

# **Innovation in Mining - A Template for Australian Industry**

Speech for  
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## **SLIDE 1: Introduction**

I'd like to begin by respectfully acknowledging the Traditional Owners of the land on which we're gathered, the Tur-a-bul and Yug-er-a peoples, and pay my respects to their Elders both past and present.

I also want to acknowledge Mr Andrew Vigar, Chairman of the Brisbane Mining Club. Thank you for inviting me to speak today.

In the coming days Brisbane will host the **Advance Queensland Innovation and Investment Summit**, a most welcome initiative for which we congratulate all involved.

As the person lucky enough to be head of Technology and Innovation for Rio Tinto I welcome the chance to offer some thoughts on this highly topical and centrally important area.

It's timely to examine the concept of innovation properly and try to understand what it can offer us, as miners, and more generally as business operators. And to lift our gaze to the horizon, to contemplate what an innovative mining sector can offer Australia as a nation grappling with the challenges of transitioning to a more diverse economic future.

Rio Tinto is well known for its investment in the people, knowledge and technological capabilities to drive continuous innovation. We see it as a key point of differentiation and competitive advantage.

It's encapsulated in our *Mine of the Future*<sup>TM</sup> programme, a multi-faceted initiative with no less an ambition than to imagine, articulate, engineer and bring into being every aspect of mining operations as they might exist 10, 20 or even 50 years from now.

I'll share some of what we see as the road ahead for the *Mine of the Future*<sup>TM</sup>

later, but for now let's just say this approach is the product of a company that has always seen innovation at its core across its long history.

We like to say it's in our DNA - and it's no exaggeration. The Rio Tinto story goes back more than 140 years, all the way to the Huelva region in south-west Spain. That's where the Rio Tinto - red river - flows like claret, such is the wealth of minerals like copper in the earth.

The meaning of that colouration is not news - the Romans, the Carthaginians, even the Phoenicians all knew there was 'copper in them thar hills' and they all mined there to the limits of their knowledge and technology. After literally thousands of years of people clawing away at the same ground, the resource was understandably thought to be exhausted.

The original founders of the Rio Tinto mining company however, had a different idea. They thought if they applied the technologies and techniques of the late 19th century, they could win metals from that ground that had previously been simply impossible to economically extract. The core of this was what we now know as modern open-cut mining techniques.

Right from the outset, it was all about innovation.

It turned out they were right. And we have never looked back, still carrying that driving quest for a better way to extract the earth's mineral riches.

At its heart, innovation is about people and partnerships. Understanding that fact is a serious competitive advantage. It is for Rio Tinto and it's also an advantage Australia can develop internationally.

It animates our belief that company-wide, relentless innovation is not something merely desirable - it's not about bragging rights. It's about long-term survival. Or rather, the difference, in the modern competitive environment, between merely surviving and thriving. This is just as true for Australia's economy as it is for a company like Rio Tinto.

It has driven the creation of state-of-the-art iron ore mining operations that can be seen today in the Pilbara, where this year Rio Tinto marks the 50th anniversary of the company's first contracted shipment of iron ore to Japan in 1966. You almost need to view it from a stationary orbit in space to absorb the scale of what has been achieved.

## SLIDE 2: Iron Ore operations

You would see 15 mines operating as one enormous extractive machine. They contain the world's largest fleet of autonomous haul trucks and are interconnected

by 1,700 kilometres of rail infrastructure linking to four port terminals. The machine runs 24 hours a day, every day of the year.

The entire apparatus is run, monitored and continuously fine-tuned from our purpose-built Operations Centre in Perth, roughly 1,500 km away.

We're proud of this work, and its role in arming us with the productive efficiency to weather whatever cyclical markets may throw at us. But a core feature of a truly innovative business culture is that people - whatever their achievements - never rest content. The time for complacency is never.

So even as we work to assimilate some really revolutionary technologies and improvements into our operations, to the point they become business-as-usual, we are also turning our minds to the next wave.

If the hard work, fresh thinking and heavy investments of the last decade equipped us so well to meet current market conditions, our concern should be what we will tell ourselves a decade on from now.

What will we look back to in 2026 as the innovations that have driven improved safety, even greater productivity, higher volumes, reduced environmental impact, and, of course, bankable profitability?

We're already off in hot pursuit of the next tranche of that transformative innovation. Where do we expect to find it? We already know where to look.

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## **From Big Data to Meaningful Information**

### **SLIDE 3: Operations Centre**

The heart of the Perth Operations Centre I spoke of is not merely technology - much of that is these days, quite frankly, unremarkable. The beating heart of it is something much more powerful. It's a principle.

Put simply it comes down to some key people being able - and also willing - to imagine, a decade ago, something like this:

'What if we don't run all these mines in isolation from each other, each with its own machinery and maintenance crews making small improvements every day but with no ready way to share that information around?'

'What if we pull back to the stationary orbit view and look at the whole picture?'

Could we meld it all into one and bring all that information to one place? A place with the world's best technology and expertise? How much could we extract from all that information to drive productivity and make the whole giant machine purr like a Ferrari - or perhaps Mercedes given their Formula 1 performance?'

It's this feat of imagination and this principle that animates real innovation.

Assume nothing, challenge everything, let your bias be towards change, so long as you can support it with data.

If there's anything the Operations Centre experience has taught us, it's that gathering, warehousing, analysing and comprehending as much data as possible will reliably yield productivity dividends.

To us operating a fleet of 300 tonne haul trucks from 1,500 km away is in many ways the first step in a much bigger picture. The more substantial value lies in the constant, centralised, collection and analysis of data the trucks generate - data that previously didn't exist or couldn't be put to use.

It's the data which enables trucks to be run far more efficiently, with less fuel, for more days of the year and years longer. That data is like a river to a 19th century prospector. If you know how to pan it, it yields up gold.

This is the 'Big Data' we hear so much about.

But I should be clear. Our attitude, bluntly expressed, is that we couldn't care less about data itself.

Here's why.

#### SLIDE 4: Data

That's a piece of data. Exciting isn't it?

#### SLIDE 5: Big Data

How about 'Big Data'?

Let's be honest, it's no more interesting.

When we talk of Big Data of the type Rio Tinto is generating, it's difficult to get your head around the sheer volume. One example will make the point.

#### SLIDE 6: Autonomous truck

Each one of the 900 odd haul trucks we run is fitted with more than 200 sensors.

Each truck generates about 5 terabytes of data, every day. 4,500 TB across the fleet. Every day. Just from trucks.

Processing plants have another 20 or 30,000 sensors each - and on it goes. It's a data stream in the same way the Amazon River is a creek.

But it's not this raw data we're interested in - it's the meaningful information it can deliver. Data is the river, constantly streaming at us. It's the knowledge we pan from it that is precious. And this information resides in patterns.

The patterns are discoverable, but only with vast computing power and world-class expertise in advanced analytics and diagnostics.

Our teams analyse data and distil from it improvements to operations from the Pilbara to the Hunter Valley, to Mongolia and the US.

So, a little like mining itself, we collect eye-watering volumes of data and crush and process it down to useful information. Finally, there is a critical and equally important third stage. Visualisation.

We transform the information into tools to help our people on the ground make better decisions, all day, every day. It's those people and their ever-improving decisions informed by powerful new insights that generate the value and continuously sharpen our competitive edge.

Two systems within Rio Tinto are critical here: what we call *MAS* and *RTVis*<sup>TM</sup>. *MAS* is our 'mine automation system' and operates essentially like a network server application. It pulls in all the data and mines it for information.

#### SLIDE 7: *RTVis*<sup>TM</sup>

*RTVis*<sup>TM</sup> - Rio Tinto Visualisation - is the end-user product. If *MAS* is the server application, *RTVis*<sup>TM</sup> is the client app. It's what sits on an operator's desktop. It's quite literally based on a 3D gaming engine and it quite literally allows operators to see into the entrails of mine operations.

They can fly over a site and dive down to the detailed information they need. They can hover over an excavator, follow a haul truck, examine the quality of ore it's carrying, zoom in to the strut pressure on a particular truck part that could be at risk of failure.

They can dive underground via real-time drill data. Fuzzy guesswork in setting charges leads to oversized boulders, leads to breakdowns and delays at the crushing plant and down the line. Now operators can compare the hardness of the rock in different zones of a drill bench, so we get previously unachievable accuracy in blast planning.

All this yields big savings in time, effort, fuel, equipment failures, remedial maintenance ... it's a gift that just keeps giving.

As you may know, we essentially mine in blocks so a mine plan is fairly neat and rectangular, whereas geology is anything but. Visualisation technology allows us to differentiate the wobbly, asymmetrical boundaries between high and low grade ore deposits in three-dimension. It brings precision in place of the 'drill, blast and hope for the best' approach.

*RTVis*<sup>TM</sup> makes simultaneous use of up to 30 sources of information. We built it ourselves. Off-the-shelf products can't cut it. This stuff has to be customised from the ground up to the operations it is serving.

Don't misunderstand me - we're enthusiastic collaborators. We work intensively with, and invest heavily in, the University of Sydney on our *Mine of the Future*<sup>TM</sup> project, for example, and with partners like Komatsu, Atlas Copco, Hitachi and Caterpillar on elements such as autonomous trucks and drill rigs.

We now have close to 1,000 users of *RTVis*<sup>TM</sup>. It's been rolled out to around 80 per cent of our open cut sites around the world. Wherever it goes the gains multiply. Any new features of the software can be rolled out to all sites around the world in a matter of days, capturing synergies across the group.

To give you just a few examples:

*RTVis*<sup>TM</sup> enabled our teams at the Hope Downs 1 mine in the Pilbara to improve the way drill patterns are tailored to the ground conditions. In six weeks, they reduced the cost of each pattern around 13 per cent, which saved \$150,000.

At Kennecott mine in the US, two years ago they were faced with delays from end-of-shift operator changeovers, which cascade into queue and hang time at loading units. *RTVis*<sup>TM</sup> *Kiosk* machines around the site let operators see their assigned

truck and pinpoint its location in the cycle, so when it arrives at the change area, they are waiting and ready to roll. This efficiency, together with other enabling initiatives, yielded an increase of 16 loads in the first two hours of each shift. Kennecott has since gone on to be the largest users of RTVis™, it is a part of how they now do business, from planning through to extracting our products from the ground.

At West Angelas *RTVis*™ has been integral to a programme targeting high grade ore previously mis-classified or missed altogether. We are continuing to see increasing improvements on the yield of saleable ore product, now up by 2.5 per cent and enabled the delivery of around 900,000 tonnes of additional production last year. You can do your own sums on the value this has delivered.

There's a much longer list, but you get the picture.

In other areas data is harvested and information extracted and applied in different ways. A brilliant application is our Predictive Asset Health system where large quantities of equipment data is captured, cleaned up and then processed using a set of rules developed through machine learning and advanced analytics.

This enables us to quantify the risk of impending failure based on complex relationships between many parameters. Already, this has allowed us to extend the life of a haul truck engine from 25,000 hours to 30,000.

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## **Mining can show how it's done**

### **SLIDE 8: Mining operation**

I can't be the only one who's tired of clichés about the 'end of the mining boom'.

Lately it's become mandatory for commentators, pundits and taxi drivers, to expound at length about how the mining good times are all over and Australia needs to find its next boom sector. And it better have something to do with smart phones or online shopping.

While it's true the unprecedented mining investment and construction phase of recent history has tailed off, it doesn't mean we should underestimate the role mining will still play in this country's economic future.

That huge investment wave is now manifesting as capacity - and that capacity is in use, I can assure you. Mining has been a mainstay Australian industry for two centuries and will remain so. Construction may have plateaued, but output is at historic highs.

In the 19th century popular cliché had it that 'Australia rode on the sheep's back', such was the importance of the wool industry. That prominence declined and the cliché fell from favour, but the industry didn't disappear.

To this day we are one of the world's biggest wool producers, contributing roughly a quarter of the clip sold internationally and arguably most of the best quality stuff. Exports this year will be worth around \$3 billion.

My point is that cliches come and go, but competitive industries with high quality product endure, especially if they continue to grow and innovate to keep their productivity ahead of the game.

Mining is the poster-child for this truth. It's agility in experimenting with new approaches and continuous improvement means it can offer a wealth of experience and insight to the rest of the economy and the nation.

Australia has a genuine and large-scale problem with declining competitiveness.

The only possible solutions to it are grounded in a sharp, new, national focus on innovation.

A truly smart economy will draw on and share inspiration, ideas and know-how from a broad range of sectors. Just as mining will continue to improve by learning from other industries, we have much to contribute to Australia's drive to become more innovative, productive and competitive.

[SLIDE 9: Girls in engineering programme](#)

We need intelligent, economy-wide, data-driven innovation to become the new norm. And this necessity should be a fundamental bedrock in our secondary and tertiary education systems.

They should teach the need for it, the ways in which it will underpin our prosperity and the mindset and methodology required to produce high-yield innovations.

If Australia is to hold its place as a leading economy and nation this century, we need a major re-focus in education and an emphatic shift toward STEM subjects.

By this I mean not just teaching them, but inculcating them as cultural values.

We want the next generations of Australian kids to aspire single-mindedly towards excelling in those fields. We want the kid who tops the maths or geology test to be as much a playground hero as the footy captain.

And when they scan the landscape for benchmark examples to illustrate the benefits of continuous, strategically driven innovation, they will find none better than Australia's mining industry, which is quite simply leading the world.

Large parts of Australia's economy could benefit from the lessons our mining industry has learnt. Many businesses could gain by acquiring our long view -

decades long - of investing and market cycles, rather than a reactive focus on daily market fluctuations.

To replicate mining's success, adopt our focus on driving down costs to globally competitive levels, with adaptive use of technology and an unremitting focus on productivity gains.

Mining can show the way on intelligent approaches to labour market reform, employee welfare, workplace safety, environmental impact management and fostering economic development in the communities where we work.

Our *Mine of the Future*<sup>™</sup> envisions not just what resource extraction will be like in coming decades, but how whole swathes of our economy could look, with the right policy drivers. It's a comprehensive vision encompassing productivity, certainly, but so much more besides.

#### SLIDE 10: safety

It seeks to drive innovations to improve safety, reduce carbon emissions, use land, energy and resources more efficiently, moderate environmental impact, diversify the workforce and value, nurture and retain employees. And all the while supply the growing global demand for the minerals and metals needed to modernise the developing world and provide equitable living standards for everyone.

The impact of autonomous trucks, drills, dumpers and stackers is not only to boost productivity and profitability. It has paid massive human dividends in the safety for our workforce.

In Hunter Valley mines and at Oyu Tolgoi in Mongolia workers are wearing new 'SmartCap' technology that gives them continuous, real-time feedback on their alertness levels so they can manage fatigue, make better decisions and complete their shifts in safety.

Continuous software upgrades have reduced noise and fuel consumption on our Komatsu haul trucks. In Australia alone this has generated 4.4 million litres in fuel savings annually, cut greenhouse emissions by 12,000 tonnes and reduced noise from each truck by 2 decibels. This work continues and further gains are coming.

Mining shows the way on working closely with indigenous Australians, respecting their cultural values and spiritual relationship to the land and providing the manifold, irreplaceable benefits of well-paid employment. Rio Tinto, I'm proud to say, is one of the biggest private sector employers of indigenous Australians. And that's just us.

Mining can be the role model for creating a workplace culture that values and supports women and actively helps them achieve their full potential. That would surprise many people but it's true.

In fact, it's worth asking what is the human face to this, who represents the *Mine of the Future*<sup>TM</sup> ?

### SLIDE 11: Our people

They do. We see the face of mining being as diverse as the countries and communities we operate in around the world.

Allowing employees who are also new parents the flexibility to job-share would seriously challenge a great many industries in Australia.

In mining we make it happen. Innovations such as this across areas such as cultural and employee welfare, safety, and environmental management all spring from the same mindset that allows us to know months in advance when a truck engine will fail.

In many ways driving workplace cultural change to become more inclusive and diverse is just as important as driving innovative technologies. The most successful businesses, both today and into the future, will innovate and excel by

drawing on the many different talents and perspectives offered by a truly diverse workforce.

We'd love to see that drive spread throughout the rest of Australia's economy and business culture.

It can propel our nation into a very successful future.

Thank you.

