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Including

Hydromet Processing of Copper, Nickel & Cobalt Sulphides Forum

Sponsored by

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PROCEEDINGS OF
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Including

Hydromet Processing of Copper, Nickel & Cobalt Sulphides Forum

21-23 May 2018

Perth, Australia

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WHAT IS CHANGING IN THE GLOBAL MINERALS INDUSTRY - DELIVERING VALUE BY LEVERAGING RESOURCES

By

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ABSTRACT

There have been remarkable changes in the mining industry since September 1959 when a group of mining industry executives signed the memorandum of understanding that gave rise to the Australian Minerals Industries Research Association (A.M.I.R.A.). These changes and the corresponding industry pressures span business, technology, and societal areas. They have led to the emergence of new technologies that have improved our ability to explore, that allow us to mine more efficiently and to process lower grade ores. Outcomes from AMIRA International projects have contributed to and continue to contribute to shaping our industry. Many of the solutions from these projects helped to deliver multi-million dollar gains for our members and changed work flow processes for our industry in general. These changes come hand in hand with capacity building in research institutions, resulting not only in the development of world-class international research capability but also the training of students that have gone on to become leaders in industry and academia. Of course, change is a continuous process and now our industry is at the early stages of new revolutions including large increases in energy and water costs, automation, data analytics, the emergence of “Internet of things” (IoT) and other technologies that have the potential to further disrupt and change how industry does business by addressing the immediate challenges. AMIRA International continues to work for the minerals industry, evolving to address these new challenges.

The time is right for a step-change in industry collaboration to solve our biggest challenges, and capture our most attractive opportunities. Collaboration is not easy, particularly peer-to-peer collaboration. Many of the truly difficult challenges will require the latter to be successfully addressed. It is doubtful that the types of the collaboration that are in vogue now will deliver the transformational changes that will come from addressing the long terms challenges of the industry, indeed they are really focusing on the short-term challenges. This paper is a cloudy crystal ball look at the greatest of these challenges and the collaborative effort required and how AMIRA International can contribute to capturing the value and mitigating the risks.

Keywords: Technology, Change, AMIRA

Topics

- Where was industry back in 1959 and where are we now?
- The role of AMIRA International
- Past and current R&D projects of AMIRA International
- Why companies should collaborate
- What are the short and long term industry challenges?
- How can AMIRA International assist industry in addressing the challenges?
- Conclusions

Another key event in 1959

Birth of A.M.I.R.A.

"The beginning is the most important part of the work."
- Plato

The **Australian Mineral Industries Research Association Limited** (A.M.I.R.A.) was incorporated on 2nd September 1959.

It began with just six members and included the "Who's Who" of the mineral industry:

- **Sir Morris Mawby** (CRA → Rio Tinto)
- **Sir George Fisher** (Mount Isa Mines → Xstrata → Glencore)
- **Sir Ian McLennan**, (Broken Hill Proprietary → BHP Billiton → BHP)
- **Harry Hey** (EZ → Pasminco → Zinifex → Oxiana → OZ Minerals → MMG)
- **Lindesay Clark** (WMC → BHP)
- **Joseph Glenn** (ICI Australia → Orica)

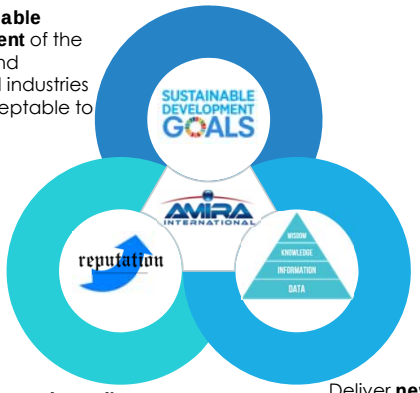
Chairmen of AMIRA 1959-2018

All of the above companies are still members of AMIRA International now a global organisation

Core purpose: creating value through collaboration….

by developing and managing collaborative projects and other activities, to **enable**:

The **sustainable development** of the minerals and associated industries that is acceptable to society



Enhanced standing of the minerals and associated industries amongst stakeholders locally and globally

Deliver **new data, knowledge, technologies, products and services**

How does AMIRA work?

market pull model

Finalise legal agreements and start project

Manage project and deliver to expectations

Secure financial commitment from industry

01 Engage members: identify and understand challenge, test idea via an EOI

02 Seek and engage (the best) solution providers

03 Prepare formal project proposal in collaboration with solution providers & industry

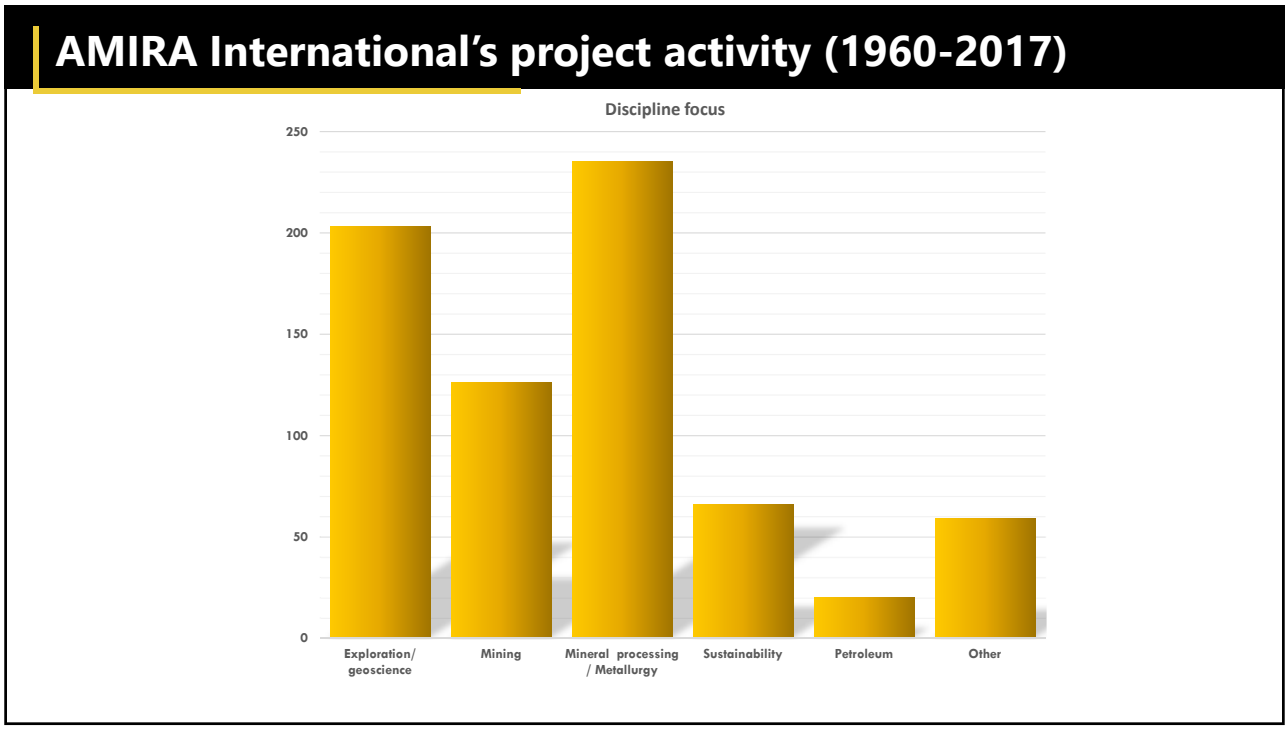
04

05

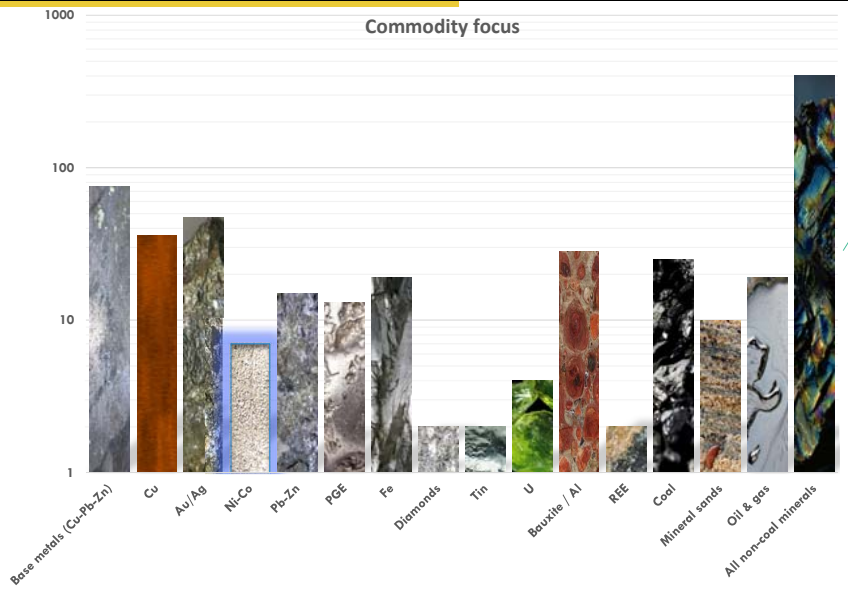
06

Ideation & project development

Project management & delivery



AMIRA International's project activity (1960-2017)



The vast majority of project outcomes typically apply across many different commodities

AMIRA International is the custodian of the project reports which only members can access

Projects in which the relevant commodity first appears in the project title is counted as a project whose principal focus is that commodity. Project numbers in log scale

AMIRA International

A History of Successes

Developed and managed ≥ 707 collaborative projects over the last 59 years – over AU$630 million (in 2017$) has been invested by industry

AMIRA International's current project activity

Projects under management (mineral processing/met)

- **P9Q** – Translating research to industry tools: Validated Multi-Component Mineral Processing Simulator (JKMRC, Uni. of Cape Town, Chalmers Uni., Hacettepe Uni., Uni. de Federal do Rio de Janeiro, CRC ORE
- **P260G** – Flotation (University of South Australia)
- **P705D** – Cost, Productivity and Occupational Health Improvements for Base Metal Electrowinning (Missouri Uni. of Science and Technology in cooperation with, Uni. Federal de Minas Gerais and Laurentian Uni.)
- **P1185** – Demonstration of the SuperFine Crusher (SFC) Technology (IMPTEC and Uni. of South Australia)
- **P1196** – Application of ColdBlock Digestion Technology for Gold Assay and Base Metal Determinations (ColdBlock Technologies Inc. and Dr Matthew Leybourne, Laurentian Uni.)

Some projects under development

- Optimal pushback design
- Interoperability enablement for natural resources
- Reducing fuel consumption and wear in mobile mining fleet using Gernano nanoparticle oil additive
- Conveyor Belt Health Monitoring System
- Eco-efficient beneficiation of minerals

Many companies seem not to be collaborating with peers in technology development – *why!?*

- Collaboration can be **hard work**!
- **Loss of competitive advantage**
- One reason often used to justify going-it-alone is that the company can **capture competitive advantage**

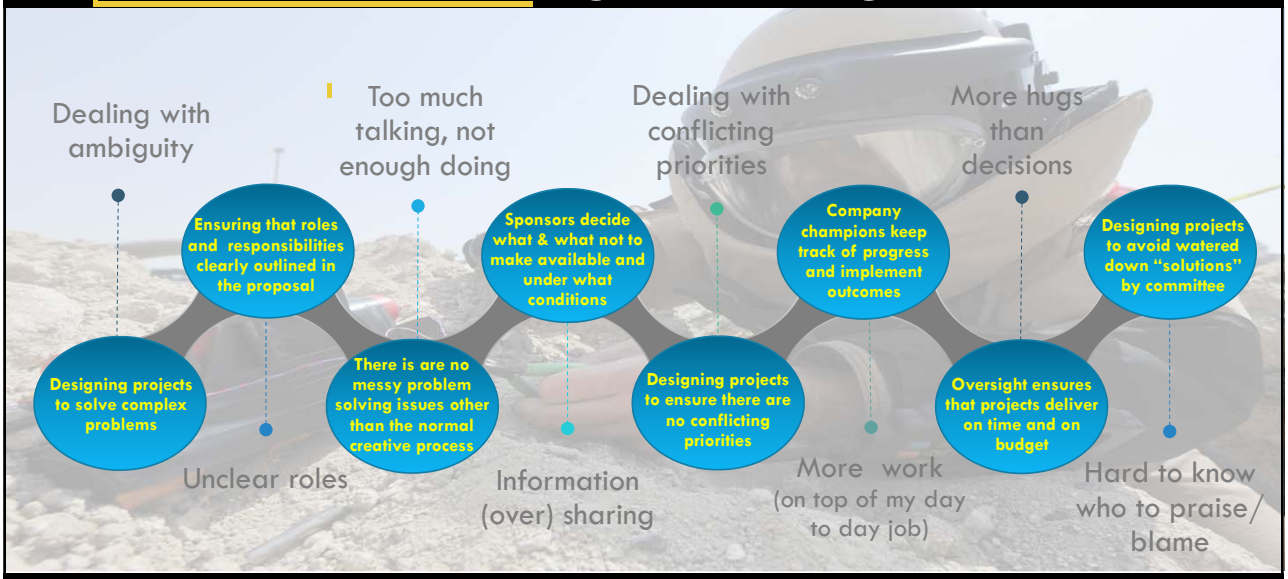
  but...

- There is an **unrealistic view** on how long a company's competitive advantage will last
- **No company has a mortgage** on skills, knowledge and smart people

Yes, collaboration is not easy!

Source: HBR, Dec 2011 - https://hbr.org/2011/12/eight-dangers-of-collaboration

This is how AMIRA mitigates the dangers …



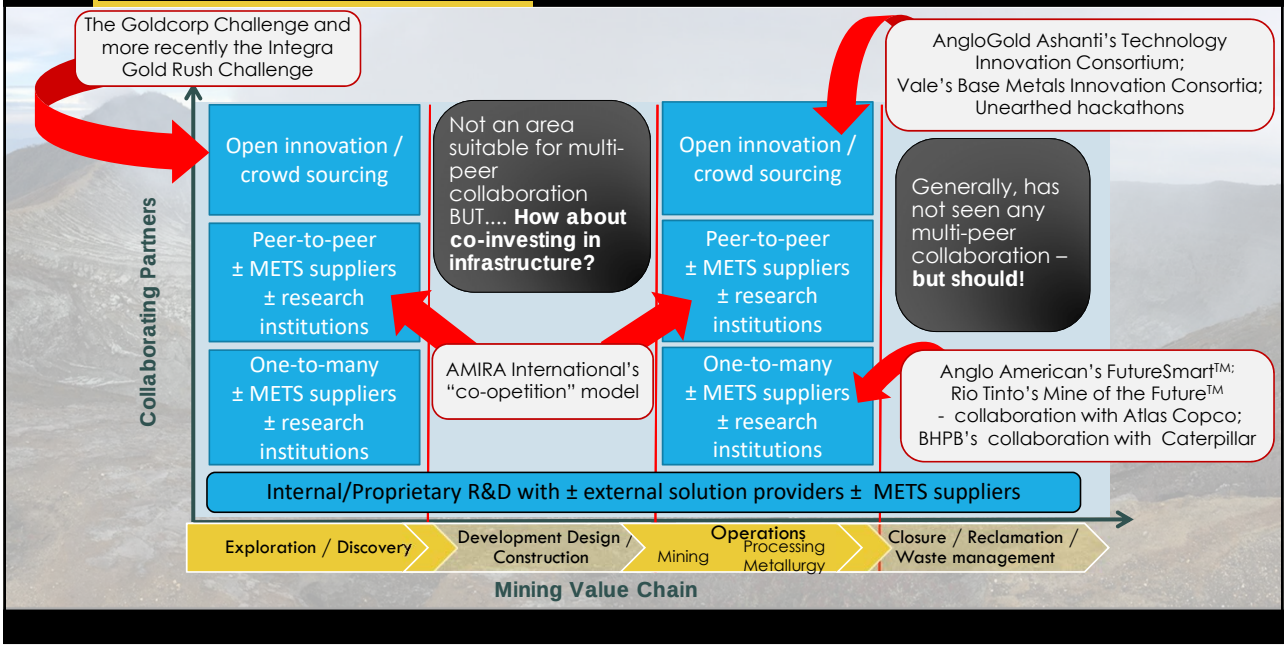
Source: HBR, Dec 2011 - https://hbr.org/2011/12/eight-dangers-of-collaboration

Changing expectations

Companies seem to be prepared to collaborate but they …

- .. seem **unwilling** to do so with peers
- .. are focused on **one-on-ones**
- .. want **timely implementable** solutions
- .. seek **holistic solutions**
- .. are focused on **short time horizons**

So where and how are mining and processing companies collaborating?



What are the current industry challenges?

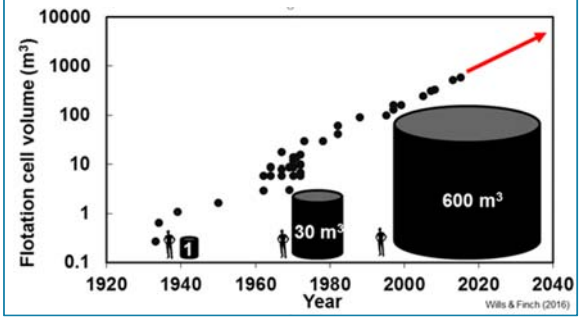
- Deeper, real-time, understanding of the (whole of the) resource (prior to development)
- Boosting productivity and maintenance performance
- Optimising material and equipment flow, towards a continuous mining and processing mindset
- Selective mining and processing to boost processing intensity
- Improving performance and reducing harm
- Mining and processing complex and currently uneconomic resources
- Reducing capex and opex
- Access to and optimisation of water and energy
- Reducing mining's footprint, including boosting environmental performance & waste management
- Finding new tier 1 resources / reserves
- Securing an enduring License to Operate
- Securing a future talent pool
- Successful uptake and implementation of new technologies across the business

Source: METS Ignited – Mining innovation: key mining industry challenges (June 2017), with contribution from AMIRA

A *need* for smarter innovation

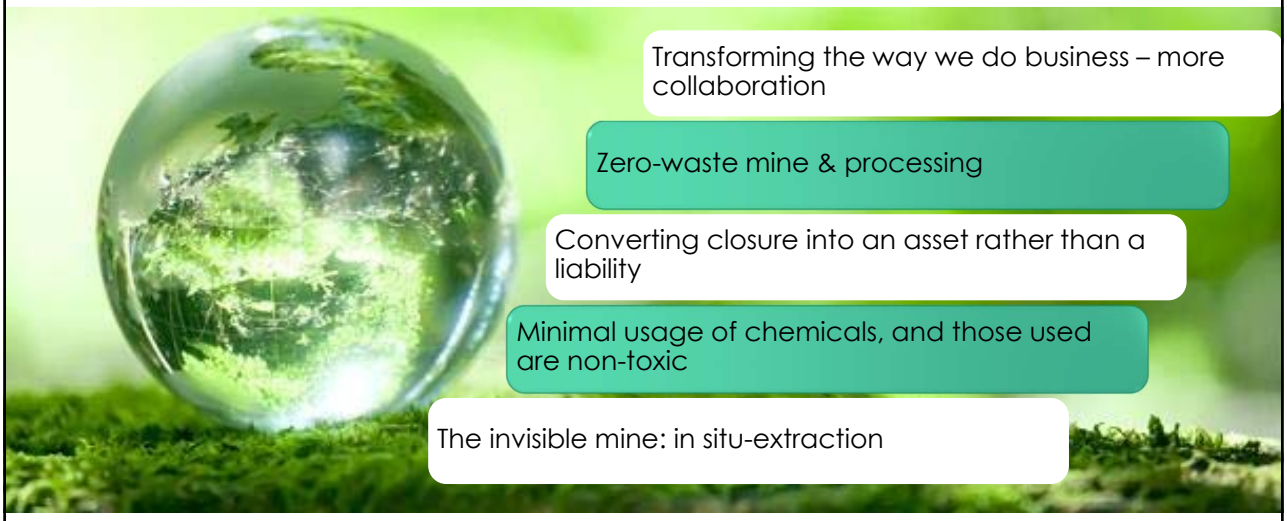
Bigger, Bigger, Bigger..

Innovation in flotation has been about building larger cells
The next cell should be … 10 times smaller?*



* Source: Kevin Galvin : *Beneficiation - the next frontier to reduce the environmental footprint and extract more metal from ores of increasingly declining quality*: AMIRA international Ideas factory April 2018

What are the industry's longer term challenges?



How can AMIRA assist members address short & long term challenges?

Concluding remarks

- The Australian mining and processing industry has had an exemplary record in collaboration that has led to an incredible transformation of industry since the late 1959 when AMIRA was created to facilitate this type of collaboration
- Industry is facing both immediate and long terms challenges – many of these are more affectively tackled through peer-to-peer collaboration
- Collaboration to address the truly difficult challenges is more important than ever: scarce funds; more complex problems requiring multidisciplinary, multi-institutional teams, and sustained longer-term R&D investment
- A step change in collaboration is needed - but collaboration is not easy; this is where AMIRA comes in