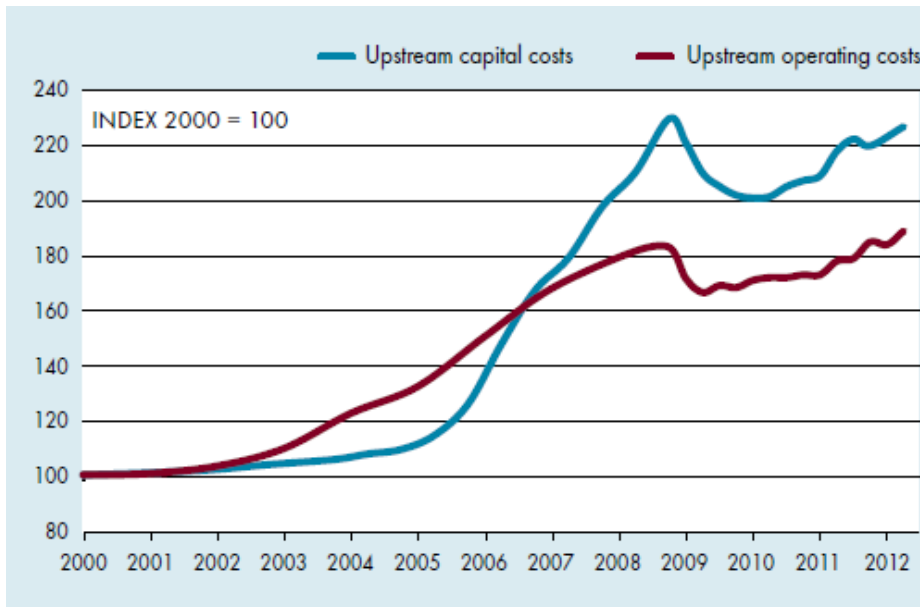
www.csiro.au



Cheaper and Easier to more Complex and Expensive



Costs are increasing



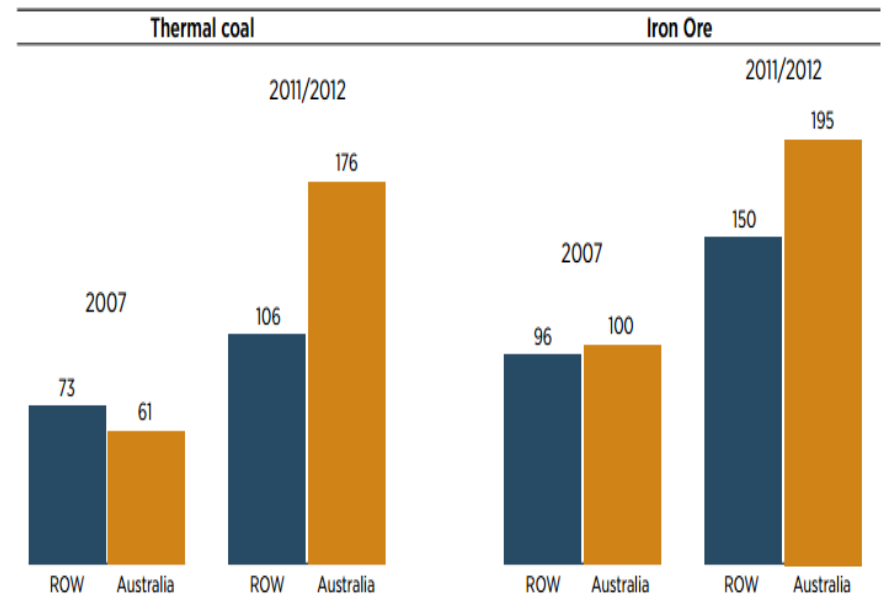
Upstream oil and gas cost indices (Australia): 2000 to 2012

Source: APPEA

Capital costs in the mining sector

Capital Spend to Build a Tonne of New Capacity

2011 US\$ per tonne of capacity



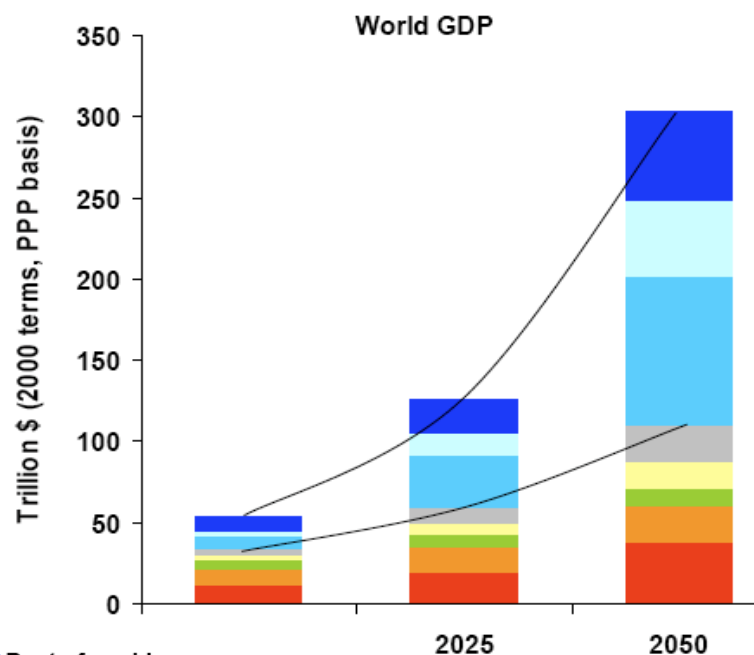
Source: Bank of America Merrill Lynch; JP Morgan; company announcements; press reports

The innovation imperative

Using innovation to leverage and maximise competitive advantage.

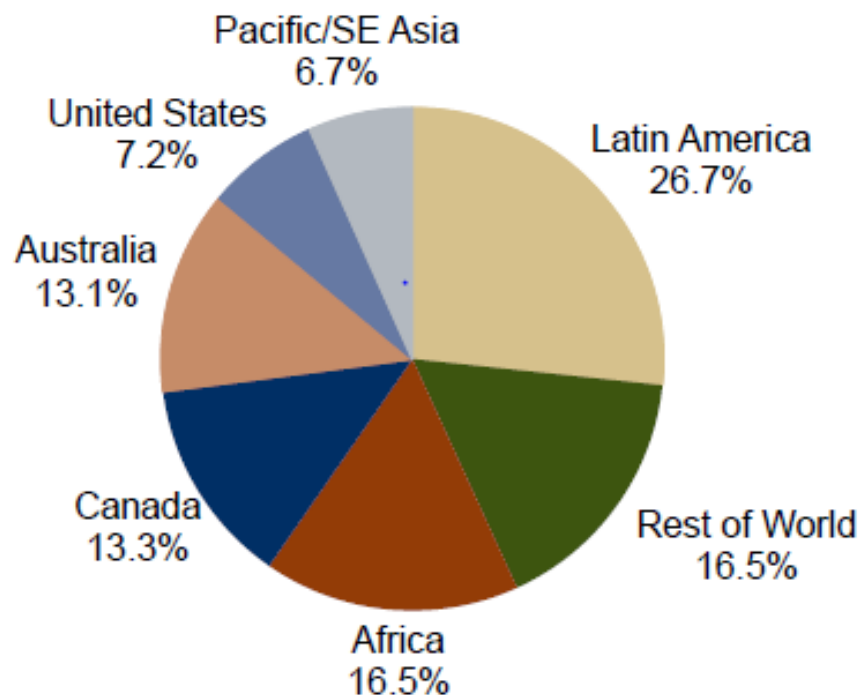
Developing world's share of economy is expected to double – where will supply come from?

\$19 trillion of new capital investment estimated to meet demand to 2030
(McKinsey global report)



for base 2005 data; Global Insight for growth e
s for 2050 data

Share of global exploration spend
2013



New money, new markets

Rising demand, increasing urbanisation and rapid development of emerging economies is shifting markets for minerals and metals, changing the global distribution of minerals' producers and seeing Asia become responsible for a growing proportion of global mining investment.

A global and globally connected business



The knowledge economy

Increasingly globalised market for selling know-how and services to the minerals and energy sectors.



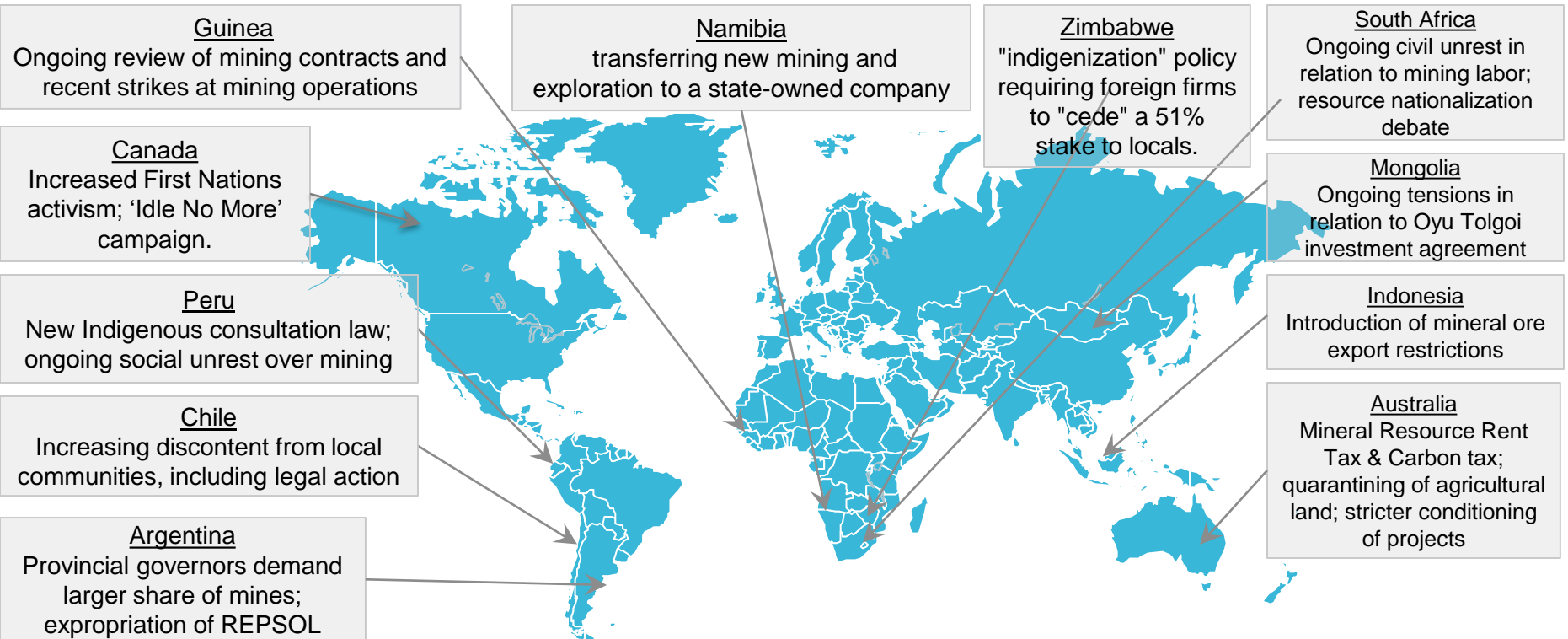
Going, Going Gone

“The fate of biological diversity for the next 10 million years will almost certainly be determined during the next 50–100 years by the activities of a single species”

Paul Ehrlich and Robert Pringle (2008)

Transparency, accountability and a social license to operate

A volatile political and social climate



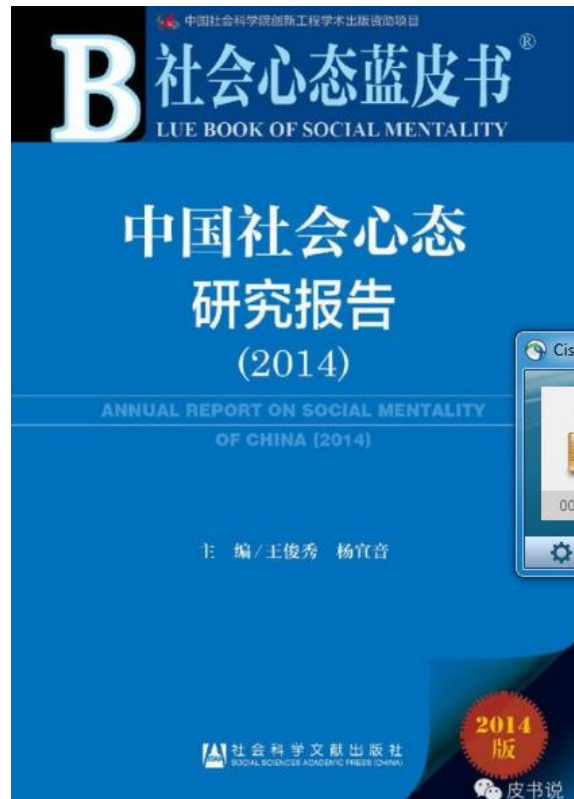


Tell me more

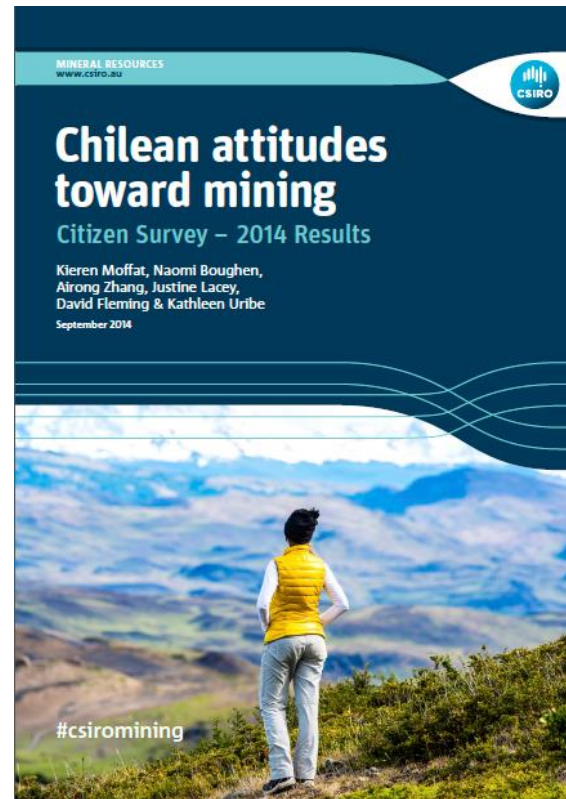
New governance challenges, crowd sourced regulation and scrutiny, efficiency in the face of global scrutiny, global accountability

Citizen attitudes to mining

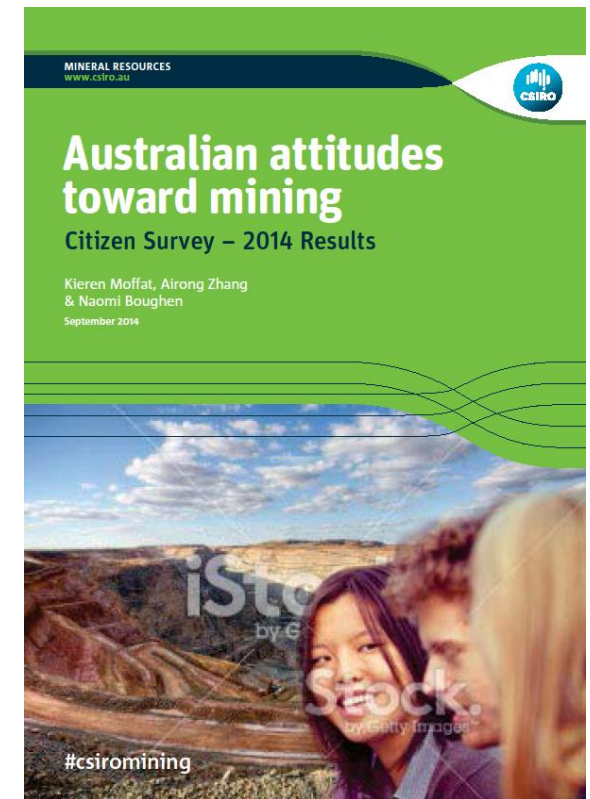
China



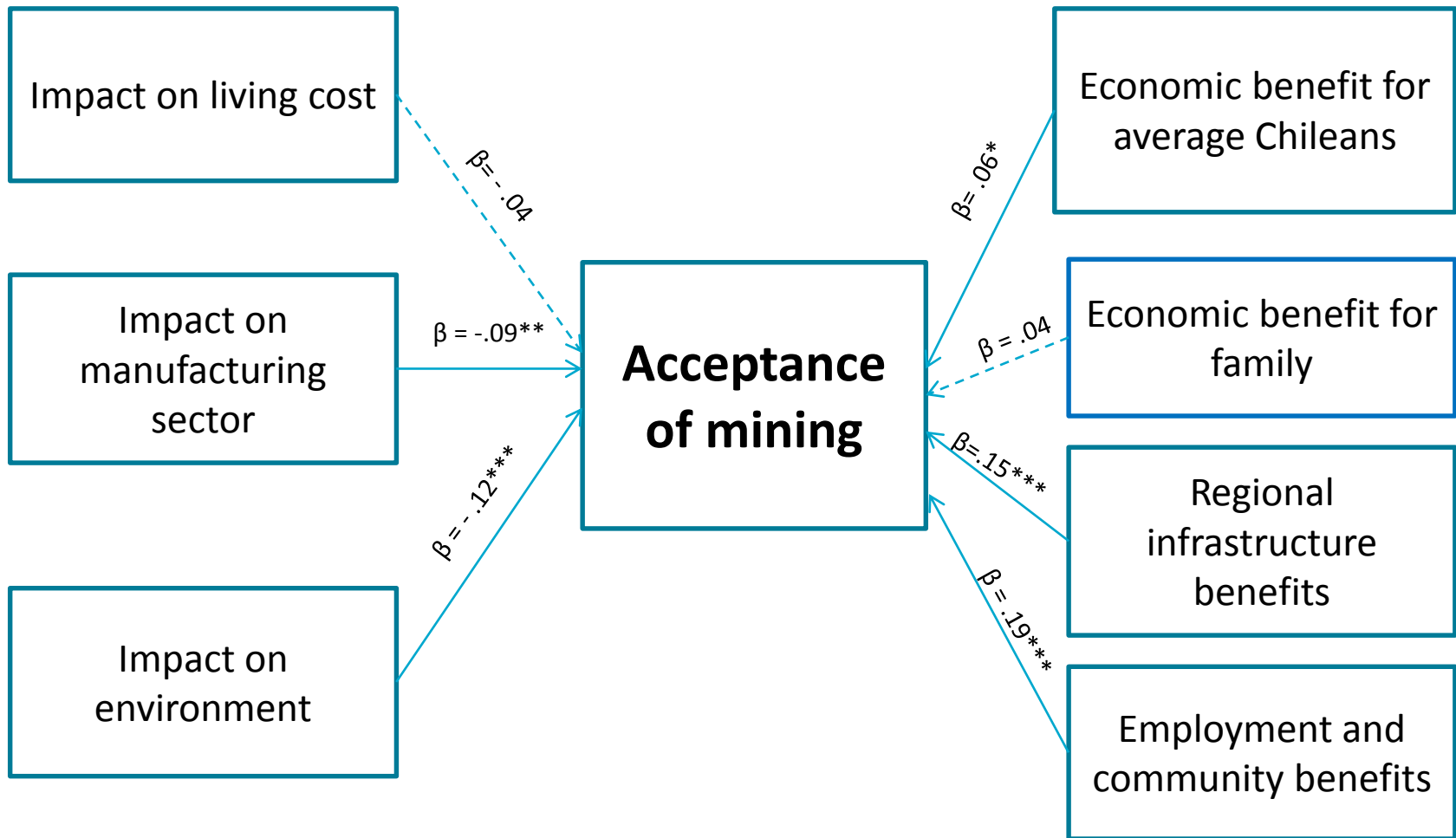
Chile



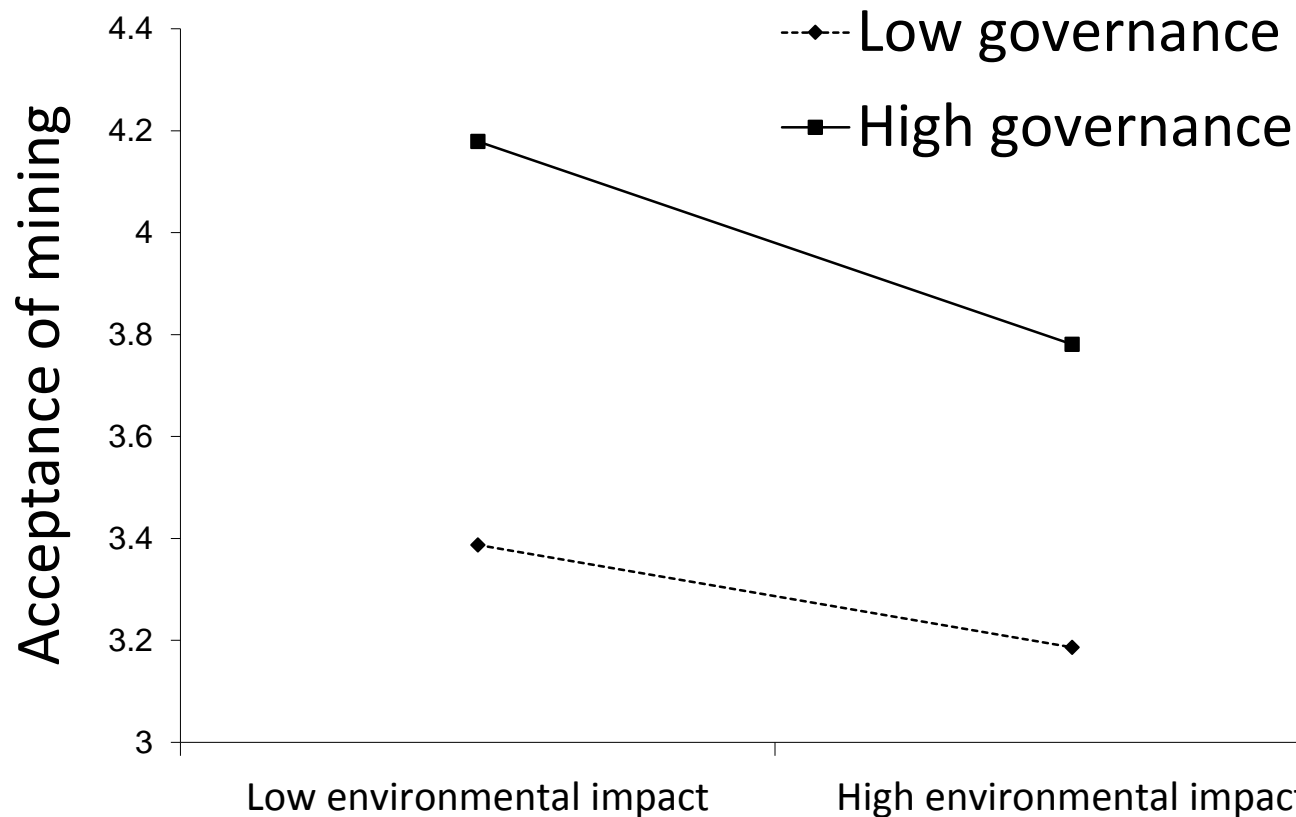
Australia



Citizen balancing of impacts and benefits



The significance of environmental impact and governance on social license



Environmental Governance – a new paradigm?

www.csiro.au



Responsible resource development

Supporting responsible and sustainable development of Australia's industries

Operations



Reducing the intensity of
inputs

Mine/Lease/Site



Mitigating wastes and
emissions

Regional Scale



Managing long- term
consequences

The challenge



What are we trying to protect, for whom and for how long?

But this is a non-trivial question

"**Wicked problem**" is a phrase originally used in [social planning](#) to describe a problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognize.

The term "wicked" is used to denote resistance to resolution, rather than evil.^[1] Moreover, because of complex [interdependencies](#), the effort to solve one aspect of a wicked problem may reveal or create other problems

Horst Rittel cites ten characteristics of these complicated social issues

Rittel, Horst. "Dilemmas in a General Theory of Planning." *Policy Sciences*, 1973: 155-169.:

- Wicked problems have no definitive formulation.
- Wicked problems bleed into one another, unlike the boundaries of traditional design problems that can be articulated or defined. Success is difficult to define
- Solutions to wicked problems can be only good or bad, not true or false. There is no idealized end state to arrive at, and so approaches to wicked problems should be tractable ways to *improve* a situation rather than solve it.
- There is no template to follow. Teams that approach wicked problems must literally make things up as they go along.
- There is always more than one explanation for a wicked problem depending greatly on the individual perspective of the designer.
- Every wicked problem is a symptom of another problem.
- No mitigation strategy for a wicked problem has a definitive scientific test
- ***Offering a "solution" to a wicked problem frequently is a "one shot" design effort***
- Every wicked problem is unique.
- Designers attempting to address a wicked problem must be fully responsible for their actions.

Grossly simplifying the problem

Multiple stakeholders hold differing values – who gets to decide?

We have not been here before – no pre-existing solution exists

Everything is interconnected

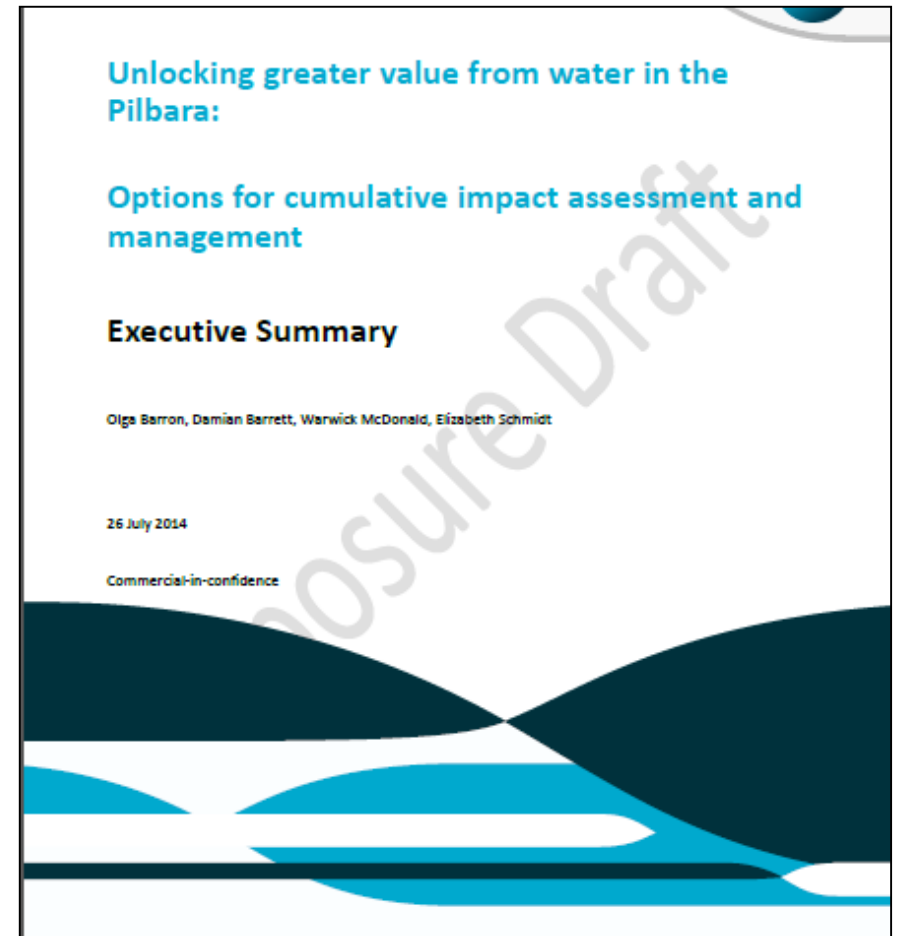


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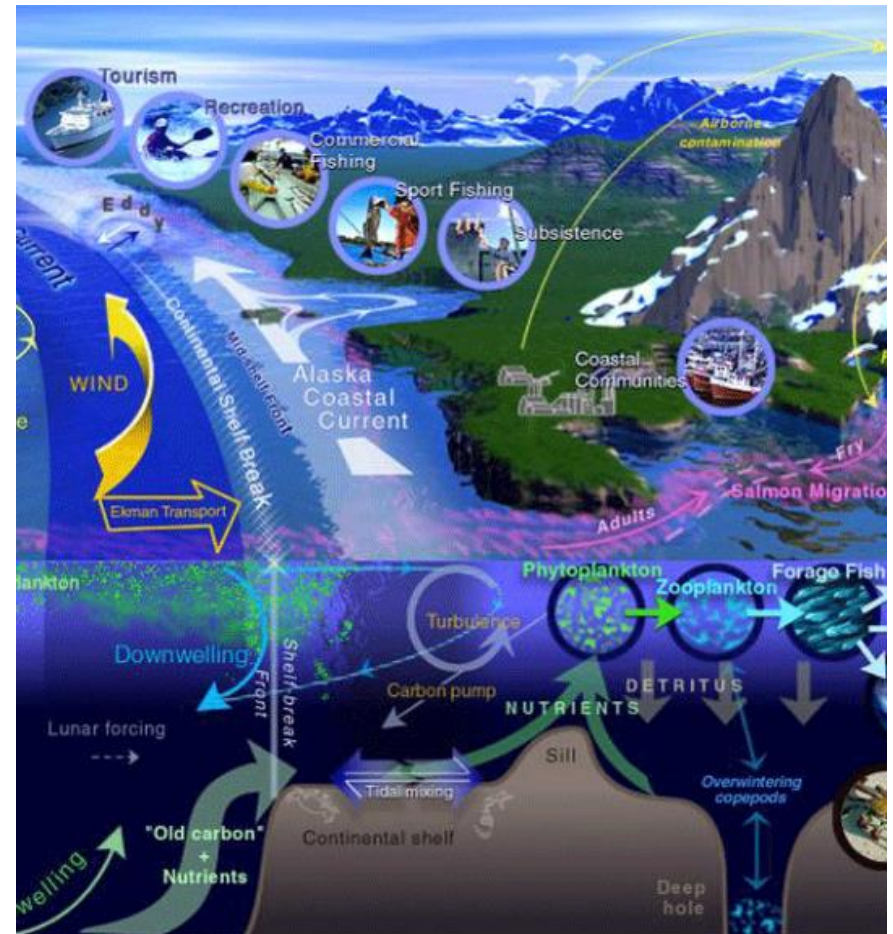


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Plugged in and switched on - things to think about

Real time monitoring

Crowdsourced Regulation

A risk-based approach



In the 21st century we will have old conversations in new ways....



